ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1	A. A. B. Ismail, M. R.; Hendy, O.; Abdel Rasoul, G.; Wang, K.; Olson, J. R.; Rohlman, D. S.	Comparison of neurological health outcomes between two adolescent cohorts exposed to pesticides in Egypt	2017	Pesticide-exposed adolescents may have a higher risk of neurotoxic effects because of their developing brains and bodies. However, only a limited number of studies have addressed this risk among adolescents. The aim of this study was to compare neurological outcomes from two cohorts of Egyptian adolescents working as pesticide applicators. In 2005 and 2009, two cohorts of male adolescents working as pesticide applicators for the cotton crop were recruited from Menoufia Governorate, Egypt. The same application schedule and pesticides were used at both times, including both organophosphorus, and pyrethroid compounds. Participants in both cohorts completed three neurobehavioral tests, health and exposure questionnaires, and medical and neurological screening examinations. In addition, blood samples were collected to measure butyryl cholinesterase (BChE) activity. Pesticide applicators in both cohorts reported more neurological symptoms and signs than non-applicators, particularly among participants in the 2005 cohort (OR ranged from 1.18 to 15.3). Except for one test (Trail Making B), there were no significant differences between either applicators or non-applicators of both cohorts on the neurobehavioral outcome measures ($p > 0.05$). The 2005 cohort showed greater inhibition of serum BChE activity than the 2009 cohort ($p < 0.05$). In addition, participants with depressed BChE activity showed more symptoms and signs than others without BChE depression ($p < 0.05$). Our study is the first to examine the consistency of health outcomes associated with pesticide exposure across two cohorts tested at different times from the same geographical region in rural Egypt. This similar pattern of findings across the two cohorts provides strong evidence of the health impact of exposure of adolescents to pesticides.	PLoS ONE [Electronic Resource]	12	2	e0172696	Job title			Cohort (prospective)	Job title	neurological	medical test result	Egypt	lmic
2	A. A. Gomez-Martin, B.; Lozano-Paniagua, D.; Margison, G. P.; de Vocht, F.; Povey, A. C.; Hernandez, A. F.	Increased N7-methyldeoxyguanosine DNA adducts after occupational exposure to pesticides and influence of genetic polymorphisms of paraoxonase-1 and glutathione S-transferase M1 and T1	2015	There are concerns about genetic risks associated with long-term exposure to pesticides as these compounds may damage DNA, resulting in mutations that eventually lead to cancer, neurological, and reproductive adverse health effects. This study assessed DNA damage in intensive agricultural workers exposed to pesticides by determining the levels of N7-methyldeoxyguanosine (N7-MedG), an adduct known to be a robust biomarker of recent exposure to chemical methylating agents. A cohort of 39 plastic greenhouse workers was assessed for changes in lymphocyte DNA N7-MedG levels between low level and high level exposures during the course of a spraying season. The contributions of genetic polymorphisms of the pesticide-metabolizing enzymes paraoxonase-1 (PON1) and the glutathione S-transferases, GSTM1 and GSTT1, on N7-MedG levels and other potential confounders were also assessed. N7-MedG increased in the period of high pesticide exposure as compared to the low exposure period (0.23 and 0.18 micro mol N7-MedG/mol dG for the unadjusted and adjusted linear mixed models, P=0.02 and 0.08, respectively). Significant decreased levels of erythrocyte acetylcholinesterase and plasma cholinesterase were observed in the high versus low exposure period in both the unadjusted (2.85 U/g hemoglobin and 213.13 U/L, respectively) and adjusted linear mixed models (2.99 U/g hemoglobin and 230.77 U/L, respectively), indicating pesticide intake. In intensive agriculture workers, higher pesticide exposure increased DNA alkylation levels, further demonstrating the genotoxicity of pesticides in man. In addition, pesticide-exposed individuals with inherited susceptible metabolic genotypes (particularly, null genotype for GSTM1 and the PON1 192R allele) appear to have an increased risk of genotoxic DNA damage. Environ. Mol. Mutagen. 56:437-445, 2015. <U+00AC><U+00A9> 2014 Wiley Periodicals, Inc.	Environmental & Molecular Mutagenesis	56	5	437-45	EAM not reported			Cohort (prospective)	Specific active ingredient	genetic (biomarkers)	medical test result	Spain	hic
3	A. A. Hassan	Effects reported in farm workers repeatedly exposed to pesticides	2012	Purpose: Growing interest has been observed for hair to document human exposure to pesticides. Most of the studies based on hair analysis focused on specific compounds or compounds family such as organochlorines or organophosphorus, and occupational exposure to agricultural pesticides including several chemical families has been few documented. Moreover, studies were based on a single sampling and follow-up of the exposure was generally not performed. Method: A sensitive method using liquid-liquid extraction with gas chromatography mass spectrometry was used to test hair samples for 15 pesticides including molecules from different chemical families currently used in agriculture. The population investigated was composed of 9 farm workers who provided repeated hair sampling between March and November 2010. Results and conclusion: Among the 54 hair samples that were collected. 12 different target molecules were detected. For agricultural pesticides, the concentration is volunteers' hair matched with agricultural activity and the highest concentration was observed for Cyprodinil, an anilinopyrimidine used as fungicide. For organophosphorus and organochlorines, malathion and chlordane were the most frequently detected molecules, with concentration ranging from 0.1 to 25.6 pg/mg. and the medical investigations showed that repeated or prolonged exposure to pesticides may result in the same effects as acute exposure including the delayed symptoms. Other effects reported in workers repeatedly exposed include impaired memory and concentration, disorientation, severe depressions, irritability, confusion, headache, speech difficulties, delayed reaction times, nightmares, sleepwalking and drowsiness or insomnia.	Toxicology Letters	211	NA	S127	Biomonitoring (hair)			Cohort (prospective)	Specific active ingredient	pesticide-related symptoms	medical test result	Egypt	lmic
4	A. A. Ismail, D. S. Rohlman, G. M. Abdel Rasoul, M. E. Abou Salem and O. M. Hendy	Clinical and biochemical parameters of children and adolescents applying pesticides	2010	BACKGROUND: The primary agricultural product in Egypt is the cotton crop. Children and adolescents work seasonally in the cotton fields applying pesticides. OBJECTIVE: To examine the effect of pesticide exposure on clinical and biochemical parameters in children and adolescents applying pesticides. METHODS: Male children currently applying pesticides and aged between 9 and 19 years (n = 50) were recruited for this study. They were asked to complete work, health, and exposure questionnaires; examined for any medical and neurological problems with particular attention to sensory and motor functions including cranial nerves, sensory and motor system, and reflexes. From each participant, a blood sample was taken to measure acetylcholinesterase activity, and liver and kidney functions. Children who have never worked in agriculture (n = 50), matched on age, education, and socioeconomic status were also studied and served as controls. RESULTS: More neuromuscular disorders were identified in pesticide applicators than controls. A significant lower level of acetylcholinesterase was found in the applicator group compared to the controls. There was also a significant difference in hematological, renal and hepatic indices in the exposed children compared to the control children. Working more days in the current season and also working more years as a pesticide applicator were both associated with an increase in the prevalence of neuromuscular abnormalities and significant changes in the laboratory tests. CONCLUSION: Children and adolescent pesticide applicators working in farms of Egypt are at risk of developing serious health problems similar to those of adults.	International Journal of Occupational & Environmental Medicine	1	3	132-43	Self-reported exposure	Biomonitoring (blood)		NA	Pesticides in general	neurological	medical test result	Egypt	lmic

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5	A. A. Malekirad, M. Faghih, M. Mirabdollahi, M. Kiani, A. Fathi and M. Abdollahi	Neurocognitive, mental health, and glucose disorders in farmers exposed to organophosphorus pesticides	2013	About 25 million agricultural workers in the developing world suffer from at least one episode of poisoning each year, mainly by anticholinesterase-like organophosphates (OPs). The objective of this cross-sectional study was to establish the OP toxicity in 187 occupationally exposed farmers in terms of neurocognitive impairment, mental health status, clinical symptoms, diabetes, and haematological factors. The exposed group was compared to 187 healthy age-, sex-, and education-matching controls. Neurocognitive impairment was measured using the Subjective Neurocognition Inventory (SNI) and mental health status using the General Health Questionnaire-28 (GHQ-28). The subjects were also tested for fasting blood glucose (FBG), blood urea nitrogen (BUN), cholesterol (CL), triglycerides (TG), creatinine, oral glucose tolerance test (GTT), high-density lipoprotein (HDL), aspartate aminotransferase (AST), alanine aminotransferase (ALT), and alkaline phosphatase (ALP). The exposed farmers showed higher FBG (p<0.001), BUN (p=0.007), CL (p<0.001), oral GTT (p<0.001), and lower AST (p<0.001), ALP (p<0.001), and creatinine (p=0.004) than controls. The rates of anxiety/ insomnia and severe depression were also significantly higher in the farmers than in controls (p=0.015 and p<0.001, respectively). Meanwhile, the rate of social dysfunction was significantly lower than in controls (p<0.001). Disorders affecting psychomotor speed, selective attention, divided attention, verbal memory, nonverbal memory, prospective memory, spatial functioning, and initiative/energy were all lower in the farmers (p<0.001). Farmers showed clinical symptoms eczema, saliva secretion, fatigue, headache, sweating, abdominal pain, nausea, superior distal muscle weakness, inferior distal muscle weakness, inferior proximal muscle weakness, breath muscle weakness, hand tingling, foot tingling, epiphoria, polyuria, miosis, dyspnoea, bradycardia, and rhinorrhoea, which all significantly correlated with the number of working years. These findings indicate that farmers who work with OPs are prone to neuropsychological disorders and diabetes.	Arhiv Za Higijenu Rada i Toksikologiju	64	1	43108	Self-reported exposure			Cross-sectional	Pesticides in general	neurological	self-reported	Iran	umic
6	A. A. Ravan, C. S. Sankhla and M. Gadhari	Analysis of age of onset and epidemiological factors in parkinsons disease	2012	Introduction: Various epidemiological studies provide important clues to the potential risk factors in Parkinson's disease [PD]. The incidence of the disease increases with age and advanced age is considered to be a risk factor in development of PD. Along with the age occupational exposure, head injury are also considered as the risk factor. Objectives: To evaluate age of onset and etiological factors of Parkinson disease Methods: 230 patients of Parkinson's disease and 177 Age and Sex matched controls answered epidemiology questionnaire. The questionnaire included age of onset of their first symptom, and epidemiological risk factors like family history of PD, toxins exposure, childhood neurological infections, exposure to Metals, recreational drug abuse, exposure to Pesticides, past head injury, Alcohol consumption, ingestion of Neuroleptics, rural living and well water drinking. Results: The mean age of onset in this study was 54.83 (SD <U+00AC><U+00B1>12.2) (men-55.5 and women-53.23). Very strong association (p = 0.0001) was seen in the positive family history as compared to controls. Association with head injury (p = 0.043) as well as ingestion of neuroleptic drugs (p = 0.027) are statistically significant in development of PD. Conclusions: The age of onset in India is lower than the western population. Family history, head injury and neuroleptics are causative factors.	Parkinsonism and Related Disorders	18	NA	S11-S12	Self-reported exposure			Case-control	Pesticides in general	neurological	doctor-diagnosed	India	lmic
7	A. A. W. Ismail, K.; Olson, J. R.; Bonner, M. R.; Hendy, O.; Abdel Rasoul, G.; Rohlman, D. S.	The impact of repeated organophosphorus pesticide exposure on biomarkers and neurobehavioral outcomes among adolescent pesticide applicators	2017	Egyptian adolescents are hired as seasonal workers to apply pesticides to the cotton crop and may perform this occupation for several years. However, few studies examined the effects of repeated pesticide exposure on health outcomes The goal of this study was to determine the impact of repeated pesticide exposure on neurobehavioral (NB) performance and biomarkers of exposure (urinary metabolite) and effect (cholinesterase activity). Eighty-four adolescents from two field stations in Menoufia, Egypt, were examined four times: before and during pesticide application season in 2010 and again before and during application season in 2011. At each of the four time points, participants completed a questionnaire, performed an NB test battery, and were assessed for urinary levels of the chlorpyrifos metabolite TCPy (3,5,6-trichloro-2-pyridinol) and blood cholinesterase activity. Following the study cohort over two consecutive pesticide application seasons revealed that TCPy levels significantly increased following exposure, and returned to baseline levels following the end of the application season. Blood butyryl cholinesterase activity exhibited a similar pattern. Although NB outcomes displayed learning and practice effects over time, deficits in performance were significantly associated with increased TCPy levels with reduction in the number of NB measures showing improvement over time. Biomarkers of exposure and effect demonstrated changes associated with pesticide application and recovery after application ended. Deficits in NB performance were correlated with elevated pesticide exposure. Data demonstrated that repeated pesticide exposure may exert a long-term adverse impact on human health.	Journal of Toxicology & Environmental Health Part A	80	10	542-555	Biomonitoring (urine)			Cohort (prospective)	Specific active ingredient	neurological	medical test result	Egypt	lmic
8	A. Abdolahi, E. van Wijngaarden, M. D. McClean, R. F. Herrick, J. G. Allen, A. Ganguly and G. R. Bunin	A case-control study of paternal occupational exposures and the risk of childhood sporadic bilateral retinoblastoma	2013	BACKGROUND: The risk factors for sporadic (ie, non-familial) retinoblastoma remain largely unknown. OBJECTIVES: We examined the relationship between paternal occupational exposures from jobs held 10 years and 1 year prior to conception and the risk of sporadic bilateral retinoblastoma in children. METHODS: Paternal occupational data were obtained for 198 incident cases diagnosed with sporadic bilateral retinoblastoma from January 1998 to May 2006 and 245 referral-based controls from the case child's relatives and friends who were matched to 135 of the cases on birth year. Industrial hygienists independently assigned exposure scores for nine agents. Adjusted ORs and 95% CIs were computed using logistic regression models, using the full sample of cases and controls as well as subset of cases with matched controls only. RESULTS: There was some indication of an elevated risk associated with paternal pesticide exposure in the 10 years prior to conception (OR=1.64; 95% CI 1.08 to 2.50) as well as in the year before conception (OR=2.12; 95% CI 1.25 to 3.61). However, results for pesticide exposure were inconsistent and varied by analysis approach. An increased risk was also observed for non-welding metal exposure during the 10 years prior to conception in the full (OR=1.35; 95% CI 0.86 to 2.12) and matched (OR=1.40; 95% CI 0.82 to 2.37) samples, but not in the year before conception. Exposure-response trends were observed for pesticides and non-welding metal exposures. CONCLUSIONS: Our findings suggest a potential role of paternal occupational exposures to non-welding metals and perhaps pesticides in the aetiology of childhood retinoblastoma.	Occupational & Environmental Medicine	70	6	372-9	Expert case-by-case assessment	Self-reported job history		Case-control	Pesticides in general	offspring	doctor-diagnosed	USA/Canada	AHIC

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9	A. Abell, E. Ernst and J. P. Bonde	Semen quality and sexual hormones in greenhouse workers	2000	OBJECTIVES: This study focused on determining the testicular function of greenhouse workers exposed to pesticides. METHODS: Semen was examined for 122 of 199 eligible men (61%) from 30 ornamental flower greenhouses. Sperm concentration, morphology, and viability were measured according to World Health Organization guidelines, and the curvilinear sperm velocity was determined by a computer-assisted analysis of video recordings. Three groups were formed according to expert judgment of current exposure to pesticides from cultures, pesticide formulations, and the transfer of pesticide residues from leaves to hands, and also ranked according to years of work in a greenhouse. The risk estimates were adjusted for the effects of sexual abstinence and other potentially confounding factors. RESULTS: According to current exposure the median values of sperm concentration and the proportion of normal spermatozoa were 60% and 14% lower, respectively, in the high level exposure group (N=13) than in the low-level group (N=44), and the values of the intermediate group fell in between. The adjusted differences between the high-level and low-level exposure groups were statistically significant, while no differences were observed for the viability and velocity of sperm and sexual hormones. The median sperm concentration was 40% lower for the men with > 10 years' experience in a greenhouse than for those with < 5 years' experience. The age-adjusted testosterone/sex-hormone-binding globulin ratio declined 1.9% (95% confidence interval 0.4-3.4%) per year of work. CONCLUSIONS: The results are compatible with the hypothesis that male fecundity may be at risk from exposure to pesticides in the manual handling of cultures in greenhouses.	Scandinavian Journal of Work, Environment & Health	26	6	492-500	Expert case-by-case assessment			Cross-sectional	Pesticides in general	reproductive	medical test result	Denmark	hic
10	A. Abell, S. Juul and J. P. Bonde	Time to pregnancy among female greenhouse workers	2000	OBJECTIVES: This study examined the possibility that work in greenhouses with potential exposure to pesticides entails a risk for reduced fecundity in terms of increased time to pregnancy. METHODS: Among 1767 female members of the Danish Gardeners Trade Union, telephone interview data were obtained on the 492 most recent pregnancies of women employed when they stopped contraception to get a child (the starting time). The pregnancies were classified according to job characteristics at the starting time. The ratio between the likelihood of pregnancy during a month for the exposed persons versus the referents (the fecundability ratio) was estimated by discrete proportional hazards regression. RESULTS: The adjusted fecundability ratio for workers in flower greenhouses versus other union members was 1.11 [95% confidence interval (95% CI) 0.90-1.36]. Among workers in flower greenhouses the handling of cultures many hours per week, the spraying of pesticides, and the nonuse of gloves was related to reduced fecundability [adjusted fecundability ratio 0.69 (95% CI 0.47-1.03), 0.78 (95% CI 0.59-1.06), and 0.67 (95% CI 0.46-0.98), respectively]. CONCLUSIONS: The findings suggest that female workers in flower greenhouses may have reduced fecundability and that exposure to pesticides may be part of the causal chain. Additional studies of fertility among women working in greenhouses are highly warranted.	Scandinavian Journal of Work, Environment & Health	26	2	131-6	Self-reported exposure			Cross-sectional	Pesticides in general	reproductive	self-reported	Denmark	hic
11	A. Adj<U+221A><U+00A9>mian, J. P. Grillet and B. Delemotte	Use of pesticides by farmers: Practice, adverse effects and evolutionary aspects	2002	Objectives: A study was designed in order to evaluate the frequency of exposure and of the disorders a priori associated by the applicators with the use of pesticides. Methods: A questionnaire was sent to male farmers of 27 rural areas who were invited by the local funds of Mutualit<U+221A><U+00A9> Sociale Agricole to have a check-up during the last quarter of 1999. Results: Out of 2 972 collected and then exploited questionnaires, 2 085 farmers state to have used pesticides during the past year. At least one measure of protection (gloves, mask, specific clothing or cabin of tractor) was used by 1 408 operators during the process. But hardly more than one in ten associates two measures of protection. With regard to behaviors, 283 farmers specify to have had a shower after the process, 120 operators declare to have smoked and 119 to have drunk and/or eaten during treatment. When using these products, 413 operators complain of health trouble (cephalalgia, cutaneo-mucous trouble, digestive disorders, respiratory and ORL problems) at least once, during the last twelve months. Three variables significantly raise the percentage of indicated trouble: to drink and/or to eat during treatment, the number of products used for a single treatment, the presence of at least one measure of protection. Conclusion: The rate of protection increases by comparison with the previous studies, but the frequency of indicated trouble stays at the same level.	Archives des Maladies Professionnelles et de Medecine du Travail	63	2	77-82	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	NA	NA
12	A. Aryal, A. F. Khan, I. Hamid, S. Islam, D. Dutt and K. Khan	Comparing mental and neuropsychological health outcomes between two pesticide exposure groups in rural Bangladesh	2016	Background: Agricultural workers are at risk of pesticide exposures in agriculture-dependent South Asian countries due to lack of monitoring and education on proper use of personal protective equipment (PPE). Limited information is available in the literature if pesticide exposure is associated with mental and neuropsychological health outcomes in this region. The major goal of the present study was to examine the associations of pesticide exposure with several mental and neuropsychological health outcomes. Methods: A pilot study was conducted in a rural community in Matlab, Bangladesh on 57 healthy adults who were 30-55 years old and were also free from any chronic illness. Among the subjects, 38 were occupationally exposed (regularly using pesticides in the field) and 19 were environmentally exposed (living in the agricultural community but were not using pesticides). Participants responded to a number of demographic, pesticide exposure, 16 depression and 20 stress questions through a face-to-face interview conducted by a research team that included a physician. At the same time, the team completed two parts of Trail Making Test (TMT), a neuropsychological pencilpaper test. To compare two exposure groups for the demographic characteristics and outcomes we used independent sample t-test and chisquare test for continuous and categorical variables respectively. Findings: After the preliminary analysis, it was observed that occupationally exposed group had non-significantly higher depression score on the Center for Epidemiologic Study Depression (CESD) scale as compared to environmentally exposed group. Furthermore, occupationally exposed group had significantly higher depression score on the CESD interpersonal subscale ($p < 0.05$). Occupationally exposed group took longer time (Mean times in sec <U+00AC><U+00B1> sd were 73.1 <U+00AC><U+00B1> 40.3 vs 123.8 <U+00AC><U+00B1> 48.7 for part A; 56.8 <U+00AC><U+00B1> 25.1 vs 112.0 <U+00AC><U+00B1> 28.7 for part B) to complete both parts of the TMT even though the differences were not statistically significant perhaps due to the small sample size. Interpretation: The findings of this study are preliminary, and larger studies need to be conducted in this population to obtain further evidence on the mental and neuropsychological health outcomes of pesticides.	Annals of Global Health	82	3	438	Self-reported exposure			Cross-sectional	Pesticides in general	mental disorders	self-reported	Bangladesh	lmic

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13	A. Ascherio, H. Chen, M. G. Weisskopf, E. O'Reilly, M. L. McCullough, E. E. Calle, M. A. Schwarzschild and M. J. Thun	Pesticide exposure and risk for Parkinson's disease	2006	OBJECTIVE: Chronic, low-dose exposure to pesticides is suspected to increase the risk for Parkinson's disease (PD), but data are inconclusive. METHODS: We prospectively examined whether individuals exposed to pesticides have higher risk for PD than those not exposed. The study population comprised participants in the Cancer Prevention Study II Nutrition Cohort, a longitudinal investigation of US men and women initiated in 1992 by the American Cancer Society. Follow-up surveys were conducted in 1997, 1999, and 2001. The 143,325 individuals who returned the 2001 survey and did not have a diagnosis or symptoms of PD at baseline (1992) were included in the analyses. RESULTS: Exposure to pesticides was reported by 7,864 participants (5.7%), including 1,956 farmers, ranchers, or fishermen. Individuals exposed to pesticides had a 70% higher incidence of PD than those not exposed (adjusted relative risk, 1.7; 95% confidence interval, 1.2-2.3; p = 0.002). The relative risk for pesticide exposure was similar in farmers and nonfarmers. No relation was found between risk for PD and exposure to asbestos, chemical/acids/solvents, coal or stone dust, or eight other occupational exposures. INTERPRETATION: These data support the hypothesis that exposure to pesticides may increase risk for PD. Future studies should seek to identify the specific chemicals responsible for this association.	Annals of Neurology	60	2	197-203	Self-reported exposure			Cohort (prospective)	Pesticides in general	neurological	self-reported	USA	hic
14	A. B. Blanc-Lapierre, G.; Gruber, A.; Leffondre, K.; Lebailly, P.; Fabrigoule, C.; Baldi, I.	Cognitive disorders and occupational exposure to organophosphates: results from the PHYTONER study	2013	The involvement of organophosphate insecticides in cognitive disorders is supported by epidemiologic and biological evidence, but the effects of long-term exposure remain debated. We studied the association between organophosphate exposure and cognitive performance in vine workers from the PHYTONER study cohort in the Bordeaux area of France. Results from interviews of 614 subjects conducted at the 4-year follow-up between 2001 and 2003 were analyzed. Exposure to pesticides since 1950 was assessed with cumulative exposure scores for 34 organophosphates combining an historical crop-exposure pesticide matrix and field exposure studies, taking into account the characteristics of treatment (mixing, spraying, equipment cleaning) and reentry tasks. For the 11 organophosphates retained in the analysis, exposure (ever vs. never) was associated with low cognitive performance. No dose-effect relationship was found, but an increased risk was observed with a 50-mg increase in the cumulative score, which was greater with mevinphos (Benton Visual Retention Test: odds ratio = 3.26, 95% confidence interval: 1.54, 6.88; Trail Making Test, part A: odds ratio = 3.03, 95% confidence interval: 1.39, 6.62). Our results support the hypothesis that cognitive disorders observed in vine workers may be associated with exposure to specific organophosphates.	American Journal of Epidemiology	177	10	1086-96	Crop exposure matrix			Cohort (prospective)	Chemical class	mental disorders	doctor-diagnosed	France	hic
15	A. B. Burdorf, T.; Jaddoe, V. W.; Hofman, A.; Mackenbach, J. P.; Steegers, E. A.	The effects of work-related maternal risk factors on time to pregnancy, preterm birth and birth weight: the Generation R Study	2011	OBJECTIVE: To investigate the influence of maternal working conditions on fertility and pregnancy outcomes. METHODS: 8880 women were enrolled in a large prospective birth cohort during early (76%), mid (21%) or late pregnancy (3%) (61% participation). Complete questionnaire information was available for 6302 women (71% response). Outcomes were prolonged time to pregnancy (TTP) (> 6 months), preterm birth (< 37 weeks) and decreased birth weight (< 3000 g). Self-reported exposure to chemical agents was based on a limited list of chemicals. Physical load questions concerned manual materials handling, prolonged sitting and long periods of standing. A job-exposure matrix (JEM) linked reported job title to workplace chemical exposure within jobs according to expert judgement. Associations between maternal occupational exposure and fertility and pregnancy outcomes, adjusted for age, education, minority, parity, smoking and alcohol use, were studied using logistic regression analysis. RESULTS: Women in jobs with regular handling of loads >= 5 kg had better fertility and pregnancy outcomes. No self-reported exposure to chemicals was associated with any outcomes and self-assessments had very low reliability compared with JEM-based assessments. JEM-based maternal occupational exposure to phthalates was associated with prolonged TTP (OR 2.16, 95% CI 1.02 to 4.57) and exposure to pesticides was associated with decreased birth weight (OR 2.42, 95% CI 1.10 to 5.34). The population attributable fractions were small at 0.7% for phthalates and 0.7% for pesticides. CONCLUSION: This birth cohort study presents evidence of health-based selection into the workforce and adverse effects of maternal occupational exposure to phthalates and pesticides on fertility and pregnancy outcomes.	Occupational & Environmental Medicine	68	3	197-204	Job exposure matrix			Cohort (prospective)	Pesticides in general	reproductive	self-reported	Netherlands	hic
16	A. C. Lo, A. S. Soliman, H. M. Khaled, A. Aboelyazid and J. K. Greenson	Lifestyle, occupational, and reproductive factors and risk of colorectal cancer	2010	PURPOSE: Lifestyle factors and environmental exposures might help explain the risk of colorectal carcinoma in countries where the incidence is low, but unique patterns of young onset and a high proportion of rectal cancer exist. METHODS: We obtained detailed lifestyle information from 421 patients with colorectal cancer and 439 hospital-controls in Egypt. Logistic regression models were computed to evaluate the risk factors of colorectal carcinoma. RESULTS: A history of pesticide exposure and more frequently eating food directly from farms were significantly associated with a higher risk of colorectal carcinoma (odds ratio = 2.6; 95% CI = 1.1-5.9, and odds ratio = 4.6; 95% CI = 1.5-14.6, respectively). Parous women who reported 7 or more live births or breastfed for 19 months or longer per live birth had a significantly lower risk for colorectal carcinoma (odds ratio = 0.3; 95% CI = 0.2-0.7, and odds ratio = 0.2; 95% CI = 0.1-0.4, respectively). Compared with patients aged 40 years or older, industrial exposures were more common in younger patients (P = .05). CONCLUSIONS: Agricultural and industrial exposures were associated with increased risk of colorectal carcinoma, whereas prolonged lactation and increased parity were inversely associated with colorectal carcinoma in women. Further research to elucidate the biological role of intense environmental and industrial exposures and reproductive factors including lactation may further clarify the etiology of colorectal cancer.	Diseases of the Colon & Rectum	53	5	830-7	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Egypt	lmic
17	A. C. Lo, A. S. Soliman, N. El-Ghawalby, M. Abdel-Wahab, O. Fathy, H. M. Khaled, S. Omar, S. R. Hamilton, J. K. Greenson and J. L. Abbruzzese	Lifestyle, occupational, and reproductive factors in relation to pancreatic cancer risk	2007	OBJECTIVES: This study examined the epidemiology of pancreatic cancer in Egypt. METHODS: We obtained detailed information on smoking, occupational, medical, and reproductive histories from 194 pancreatic cancer cases and 194 controls. RESULTS: Compared with not smoking, smoking cigarettes alone or in conjunction with other smoking methods (eg, water pipe, cigar) was associated with an increased risk (odds ratio [OR], 4.5 and 7.8; 95% confidence interval [95% CI], 1.9-10.7 and 3.0-20.6, respectively). Passive smoking was also a significant risk factor (OR, 6.0; 95% CI, 2.4-14.8). The risk of pancreatic cancer was elevated among subjects exposed to pesticides (OR, 2.6; 95% CI, 0.97-7.2). A prior diagnosis of diabetes mellitus for a period of 10 years was associated with higher risk (OR, 5.4; 95% CI, 1.5-19.9). For women, having 7 or more live births and lactating for 144 months or longer were associated with a reduced risk (OR, 0.5 and 0.2; 95% CI, 0.2-1.3 and 0.1-0.9, respectively). No association was found between family history, allergy, or obesity and pancreatic cancer in Egypt. CONCLUSIONS: Multiple tobacco consumption methods, passive smoking, pesticide exposures, and diabetes are associated with an increased risk for pancreatic cancer. Prolonged lactation and increased parity are associated with a reduced risk for pancreatic cancer.	Pancreas	35	2	120-9	Self-reported exposure			NA	Pesticides in general	cancer	doctor-diagnosed	Egypt	lmic

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18	A. C. M. Povey, R.; Alhamwi, H.; Stocks, S. J.; Watkins, G.; Burns, A.; Agius, R.	Pesticide exposure and screen-positive neuropsychiatric disease in British sheep farmers	2014	Background: Epidemiological evidence linking low dose pesticide exposure and chronic ill-health in UK sheep farmers is limited. Our aim was to examine whether neuropsychiatric disorders were associated with low dose chronic and/or more acute pesticide exposure in sheep farmers. Methods: A cohort of British farmers working in the 1970s was sent a screening questionnaire which asked about their health and work history. The prevalence of screen-positive depression, dementia, Parkinsonism and neuropathy was determined using a priori algorithms. Self-reported pesticide exposure was assessed by whether the participant had ever handled the pesticide concentrate (for low dose chronic exposure) or sought advice for pesticide poisoning (acute exposure) and participants categorised into those with only acute or chronic exposure, those with both acute and chronic exposure and those with neither acute nor chronic exposure. Associations between acute and chronic pesticide exposure, and screen-positive ill-health were determined after adjustment for demographic, lifestyle, occupation and somatic severity scores and other variables. Results: In those participants, who had never sought advice for pesticide poisoning, handling the pesticide concentrate for treating sheep was associated with elevated ORs for screen-positive neuropathy (ORadi 1.57 95%CI 0.97-2.54) and Parkinsonism (ORadj 1.56 95%CI 0.95-2.56) but not depression or dementia. In those participants who had handled the pesticide concentrate, seeking advice for pesticide poisoning was associated with screen-positive depression (Odds ratio, ORadj=9.97 95%CI 4.76-20.8), dementia (OR=6.94 95%CI 3.44-14.0), Parkinsonism (ORadj=4.77 95% 2.39-9.52), and neuropathy (ORadj=4.77 95%CI 2.39-9.52). Adjustment for somatic severity score modified little the associations with pesticide handling in those not acutely exposed but reduced the ORs for seeking advice for pesticide poisoning in those exposed chronically. Furthermore, stratification of results based upon somatic severity score indicated that the highest ORs for handling the pesticide concentrate associated with neuropathy and Parkinsonism were found in those participants whose somatic score was minimal. Conclusions: Results are consistent with low-dose exposure to pesticides being associated with screen-positive neuropathy and Parkinsonism but the stronger associations between seeking advice for pesticide poisoning and screen-positive ill-health suggest that acute pesticide exposure remains an important determinant of ill-health. Further work is required to better delineate to what extent low dose exposures may contribute to ill-health in populations without acute exposures. Somatising tendency does not appear to play an important role in this population.	Environmental Research	135	NA	262-270	Self-reported exposure			Cohort (prospective)	Pesticides in general	neurological	self-reported	UK	hic
19	A. C. P. Silv<U+221A><U+00A9>rio, S. C. Machado, L. Azevedo, D. A. Nogueira, M. M. de Castro Graciano, J. S. Sim<U+221A><U+00B5>es, A. L. M. Viana and I. Martins	Assessment of exposure to pesticides in rural workers in southern of Minas Gerais, Brazil	2017	The aim of the study was to assess of occupational exposure to pesticides in rural workers using genotoxicity test, bioindicators and clinical evaluation. Blood, urine and buccal samples from persons, rural workers exposed to a complex mixture of pesticides with organophosphates (n = 94) and without organophosphates (n = 94) were collected to compare the activities of cholinesterases, the levels of urinary dialkyl phosphates, genotoxicity data, from a cytome assay. Biomarkers were analysed by traditional/published methods Control group consisted of 50 other persons, non- occupationally exposed to pesticides from the city of Alfenas, Minas Gerais, Brazil. All subjects underwent a clinical evaluation. In the group exposed to organophosphates, the activity of acetylcholinesterase, butyrylcholinesterase and total cholinesterase was lower by 63.8%, 12.8%, and 14.8%, respectively, and 92.6% of the group had dialkyl phosphates present in their urine. The cytome assay was used to measure biomarkers of DNA damage (micronuclei and/or elimination of nuclear material by budding), cytokinetic defects (binucleated cells), and proliferative potential (basal cell) and/or cell death (condensed chromatin, karyorrhectic, pyknotic, and karyolytic cells). The group exposed to organophosphates showed significant changes in all these parameters compared to the control group and showed significant changes in budding, condensed chromatin and karyolytic cells compared with the group non-exposed to organophosphates. Data from the clinical evaluation showed significant changes in the central nervous, respiratory and auditory systems. The studied biomarkers are able to distinguish occupational and environmental exposure to pesticides and the data showed hazardous exposure to organophosphates and afforded valuable data to estimate the risk to cancer development.	Environmental Toxicology and Pharmacology	55	NA	99-106	Biomonitoring (blood)			Cohort (prospective)	Chemical class	genetic (biomarkers)	medical test result	Brazil	umic
20	A. C. Pesatori, J. M. Sontag, J. H. Lubin, D. Consonni and A. Blair	Cohort mortality and nested case-control study of lung cancer among structural pest control workers in Florida (United States)	1994	A previous report on the mortality of this cohort of Florida (United States) pest control workers found the risk of lung cancer was positively associated with the number of years licensed. An additional follow-up (1977-82) of this male cohort confirmed the excess (SMR = 1.4) and the rising risk with increasing number of years licensed (SMR = 2.2 among workers employed more than 20 years). A nested case-control study was undertaken to determine the effects of smoking and the type of pesticide exposure on lung cancer risk. Occupational histories and other data were obtained on 65 deceased lung cancer cases, 122 deceased controls, and 172 living controls. Interviews were conducted with next-of-kin regardless of the vital status of the subject. Odds ratios (OR) were adjusted by age and smoking. Adjustments for diet and other occupations had no effect on risk estimates and were not included in the final model. Using information from licensing records, ORs for lung cancer were greater for workers first licensed before age 40 (OR = 2.4, 95 percent confidence interval [CI] = 1.0-5.9 with deceased controls) and increased from 1.4 (CI = 0.7-3.0) for subjects licensed 10-19 years to 2.1 (CI = 0.8-5.5) for subjects licensed 20 or more years. Using living controls, an association with duration of employment was observed when years of licensure were lagged five years, but was not observed in unlagged analyses. Using information from the questionnaire, the risk of lung cancer was greater among those who worked as pest control operators than non-pest control workers.(ABSTRACT TRUNCATED AT 250 WORDS)	Cancer Causes & Control	5	4	310-8	Self-reported job history			Case-control	Job title	cancer	doctor-diagnosed	USA	hic
21	A. C. Povey, F. Jury, W. M. Dippnall, A. E. Smith, S. Thomson, B. Mackness, M. Mackness, P. Durrington and N. M. Cherry	GST CYP and PON1 polymorphisms in farmers attributing ill health to organophosphate-containing sheep dip	2007	Previously we reported that in sheep dippers exposed to organophosphates the frequency of paraoxonase (PON1) polymorphisms differed between those with or without self-reported ill health. We have now examined whether polymorphisms in other genes involved in xenobiotic metabolism alter disease risk in this population. There were elevated but non-significant risks associated with the CYP2D6 WT genotype (odds ratio (OR) 1.47, 95% CI 0.83-2.60), or a GSTP1*B or *C allele (OR 1.37, 95% CI 0.88-2.01) or being GSTM1*2/GSTT1*2 homozygous (OR 1.61, 95% CI 0.74-3.48). Similar results were generally obtained after the exclusion of subjects to obtain a more homogenous case-referent population: for double null GSTM1 and GSTT1 homozygotes the OR was 2.06 (95% CI 0.85-2.04). In those also likely to have been exposed to diazinon, risks associated with a GSTP1*B or *C allele (OR 1.82, 95% CI 0.92-3.63) or a GSTM1*2/GSTT1*2 homozygous (OR 2.60, 95% CI 0.72-10.42) were elevated but not to a significant extent. Risk associated with PON1 genotype and phenotype varied with CYP2D6 and GSTP1 genotype but not consistently with a priori hypotheses. Further work is necessary to delineate more clearly pathways of organophosphate activation and non-PON1 pathways of detoxification and to confirm whether CYP and GST polymorphisms alter disease risk in populations exposed to organophosphates.	Biomarkers	12	2	188-202	Self-reported exposure			Case-control	Specific active ingredient	genetic (biomarkers)	medical test result	UK	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
22	A. C. R. Povey, H. G.; Thompson, J. P.; Watkins, G.; Stocks, S. J.; Karalliedde, L.	Acute ill-health in sheep farmers following use of pesticides	2012	BACKGROUND: Sheep farmers often complain of acute ill-health, known colloquially as 'dipper's flu', immediately after treating sheep with pesticides. There have been few prospective epidemiological studies to determine it's nature and incidence. Aims To determine the nature and frequency of symptoms occurring in farmers treating sheep for ectoparasites. METHODS: In a longitudinal study, farmers who planned to treat their sheep for ectoparasites were recruited. Farmers kept a symptom diary for 7 days after starting pesticide treatment. Symptoms reported on days 1-6 were compared to those reported on day 7 via the McNemar's test and with previously published literature definitions of dipper's flu. A principal component analysis (PCA) was carried out on new symptoms occurring on days 1 and 2. RESULTS: Of 781 farmers recruited, 352 farmers (45%) completed the symptom diary. In the 7 days after starting pesticide treatment, symptom complex reporting typically peaked on day 2, but few farmers (7 or less; <2%) were identified as having dipper's flu using literature definitions. However, PCA identified two new patterns of symptom complexes that accounted for 35% of the variance. A pyrexial factor consisted of four symptom complexes (feeling generally ill; feeling sweaty, shivery, feverish, hot or cold; feeling unusually tired; and having a headache) and a respiratory factor consisted of three symptom complexes (runny, stuffy, blocked or irritated nose; cough, shortness of breath or wheeze; and eye irritation). CONCLUSIONS: Existing definitions of dipper's flu do not adequately describe symptoms that occur following the treatment of sheep for ectoparasites.	Occupational Medicine (Oxford)	62	7	541-8	Job title			Cohort (prospective)	Job title	pesticide-related symptoms	self-reported	UK	hic
23	A. Dana, R. Vinnakota, Y. Park, J. Newman, E. Langhoff and L. Geskin	A retrospective analysis of the association of dioxin (agent orange) exposure and cutaneous t-cell lymphoma	2015	The purpose of this study is to identify an association between dioxin (Agent Orange) exposure and development of cutaneous T-cell lymphoma in US veterans. Cutaneous lymphomas are cancers characterized by malignant transformation of lymphocytes, or white blood cells, which affect the skin. Definitive causative factors of CTCL have not been identified, although there have been reports linking CTCL to dioxin exposure. However, these studies have been small and unsubstantiated. During military service, many soldiers were exposed to dioxin during the Korean and Vietnam conflicts from 1957 through 1987. Significantly, despite CTCL being a very rare lymphoma, there are 5,000 veterans diagnosed with CTCL in the VA system, which is probably is an underestimation, considering difficulty in diagnosis. We performed a retrospective chart analysis of 5,000 veterans with cutaneous T-cell lymphoma identified via the VA Informatics and Computing Infrastructure (VINCI) database and cross-referenced these individuals with the <U+201A><U+00C4><U+00FA>Agent Orange Registry<U+201A><U+00C4><U+00F9> to characterize extent and duration of dioxin exposure. The association of CTCL with dioxin exposure allows for the identification of veterans with dioxin exposure and history of chronic dermatitis such that they can be monitored prospectively for earlier diagnosis of CTCL; early detection of CTCL translates to early treatment and potential prevention of disease progression.	Journal of Investigative Dermatology	135	NA	S50	Registers			Cohort (prospective)	Chemical class	cancer	doctor-diagnosed	USA	hic
24	A. De Peyster, W. O. Willis, C. A. Molgaard, T. M. MacKendrick and C. Walker	Cholinesterase and self-reported pesticide exposure among pregnant women	1993	Ascertainment of exposure to cholinesterase-inhibiting pesticides in pregnant subjects is complicated by altered enzyme activity that results from metabolic changes associated with pregnancy. Nevertheless, this study found a high correlation (Pearson chi-square = 13.67, p = .008) between classification of pesticide exposure using self-reported interview information and plasma cholinesterase activity for 203 pregnant women for whom three trimester cholinesterase values were available. All plasma cholinesterase activity values were referenced, by trimester, to a larger sample of 1,050 plasma cholinesterase values from 535 pregnant women. Subjects who lived nearest to agricultural land and who reported that they worked with pesticides in agricultural and other occupations tended to have lower plasma cholinesterase activity than those who reported use of household pesticides only.	Archives of Environmental Health	48	5	348-52	Self-reported exposure			Cross-sectional	Chemical class	neurological	medical test result	USA	hic
25	A. E. Rojas-Garcia, I. M. Medina-Diaz, L. Robledo-Marenco Mde, B. S. Barron-Vivanco, M. I. Giron-Perez, J. B. Velazquez-Fernandez, C. A. Gonzalez-Arias, A. Albores-Medina, B. Quintanilla-Vega, P. Ostrosky-Wegman, M. C. Rojas-Garcia, N. E. Perez-Herrera and J. F. Lopez-Flores	Hematological, biochemical effects, and self-reported symptoms in pesticide retailers	2011	OBJECTIVE: This study evaluates the effects of exposure to pesticides on the health of pesticide retailers. METHODS: The study population comprised 83-male pesticide retailers and 98 controls. Serum butyrylcholinesterase levels and complete blood analysis were performed in a certified laboratory and each subject completed a structured questionnaire. RESULTS: Butyrylcholinesterase activity and hematological parameters such as hemoglobin and hematocrit were significantly lower in pesticide retailers than in control subjects. In contrast, platelet count as well as hepatic parameters such as glutamic-pyruvate transaminase and gamma-glutamyl transpeptidase activities was higher in pesticide retailers. Furthermore, pesticide retailers experienced burning sensations in the skin more frequently than controls. CONCLUSIONS: These preliminary results suggest the importance of evaluating further toxicological biomarkers in these populations.	Journal of Occupational & Environmental Medicine	53	5	517-21	Job title			Cross-sectional	Pesticides in general	hematological	self-reported	Mexico	umic
26	A. Elbaz, C. Levecque, J. Clavel, J. S. Vidal, F. Richard, J. R. Correze, B. Delemotte, P. Amouyel, A. Alperovitch, M. C. Chartier-Harlin and C. Tzourio	S18Y polymorphism in the UCH-L1 gene and Parkinson's disease: evidence for an age-dependent relationship	2003	We studied the relationship between Parkinson's disease (PD) and the S18Y polymorphism in the UCH-L1 gene and the effect on this relationship of age at onset, smoking, and pesticides. Patients requested free health coverage for PD to the Mutualite Sociale Agricole (MSA), the French health insurance organization for people whose work is related to agriculture. Controls requested reimbursement of health expenses to the MSA. A maximum of three controls were matched to each case. Analyses included participants with both parents born in Europe. There were no differences in S18Y genotypes between patients (n = 209; 67% SS, 32% SY, 1% YY) and controls (n = 488; 66% SS, 30% SY, 4% YY). The relationship between PD and S18Y was modified by age at onset (P = 0.03). The Y allele was inversely associated with PD for patients with onset before 61 years (odds ratio [OR] = 0.53; 95% confidence interval [CI], 0.29-0.99); there was no association for older patients (62-68 years: OR = 1.21; 95% CI, 0.67-2.20; >68 years: OR = 1.24; 95% CI, 0.67-2.31). Among patients, Y carriers had a later onset than noncarriers (P = 0.04). These findings were not modified or confounded by smoking and pesticides. In this community-based case-control study, carriers of the Y allele were at decreased risk of developing PD at a young age, independently of pesticides and smoking.	Movement Disorders	18	2	130-7	Expert case-by-case assessment			Case-control	Pesticides in general	NA	NA	France	hic

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27	A. Elbaz, C. Levecque, J. Clavel, J. S. Vidal, F. Richard, P. Amouyel, A. Alperovitch, M. C. Chartier-Harlin and C. Tzourio	CYP2D6 polymorphism, pesticide exposure, and Parkinson's disease	2004	We performed a case-control study of Parkinson's disease (PD) in a population characterized by a high prevalence of pesticide exposure and studied the joint effect of pesticide exposure and CYP2D6. Although they are based on a small group of subjects with the joint exposure, our findings are consistent with a gene-environment interaction disease model according to which (1) pesticides have a modest effect in subjects who are not CYP2D6 poor metabolizers, (2) pesticides' effect is increased in poor metabolizers (approximately twofold), and (3) poor metabolizers are not at increased PD risk in the absence of pesticide exposure.	Annals of Neurology	55	3	430-4	Expert case-by-case assessment			Case-control	Chemical class	neurological	doctor-diagnosed	France	hic
28	A. Elbaz, J. Clavel, P. J. Rathouz, F. Moisan, J. P. Galanaud, B. Delemotte, A. Alperovitch and C. Tzourio	Professional exposure to pesticides and Parkinson disease	2009	OBJECTIVE: We studied the relation between Parkinson disease (PD) and professional exposure to pesticides in a community-based case-control study conducted in a population characterized by a high prevalence of exposure. Our objective was to investigate the role of specific pesticide families and to perform dose-effect analyses. METHODS: PD cases (n = 224) from the Mutualite Sociale Agricole (France) were matched to 557 controls free of PD affiliated with the same health insurance. Pesticide exposure was assessed using a 2-phase procedure, including a case-by-case expert evaluation. Analyses of the relation between PD and professional exposure to pesticides were first performed overall and by broad category (insecticides, fungicides, herbicides). Analyses of 29 pesticide families defined based on a chemical classification were restricted to men. Multiple imputation was used to impute missing values of pesticide families. Data were analyzed using conditional logistic regression, both using a complete-case and an imputed dataset. RESULTS: We found a positive association between PD and overall professional pesticide use (odds ratio [OR] = 1.8, 95% confidence interval [CI] = 1.1-3.1), with a dose-effect relation for the number of years of use (p = 0.01). In men, insecticides were associated with PD (OR = 2.2, 95% CI = 1.1-4.3), in particular organochlorine insecticides (OR = 2.4, 95% CI = 1.2-5.0). These associations were stronger in men with older onset PD than in those with younger onset PD, and were characterized by a dose-effect relation in the former group. INTERPRETATION: Our results support an association between PD and professional pesticide exposure, and show that some pesticides (ie, organochlorine insecticides) may be more particularly involved.	Annals of Neurology	66	4	494-504	Expert case-by-case assessment			Case-control	Pesticides in general	neurological	doctor-diagnosed	France	hic
29	A. Escribano Uzcudun, I. Rabanal Retolaza, A. Garcia Grande, L. Miralles Olivar, A. Garcia Garcia, M. Gonzalez Baron and J. Gavilan Bouzas	Pharyngeal cancer prevention: evidence from a case--control study involving 232 consecutive patients	2002	The aim of this study was to determine risk factors for pharyngeal cancer and to propose 10 result-based preventive measures. It was a case-control study conducted in Madrid, Spain, with 232 consecutive patients diagnosed between January 1 1990 and December 31, 1995, sex- and age-matched with 232 control individuals with no oncological disease or history. By means of an interviewer-administered questionnaire, seven different epidemiological areas were surveyed, namely: (1) sociodemographic variables, (2) familial all-site cancer history, (3) medical history, (4) lifestyle (habits), (5) diet, (6) occupational exposure, and (7) non-occupational exposure. Of the great number of factors within each epidemiological area, the following were found to be risk factors after adjustment for tobacco smoking and alcoholic beverage drinking: (1) tobacco smoking, (2) alcoholic beverage drinking, (3) low and low-middle socioeconomic background, (4) low educational level, (5) rural milieu, (6) working, or having worked, as a manual worker in agriculture, (7) working, or having worked as a manual worker in building industry, (8) having an upper aerodigestive tract cancer familial history, (9) having a medical history of alcholism, low weight/malnutrition, gastroesophageal reflux or chronic obstructive bronchopneumonia, (10) low dietary intake of fruit, fruit juice, uncooked vegetables, dietary fibre-containing foods, fish and milk and dairy products, (11) high dietary intake of meat and fried foods, (12) deficient oral and dental hygiene, (13) abuse of black coffee, (14) abuse of 'carajillo' (a typical Spanish drink composed of black coffee and flambeed brandy), (15) occupational exposure to pesticides, solvents and dust of different origins. On the basis of our results and those reported by other authors, we put forward 10 measures for the prevention of pharyngeal cancer. However, due to the small size of the nasopharyngeal cancer subsample (n = 35, 15.08 per cent), our results as well as the preventive measures are to considered as referring uniquely to oropharyngeal and hypopharyngeal cancers. In addition, from descriptive statistical data inspection one can conclude that nasopharyngeal cancer is likely to bear risk factors different from those for oropharyngeal and hypopharyngeal cancers, thus nasopharyngeal cancer warrants specific epidemiological investigation with a sufficiently large patient sample.	Journal of Laryngology & Otology	116	7	523-31	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Spain	hic
30	A. F. Faustini, F.; Di Betta, L.; Magliola, E. M.; Perucci, C. A.	Cohort study of mortality among farmers and agricultural workers	1993	A cohort study was made of the mortality experience of 1701 male and 426 female farm workers (Aprilia, Italy) during the period 1972-1988. A low overall mortality was found due mainly to a decreased risk of circulatory diseases and respiratory conditions. Also, the overall cancer mortality was reduced (SMR = 0.88 for males and 0.58 for females). No statistically significant excesses were observed in cancer mortality, but there was an evident tendency towards an increased risk of gastric cancer (0 = 23, SMR = 1.24), renal cancer (0 = 5, SMR = 2.12), skin cancer (0 = 2, SMR = 1.67) and leukemia (0 = 6, SMR = 1.54), mainly of the myeloid type. Finally, 41 lung cancer cases were observed against 40.12 expected. Under 65 years excess deaths were found for all cancer sites investigated except cancer of the lymphatic and hemopoietic tissues. Since farmers usually have a low lung cancer rate, the increased mortality in the young age group (0 = 24, SMR = 1.28) and also the excess of kidney cancer (0 = 4, SMR = 3.67), although not statistically significant, deserve consideration in relation to past exposure to pesticides, especially DDT, in this population.	Medicina del Lavoro	84	1	31-41	Job title			Cohort (prospective)	Job title	mortality (all cause)	doctor-diagnosed	Italy	hic
31	A. F. G. Hernandez, F.; Lacasana, M.; Rodriguez-Barranco, M.; Tsatsakis, A. M.; Requena, M.; Parron, T.; Alarcon, R.	Pesticide exposure and genetic variation in xenobiotic-metabolizing enzymes interact to induce biochemical liver damage	2013	Metabolic activation of pesticides in the liver may result in highly reactive intermediates capable of impairing various cellular functions. Nevertheless, the knowledge about the effect of pesticide exposure on liver function is still limited. This study assessed whether exposure to pesticides elicits early biochemical changes in biomarkers of liver function and looked for potential gene-environmental interactions between pesticide exposure and polymorphisms of pesticide-metabolizing genes. A longitudinal study was conducted in farm-workers from Andalusia (South Spain), during two periods of the same crop season with different degree of pesticide exposure. Blood samples were taken for the measurement of serum and erythrocyte cholinesterase activities as well as for determining clinical chemistry parameters as biomarkers of liver function. Serum lipid levels were also measured as they may help to monitor the progress of toxic liver damage. A reduction in serum cholinesterase was associated with decreased levels of all clinical chemistry parameters studied except HDL-cholesterol. Conversely, a decreased erythrocyte cholinesterase (indicating long-term pesticide exposure) was associated with increased levels of aspartate aminotransferase and alkaline phosphatase and increased levels of triglycerides, total cholesterol and LDL-cholesterol, but reduced levels of HDL-cholesterol. Changes in liver biomarkers were particularly associated with the PON155M/192R haplotype. The obtained results therefore support the hypothesis that pesticide exposure results in subtle biochemical liver toxicity and highlight the role of genetic polymorphisms in pesticide-metabolizing enzymes as biomarkers of susceptibility for developing adverse health effects.	Food & Chemical Toxicology	61	NA	144-51	Biomonitoring (blood)			Cohort (prospective)	Chemical class	genitourinary	other	Spain	hic

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32	A. F. Hernandez	Application of biomarkers of exposure, effect and susceptibility to subjects long-term exposed to pesticides	2010	Pesticides represent a large and important class of chemicals showing acute and long-term toxicity in non target organisms, such as humans. The major results of our studies performed in plastic greenhouses workers from Southeast Spain on different categories of biomarkers (exposure, of effect and of susceptibility) will be addressed. Exposure was assessed by measuring serum cholinesterase (BChE) and red blood cell cholinesterase (AChE). Application of pesticides can result in exposure by either the dermal or respiratory route, resulting in low-grade depressions in both cholinesterases. Lifetime exposure to pesticides significantly decreased AChE in the exposed population. Significant lower levels of P-aminolevullinic acid dehydratase (ALA-D) and AChE were observed in pesticide applicators as compared to controls (41.3 and 14.5%, respectively). A number of well-established measurements were assessed for early biological effects after pesticide exposure. New serum esterases, such as P-glucuronidase and paraoxonase (PON1) as well as certain serum enzymes (aspar-tate aminotransferase, lactate dehydrogenase, amine oxidase) underwent significant changes in pesticide-exposed workers, which supports a subtle biochemical dysfunction resulting in cytotoxicity. Pesticide-induced oxidative stress may result from their biotransformation or toxic action in the body. We found that greenhouse workers were exposed to more oxidative stress as evidenced by changes in their antioxidant status (decreased levels of superoxide dismutase, catalase and glutathione reductase). The individual susceptibility to pesticides is caused by polymorphisms in biotransformation enzymes such as esterases, transferases and CYP450s. Human serum PON1 hydrolyses organophosphates entering the blood circulation and tissues thus limiting toxicity. PON1-192R allele was associated with both a higher risk of BChE inhibition and a lesser risk of having a previous episode of acute pesticide poisoning. PON1-192R and null GSTT1 were associated with higher rates of erythrocyte enzymes (AChE and ALA-D). Our forthcoming studies with novel biomarkers of effect and susceptibility will be also presented.	Toxicology Letters	196	NA	S6-S7	Biomonitoring (blood)			Cross-sectional	Chemical class	neurological	medical test result	NA	NA
33	A. F. Hernandez, B. Mackness, L. Rodrigo, O. Lopez, A. Pla, F. Gil, P. N. Durrington, G. Pena, T. Parron, J. L. Serrano and M. I. Mackness	Paraoxonase activity and genetic polymorphisms in greenhouse workers with long term pesticide exposure	2003	Serum paraoxonase (PON1) is a high-density lipoprotein (HDL) associated protein, which plays a critical role in the pathogenesis of atherosclerosis, although it was primarily associated with the hydrolysis of organophosphorus compounds. PON1 was initially thought to be independent from physiological or pathological states, although recently some environmental factors have been reported to modulate its activity. In this study, we have investigated the promoter (PON1 -108C/T and -909 C/G) and coding region (PON1 192Q/R and 55L/M) polymorphisms, as well as PON1 activity towards different substrates (paraoxon, phenylacetate and diazoxon) in 102 individuals with long term low dose exposure to pesticides in a plastic greenhouse setting (sprayers), who are probably the group of agricultural workers with the highest exposure to pesticides. PON1 activity towards paraoxon was nonsignificantly decreased (up to 53.5%) in the sprayers subgroup exposed to organophosphates (n = 41) compared with nonsprayers acting as controls (n = 39). None of the genotypes studied was associated significantly with the subgroup of individuals exposed to organophosphates, although differences between sprayers and nonsprayers were observed in the PON1 -909 G/C polymorphism. Among the environmental factors that significantly predicted lower rates of PON1 activity towards paraoxon are, interestingly, the exposure to organophosphates and current smoking. By contrast, the utilization of protective clothing while spraying pesticides inside the greenhouses was positively associated with PON1 activity, very likely by preventing the pesticides from being absorbed. This study suggests that chronic exposure to pesticides might decrease PON1 activity and pinpoints the potential usefulness of monitoring PON1 activity in occupational settings where exposure to organophosphates occurs.	Human & Experimental Toxicology	22	11	565-74	Self-reported exposure			Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	Spain	hic
34	A. F. Hernandez, F. Gil, M. Lacasana, M. Rodriguez-Barranco, A. Gomez-Martin, D. Lozano and A. Pla	Modulation of the endogenous antioxidants paraoxonase-1 and urate by pesticide exposure and genetic variants of xenobiotic-metabolizing enzymes	2013	This study evaluated the association between pesticide exposure in farmworkers and plasma levels of the endogenous antioxidants urate and paraoxonase-1 (PON1) enzyme activities (paraoxonase, arylesterase and diazoxonase, three substrate-specific assays for measuring PON1 function) by using generalized estimating equations (GEEs). Decreases in plasma and erythrocyte cholinesterases (BChE and AChE, respectively) were used as biomarkers of pesticide exposure. We also assessed the contribution of genetic polymorphisms of the pesticide-metabolising enzymes PON1, glutathione S-transferases (GST) and cholinesterase variants (BCHE) on plasma levels of endogenous antioxidants and potential gene-environment interactions. A dual effect was observed on paraoxonase depending on the pattern of pesticide exposure. Thus, exposure to anticholinesterase pesticides was associated with decreased paraoxonase activity and urate levels whereas long-term pesticide exposure showed an association with increased paraoxonase activity. Significant interactions were observed between BChE activity and PON1 regulatory region polymorphisms on arylesterase and diazoxonase activities, and between AChE activity (a biomarker for long-term pesticide exposure) and PON1192RR genotype on arylesterase activity. These findings suggest that pesticide exposure may affect plasma antioxidant potential and that relevant gene-pesticide interactions may play a mechanistic role in oxidative stress-induced diseases following pesticide exposure. Nonetheless, more studies are needed to better characterise these interactions.	Food & Chemical Toxicology	61	NA	164-70	Biomonitoring (blood)			Cohort (prospective)	Chemical class	genetic (biomarkers)	medical test result	Spain	hic
35	A. F. Hernandez, I. Casado, G. Pena, F. Gil, E. Villanueva and A. Pla	Low level of exposure to pesticides leads to lung dysfunction in occupationally exposed subjects	2008	Pesticides may contribute to adverse respiratory health effects among farmers and have been considered one causal factor for the rise in asthma prevalence. This cross-sectional study was conducted to evaluate potential respiratory function abnormalities following long-term pesticide exposure by means of a complete pulmonary function testing, including spirometry, lung volumes, and diffusing capacity for carbon monoxide. The study population was comprised by workers from a prominent intensive agriculture area of southern Spain that relied on pesticides for the control of plagues. Eighty-nine pesticide sprayers of plastic greenhouse farming and a control group of 25 nonspraying control farmers from the same area were interviewed by a general practitioner asking about sociodemographic factors, occupational exposure, and clinical symptoms by using a structured questionnaire. Multiple regression analyses showed a relationship of short-term exposure to pesticides (as indicated by a drop in serum cholinesterase > 25% of baseline levels) with reduced forced expired volume in 1 s, and of long-term exposure (as indicated by a cumulative pesticide exposure index) with reduced forced expiratory flow rate. Exposure to bipyridilium-class herbicides was a determinant of a fall in the diffusing capacity of the lungs, and neonicotinoid insecticides showed a relationship with lower pulmonary volumes (total lung capacity, residual volume, and functional residual capacity), suggestive of restrictive lung disease, and with an increased risk of reporting irritative symptoms.	Inhalation Toxicology	20	9	839-49	Biomonitoring (blood)			Cross-sectional	Chemical class	respiratory	medical test result	Spain	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
36	A. F. Hernandez, M. Amparo Gomez, V. Perez, J. V. Garcia-Larío, G. Pena, F. Gil, O. Lopez, L. Rodrigo, G. Pino and A. Pla	Influence of exposure to pesticides on serum components and enzyme activities of cytotoxicity among intensive agriculture farmers	2006	Although the effects of acute pesticide poisoning are well known for the pesticides most currently used, hardly any data exist on health effects after long-term low-dose exposures. Major unresolved issues include the effect of moderate exposure in the absence of poisoning. The increased utilization of pesticides other than organophosphates makes it even more difficult to find associations. In this study a cohort of 106 intensive agriculture workers were assessed twice during the course of a spraying season for changes in serum biochemistry, namely enzymes reflecting cytotoxicity (AST, ALT, LDH, CK, and amino-oxidase) and other biochemical parameters, such as markers of nephrotoxicity (urea, creatinine) and lipid profile (cholesterol and triglycerides). Several criteria for estimating pesticide exposure were used, the most important one being serum cholinesterase depression greater than 25% from baseline to peak exposure. Our results revealed an association of pesticide exposure with changes in AST (increased activity), LDH, and amino-oxidase (decreased activity) as well as with changes in serum creatinine and phosphorus (lower and higher levels, respectively). These results provide support for a very slight impairment of the liver function, but overall these findings are consistent with no clinically significant hepatotoxicity. Intriguingly, paraoxonase-1 R allele was found to be an independent predictor of higher rates of AST and lower rates of amino-oxidase, so that it may play a supporting role as an individual marker of susceptibility on pesticide-induced health effects. In conclusion, different biomarkers might be used to detect early biochemical effects of pesticides before adverse clinical health effects occur.	Environmental Research	102	1	25720	Job title			Cohort (prospective)	Pesticides in general	genetic (biomarkers)	medical test result	Spain	hic
37	A. F. Hernandez, O. Lopez, L. Rodrigo, F. Gil, G. Pena, J. L. Serrano, T. Parron, J. C. Alvarez, J. A. Lorente and A. Pla	Changes in erythrocyte enzymes in humans long-term exposed to pesticides: influence of several markers of individual susceptibility	2005	Changes in erythrocyte delta-aminolevulinic acid dehydratase (ALA-D) have been reported after exposure to different pesticides, including organophosphates and paraquat. In this study, we have determined ALA-D in 135 pesticide applicators (sprayers) from an intensive agriculture setting at two periods with different pesticide exposure. Acetylcholinesterase (AChE) was used as a reference biomarker. The effects of the combined polymorphism of enzymes involved in the detoxification of pesticides (paraoxonase (PON1), benzoylcholinesterase (BChE), and glutathione S-transferase (GSTM1 and GSTT1)) on the level of the target erythrocyte enzymes were also studied as biomarkers of individual susceptibility. Sprayers presented significant lower levels of ALA-D and AChE than controls (41.3% and 14.5%, respectively) at the high exposure period. When all biomarkers of individual susceptibility to pesticides were considered at the same time, the GSTT1 null allele determined higher ALA-D and AChE activities at the period of high exposure to pesticides. PON1 R allele in turn determined lower AChE activity at the low exposure period. Null genotype for both GST subclasses (GSTM1 and GSTT1) was found to be the unique independent predictor of pesticide-related symptomatology. Interestingly, sprayers were consistently underrepresented among carriers of "unfavourable" BChE variants. In conclusion, ALA-D appears to be an important biological indicator of pesticide exposure and PON1 and GSTT1 are relevant determinants of susceptibility to chronic pesticide poisoning.	Toxicology Letters	159	1	13-21	Biomonitoring (blood)			Cohort (prospective)	Chemical class	endocrine/nutritional/metabolical	medical test result	Spain	hic
38	A. F. L. Hernandez, D.; Gil, F.; Lacasa<U+221A><U+00B1>a, M.	Biomarkers for use in assessing human toxic effects from exposure to pesticide mixtures	2016	Introduction: Multiple exposures to pesticides occur from environmental, foodstuff and occupational sources. The measurement of a wide array of molecular biomarkers of target organ toxicity represents a valuable tool for assessing combined exposures to pesticides (and other chemicals) from different routes. Objective: This study assessed potential biochemical liver and brain damage in individuals occupationally exposed to pesticides. Novel, sensitive and tissue-specific biomarkers of target organ toxicity were determined in serum samples over two different study periods (high and low pesticide use). Greenhouse farmers are among those workers more heavily exposed to pesticide mixtures in a simultaneous or sequential manner. Materials and methods: A longitudinal study was conducted on 207 subjects from Almer<U+221A><U+2260>a (Southeastern Spain) at two timepoints with different pesticide use. Of them, 143 (69.1%) were intensive agriculture workers (greenhouse farmers) regularly exposed to pesticides and 64 (30.1%) were non-exposed controls. Exposure to pesticides was assessed by serum and erythrocyte cholinesterase activity. Alanine aminotransferase (ALT), aspartate aminotransferase (AST), -glutamyl transferase (GGT) and alkaline phosphatase (ALP) were measured using a clinical auto-analyzer (ILAB 600, Instrumentation Laboratory). Ornithine transcarbamylase (OTC) was determined spectrophotometrically and arginase, S100B protein and phosphorylated axonal neurofilament subunit H (pNF-H) were measured by using ELISA commercial kits. Linear mixed models were used to compare levels of biomarkers in greenhouse farmers and control subjects over the two study periods. Models were adjusted for age, gender, ethnicity and body mass index. Results: Significant decreased erythrocyte cholinesterase activity was observed in the high versus low exposure period, indicating pesticide exposure. Although therewasnot clinical evidence of liver or brain damage in the exposed population, significant changes in serum levels of AST, ALP, arginase and S100B protein were observed between greenhouse farmers and control subjects and/or for the interaction term (high vs. low exposure period)<U+221A><U+00F3>(greenhouse farmers vs. controls). Conclusions: Results suggest subtle hepatotoxic and, to a lesser extent, neurotoxic damage in association with pesticide exposure and support the potential usefulness of serum biomarkers to assess target organ function following pesticide exposure. However, a critical validation is needed for these biomarkers to be predictive of clinical outcomes.	Toxicology Letters	259	NA	S28	Biomonitoring (adipose tissue)			Cohort (prospective)	Pesticides in general	biochemical	medical test result	Spain	hic
39	A. F. L. Hernandez, M.; Gil, F.; Rodriguez-Barranco, M.; Pla, A.; Lopez-Guarnido, O.	Evaluation of pesticide-induced oxidative stress from a gene-environment interaction perspective	2013	Previously we reported that intensive agriculture workers exposed to pesticides had decreased levels of the intraerythrocyte enzymes delta-9-aminolevulinic acid dehydratase (ALA-D) and superoxide dismutase (SOD), very likely as a result of pesticide-induced oxidative stress. We have now examined in this population potential gene-environment interactions by modeling generalized estimating equations (GEE) adjusted for age, sex, body mass index and tobacco and alcohol consumption. Particularly, we assessed the interaction effects between plasma and erythrocyte cholinesterases (BChE and AChE, used as proxies for short- and long-term pesticide exposure, respectively) and a number of genetic polymorphisms of pesticide metabolizing enzymes such as paraoxonase-1 (PON1), glutathione-S-transferases (GST) and plasma cholinesterase variants (BCHE) on levels of erythrocyte antioxidant enzymes (SOD, catalase, glutathione peroxidase, glucose-6-phosphate dehydrogenase and ALA-D). We observed significant interaction effects between BChE activity and PON1192R allele on catalase, glutathione peroxidase and glucose-6-phosphate dehydrogenase activities. BChE also interacted significantly with GSM1 null genotype on ALA-D and SOD. Regarding long-term pesticide exposure, a significant interaction was found between AChE and genotypes PON1192QR and PON1108CC on GR; between AChE and PON1192RR on SOD, and between AChE and GSTM1, GSTT1 and unusual BCHE variants on catalase activity. These findings suggest relevant gene-pesticide interactions and highlight the potential role of genetic risk factors in the pathomechanism of oxidative stress-induced degenerative diseases following pesticide exposure.	Toxicology	307	NA	95-102	Biomonitoring (blood)			Cohort (prospective)	Chemical class	genetic (biomarkers)	medical test result	Spain	hic

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40	A. Ferreira, E. Maroco, M. Yonamine and M. L. F. De Oliveira	Organophosphate and carbamate poisonings in the northwest of Paran<U+221A><U+00B0> state, Brazil from 1994 to 2005: Clinical and epidemiological aspects	2008	In the present study, clinical and epidemiological aspects of 529 intoxication cases of organophosphate or carbamate pesticides in the northwest of the state of Paran<U+221A><U+00B0>, Brazil, over a twelve-year period (1994-2005), are presented. One hundred-five of 257 patients (40.8%) who attempted suicide were admitted to Intensive Care Units (ICUs), with an average hospital stay of two days (range 1-40 days). Men corresponded to 56.4% of the cases of suicide attempts and sixteen individuals died. One hundred-forty patients intoxicated due to occupational exposure were all young adults and nine of them were admitted to ICU, with average hospital stays of eight days (range 1-16 days). Of these cases, two patients died. One hundred twenty-four patients intoxicated due to accidental exposure were mainly children and had a hospital average stay of four days. Twenty patients were admitted to the ICU, and one of them died. Overall complications included respiratory failure, convulsions, and aspiration pneumonia. Deliberate ingestion of organophosphates and carbamates was much more toxic than occupational and accidental exposure. Men aged 15-39 years were the most likely to attempt suicide with these agents and had more prolonged ICU with significant complications and mortality.	Revista Brasileira de Ciencias Farmaceuticas/Brazilian Journal of Pharmaceutical Sciences	44	3	407-415	Registers			Cohort (prospective)	Pesticides in general	pesticide-related illness	doctor-diagnosed	Brazil	umic
41	A. Fontana, C. Picoco, G. Masala, C. Prastaro and P. Vineis	Incidence rates of lymphomas and environmental measurements of phenoxy herbicides: ecological analysis and case-control study	1998	The authors conducted an ecological study of the distribution of malignant lymphomas in a rice-growing area in northern Italy. They considered data on concentrations of phenoxy herbicides in soil and water and found the highest incidence of non-Hodgkin's lymphoma in subjects who lived in an area where 2,4-dichlorophenoxyacetic acid and 2,4,5-trichlorophenoxyacetic acid existed in very high concentrations. During 1985-1988, the incidence of non-Hodgkin's lymphoma in males in the most-polluted municipalities was twice as high as was noted for the remaining less-polluted territories. During 1991-1993, non-Hodgkin's lymphoma was higher by 60%. The authors also conducted a population-based case control study. They found an association between employment of women in rice-growing jobs (particularly as rice weeders) and risk of non-Hodgkin's lymphoma (odds ratio=1.9; 95% confidence interval=0.6, 6.0). Work in rice fields was correlated strongly with residence in polluted areas. The authors did not detect an association between area of residence or occupation and incidence of Hodgkin's disease.	Archives of Environmental Health	53	6	384-7	Job title			Case-control	Job title	cancer	doctor-diagnosed	Italy	hic
42	A. Gupta, N. Ketchum, C. G. Roehrborn, A. Schecter, C. C. Aragaki and J. E. Michalek	Serum dioxin, testosterone, and subsequent risk of benign prostatic hyperplasia: a prospective cohort study of Air Force veterans	2006	BACKGROUND: Operation Ranch Hand veterans were involved in spraying herbicides, including Agent Orange, during the Vietnam War in 1962-1971; Agent Orange was contaminated with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). It has been hypothesized that dioxins may be partially responsible for an increase of male reproductive tract disorders such as testicular cancer, cryptorchidism, and hypospadias.	NA	NA	NA	NA	Registers			Cohort (prospective)	Chemical class	cancer	doctor-diagnosed	USA	hic
43	A. H. Oesterlund, J. F. Thomsen, D. K. Sekimpi, J. Maziina, A. Racheal and E. Jors	Pesticide knowledge, practice and attitude and how it affects the health of small-scale farmers in Uganda: a cross-sectional study	2014	BACKGROUND: Over the past years there has been an increase in the use of pesticides in developing countries. This study describes pesticide use among small-scale farmers in Uganda and analyses predictors of pesticide poisoning (intoxication) symptoms. METHOD: A cross-sectional study was conducted using a standardized questionnaire. Some 317 small-scale farmers in two districts in Uganda were interviewed about pesticide use, knowledge and attitude, symptoms of intoxication, personal protective equipment (PPE) and hygiene. The risk of reporting symptoms was analysed using logistic regression analysis. RESULTS: The most frequently used pesticides belonged to WHO class II. The farmers had poor knowledge about pesticide toxicity, and the majority did not use appropriate PPE nor good hygiene when handling pesticides. There was no significant association between the number of times of spraying with pesticides and self-reported symptoms of pesticide poisoning. The only significant association was between blowing and sucking the nozzle of the knapsack sprayer and self-reported symptoms of pesticide intoxication (OR: 2.13. 95% CI: 1.09 - 4.18). CONCLUSION: Unlike the practice in several other developing countries, small-scale farmers in Uganda do not use the most hazardous pesticides (WHO class 1a and 1b). However use of WHO class II pesticides and those of lower toxicity is seen in combination with inadequate knowledge and practice among the farmers. This poses a danger of acute intoxications, chronic health problems and environmental pollution. Training of farmers in Integrated Pest Management (IPM) methods, use of proper hygiene and personal protective equipment when handling pesticides should be promoted.	African Health Sciences	14	2	420-33	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	Uganda	lic
44	A. Hansell, R. E. Ghosh, S. Poole, J. P. Zock, M. Weatherall, R. Vermeulen, H. Kromhout, J. Travers and R. Beasley	Occupational risk factors for chronic respiratory disease in a New Zealand population using lifetime occupational history	2014	OBJECTIVES: To investigate associations between respiratory disease and occupational exposures in a New Zealand urban population, the Wellington Respiratory Survey. METHODS: Multiple regression analyses in a population sample of 1017 individuals aged 25 to 74 years with spirometry and questionnaire information, including a lifetime occupational history. RESULTS: Chronic bronchitis symptoms were associated with self-reported exposure to hairdressing, paint manufacturing, insecticides, welding, detergents and with ALOHA Job Exposure Matrix-assessed gases/fumes exposure. The strongest association was for hairdressing (odds ratio 6.91; 95% confidence interval: 2.02 to 23.70). Cumulative exposure to mineral dust and gases/fumes was associated with higher FEV1% (forced expiratory volume in the first second of expiration) predicted. Analyses were limited by relatively small numbers of cases. CONCLUSIONS: Increased risks of objectively defined respiratory disease, which have been previously documented, were not seen. Nevertheless, the study suggested increased risk of respiratory symptoms with various occupational exposures as well as likely healthy worker effect.	Journal of Occupational & Environmental Medicine	56	3	270-80	Job exposure matrix			Cohort (prospective)	Type of pesticide	respiratory	medical test result	New Zealand	hic
45	A. Hay and J. Tarrel	Mortality of power workers exposed to phenoxy herbicides and polychlorinated biphenyls in waste transformer oil	1997	Herbicide spray crews employed by a Canadian power company between 1950 and 1967 had a higher than expected death rate, with a standardized mortality ratio of 157% (CI 130%-194%). In 1991, the cohort consisted of 225 former sprayers of whom 127 were still alive and 98 had died. Eligibility for inclusion in the cohort was based on employer records; and a history of spraying for 30 days or more in at least one spray season. Deaths expected were based on age-specific population mortality rates for New Brunswick. The all-age SMR for the total cohort was 159%. After 1958, however, waste transformer oil was added to the phenoxy-herbicide spray mixture, the oil representing 10% of the final mixture. Spray crews wore no protective clothing. Subdividing the cohort into spray years 1950-1958 and 1959-1967 yielded SMRs of 146% (CI 115%-184%); and 215% (CI 139%-318%), respectively. The transformer oil was used during the period 1959-1967. Most excess deaths were due to cardiovascular disease.	Annals of the New York Academy of Sciences	837	NA	138-56	Registers			Cohort (prospective)	Type of pesticide	mortality (all cause)	doctor-diagnosed	Canada	hic

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46	A. Hernandez, M. A. Gomez, G. Pena, F. Gil, L. Rodrigo, E. Villanueva and A. Pla	Effect of long-term exposure to pesticides on plasma esterases from plastic greenhouse workers	2004	Previous reports in animals considered beta-glucuronidase activity as a novel biomarker of anticholinesterase (organophosphates and carbamates) pesticides exposure. Acid phosphatase activity was also shown to increase after organophosphates exposure. In addition, there is evidence that the paraoxonase status influences sensitivity to specific pesticides. In this study, activities of beta-glucuronidase, acid phosphatase, cholinesterase, and paraoxonase were measured in plasma from plastic greenhouse workers exposed over the long term to different pesticides, including organophosphates and carbamates, in order to evaluate the potential chronic toxicity of pesticides at occupational level. Our results show that activities of paraoxonase and cholinesterase were decreased in applicators of pesticides compared to non-applicators. Likewise, it was found that activities of beta-glucuronidase and acid phosphatase were associated with pesticide exposure in humans, and that both biochemical parameters were related to each other. Interestingly, the paraoxonase B allele (phenotyped in plasma) was associated with a higher risk of inhibition of cholinesterase activity above a 25% level, which supports the hypothesis that paraoxonase phenotypes are associated with susceptibility of humans to anticholinesterase pesticides toxicity.	Journal of Toxicology & Environmental Health Part A	67	14	1095-108	Self-reported exposure			Cross-sectional	Specific active ingredient	neurological	medical test result	Spain	hic
47	A. I. Sankoh, R. Whittle, K. T. Semple, K. C. Jones and A. J. Sweetman	An assessment of the impacts of pesticide use on the environment and health of rice farmers in Sierra Leone	2016	One of the biggest challenges faced by Sierra Leonean farmers is pest control. Birds, rodents, insects, crustaceans and other organisms can drastically reduce yields. In order to prevent these organisms from destroying their crop, farmers use pesticides. However there are reports that these chemicals are being misused and such misuse is having a negative impact on the environment and the health of the farmers. This research study aimed to investigate the use of pesticides in rice fields and its potential effects on the environment and on the farmers of Sierra Leone. Five hundred farmers and one hundred health workers across the country were interviewed. Fifty focus group discussions were also completed. Field observations were also undertaken to see how farmers apply pesticides to their farms and the possible threats these methods have on human health and the environment. It is clear that a wide range of pesticides are used by rice farmers in Sierra Leone with 60% of the pesticides used entering the country illegally. Most farmers have no knowledge about the safe handling of pesticides as 71% of them have never received any form of training. The pesticides kill both target and non-target organisms some of which enter the food chain. Cases of health problems such as nausea, respiratory disorders and blurred vision investigated in this research are significantly higher among farmers who use pesticides than those who do not use pesticides. Cases of pesticide intoxication are not investigated by health workers but results obtained from interviews with them also indicated that cases of pesticides related symptoms are significantly higher in environments where pesticides are used than those in which pesticides are not used.	Environment International	94	NA	458-466	Self-reported exposure			Cross-sectional	Pesticides in general	pesticide-related symptoms	self-reported	Sierra Leone	lic
48	A. J. B. De Roos, A.; Rusiecki, J. A.; Hoppin, J. A.; Svec, M.; Dosemeci, M.; Sandler, D. P.; Alavanja, M. C.	Cancer incidence among glyphosate-exposed pesticide applicators in the Agricultural Health Study	2005	Glyphosate is a broad-spectrum herbicide that is one of the most frequently applied pesticides in the world. Although there has been little consistent evidence of genotoxicity or carcinogenicity from in vitro and animal studies, a few epidemiologic reports have indicated potential health effects of glyphosate. We evaluated associations between glyphosate exposure and cancer incidence in the Agricultural Health Study (AHS), a prospective cohort study of 57,311 licensed pesticide applicators in Iowa and North Carolina. Detailed information on pesticide use and other factors was obtained from a self-administered questionnaire completed at time of enrollment (1993-1997). Among private and commercial applicators, 75.5% reported having ever used glyphosate, of which > 97% were men. In this analysis, glyphosate exposure was defined as a) ever personally mixed or applied products containing glyphosate; b) cumulative lifetime days of use, or "cumulative exposure days" (years of use times days/year); and c) intensity-weighted cumulative exposure days (years of use times days/year times estimated intensity level). Poisson regression was used to estimate exposure-response relations between glyphosate and incidence of all cancers combined and 12 relatively common cancer subtypes. Glyphosate exposure was not associated with cancer incidence overall or with most of the cancer subtypes we studied. There was a suggested association with multiple myeloma incidence that should be followed up as more cases occur in the AHS. Given the widespread use of glyphosate, future analyses of the AHS will allow further examination of long-term health effects, including less common cancers.	Environmental Health Perspectives	113	1	49-54	Algorithm/model	Self-reported exposure		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
49	A. J. De Roos, G. S. Cooper, M. C. Alavanja and D. P. Sandler	Rheumatoid arthritis among women in the Agricultural Health Study: risk associated with farming activities and exposures	2005	PURPOSE: Farming has been associated with increased risk of rheumatoid arthritis (RA) in some studies, but specific causes have not been identified. We studied risk factors for RA in the Agricultural Health Study, a cohort of over 57,000 licensed pesticide applicators and their spouses. METHODS: We used a nested case-control design, limited to female participants. Physician-confirmed cases (n = 135) were matched to five controls each (n = 675) by birth date. We used logistic regression, adjusting for birth date and state to examine associations, as estimated by odds ratios (OR) and 95% confidence intervals (CI). RESULTS: Risk of RA was not associated with mixing or applying pesticides overall or with any pesticide class, nor did it vary by number of days or years of use. Certain pesticides were associated with small nonsignificantly increased risks, including lindane (OR = 1.8, 95% CI: 0.6-5.0). RA risk was associated with welding (OR = 2.1, 95% CI: 0.8-5.4), albeit imprecisely, but not with solvents or sunlight. CONCLUSIONS: We did not identify any strong risk factors for RA. Because of the severe disability associated with this relatively common disease, further investigation into causes is warranted both in the Agricultural Health Study and elsewhere.	Annals of Epidemiology	15	10	762-70	Self-reported exposure			Case-control	Specific active ingredient	muskuloskeletal	doctor-diagnosed	USA	hic
50	A. J. De Roos, S. H. Zahm, K. P. Cantor, D. D. Weisenburger, F. F. Holmes, L. F. Burmeister and A. Blair	Integrative assessment of multiple pesticides as risk factors for non-Hodgkin's lymphoma among men	2003	BACKGROUND: An increased rate of non-Hodgkin's lymphoma (NHL) has been repeatedly observed among farmers, but identification of specific exposures that explain this observation has proven difficult. METHODS: During the 1980s, the National Cancer Institute conducted three case-control studies of NHL in the midwestern United States. These pooled data were used to examine pesticide exposures in farming as risk factors for NHL in men. The large sample size (n = 3417) allowed analysis of 47 pesticides simultaneously, controlling for potential confounding by other pesticides in the model, and adjusting the estimates based on a prespecified variance to make them more stable. RESULTS: Reported use of several individual pesticides was associated with increased NHL incidence, including organophosphate insecticides coumaphos, diazinon, and fonofos, insecticides chlordane, dieldrin, and copper acetoarsenite, and herbicides atrazine, glyphosate, and sodium chlorate. A subanalysis of these "potentially carcinogenic" pesticides suggested a positive trend of risk with exposure to increasing numbers. CONCLUSION: Consideration of multiple exposures is important in accurately estimating specific effects and in evaluating realistic exposure scenarios.	Occupational & Environmental Medicine	60	9	E11	Self-reported exposure			Case-control	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
51	A. J. Handal and S. D. Harlow	Employment in the Ecuadorian cut-flower industry and the risk of spontaneous abortion	2009	Background. Research on the potentially adverse effects of occupational pesticide exposure on risk of spontaneous abortion (SAB) is limited, particularly among female agricultural workers residing in developing countries. Methods. Reproductive histories were obtained from 217 Ecuadorian mothers participating in a study focusing on occupational pesticide exposure and children's neurobehavioral development. Only women with 2+ pregnancies were included in this study (n = 153). Gravidity, parity and frequency of SAB were compared between women with and without a history of working in the cut-flower industry in the previous 6 years. Logistic regression analysis was conducted to assess the relation between SAB and employment in the flower industry adjusting for maternal age. Results. In comparison to women not working in the flower industry, women working in the flower industry were significantly younger (27 versus 32 years) and of lower gravidity (3.3 versus 4.5) and reported more pregnancy losses. A 2.6 (95% CI: 1.03-6.7) fold increase in the odds of pregnancy loss among exposed women was observed after adjusting for age. Odds of reporting an SAB increased with duration of flower employment, increasing to 3.4 (95% CI: 1.3, 8.8) among women working 4 to 6 years in the flower industry compared to women who did not work in the flower industry. Conclusion. This exploratory analysis suggests a potential adverse association between employment in the cut-flower industry and SAB. Study limitations include the absence of a temporal relation between exposure and SAB, no quantification of specific pesticides, and residual confounding such as physical stressors (i.e., standing). Considering that approximately half of the Ecuadorian flower laborers are women, our results emphasize the need for an evaluating the reproductive health effects of employment in the flower industry on reproductive health in this population. <U+00AC><U+00A9> 2009 Handal and Harlow.	BMC International Health and Human Rights	9	1	NA	Self-reported job history			Cross-sectional	Pesticides in general	reproductive	self-reported	Ecuador	umic
52	A. J. Handal, S. D. Harlow, J. Breilh and B. Lozoff	Occupational exposure to pesticides during pregnancy and neurobehavioral development of infants and toddlers	2008	BACKGROUND: Few studies have examined the effects of in utero exposure to organophosphate and carbamate pesticides on neurobehavioral development in infants and young children. This study considers the potential effects of maternal occupation in the cut-flower industry during pregnancy on neurobehavioral development in Ecuadorian children. METHODS: Data were collected during 2003-2004 for 121 children aged 3-23 months and living in the rural highland region of Cayambe, Ecuador. Children were administered the Ages and Stages Questionnaire and were given specific developmental tests including prehension (reach-and-grasp) and visual skills. Information was gathered on maternal health and work characteristics, the home environment, and child health status. Growth measurements and a hemoglobin finger-prick blood test were obtained. We conducted multiple linear and logistic regression analyses. RESULTS: Children whose mothers worked in the flower industry during pregnancy scored lower on communication (8% decrease in score, 95% confidence interval [CI]: -16% to 0.5%) and fine motor skills (13% decrease, 95% CI: -22% to -5), and had a higher odds of having poor visual acuity (odds ratio = 4.7 [CI =1.1-20]), compared with children whose mothers did not work in the flower industry during pregnancy, after adjusting for potential confounders. CONCLUSIONS: Maternal occupation in the cut-flower industry during pregnancy may be associated with delayed neurobehavioral development of children aged 3-23 months. Possible hazards associated with working in the flower industry during pregnancy include pesticide exposure, exhaustion, and job stress.	Epidemiology	19	6	851-9	Self-reported exposure			Cross-sectional	Pesticides in general	offspring	medical test result	Ecuador	umic
53	A. J. Idrovo, L. H. Sanin, D. Cole, J. Chavarro, H. Caceres, J. Narvaez and M. Restrepo	Time to first pregnancy among women working in agricultural production	2005	OBJECTIVES: This study explores several factors potentially associated with reduced fecundability among women working in cut flowers production. METHODS: A cross-sectional study of first pregnancies was undertaken in 47 Colombian floriculture companies. Two thousand and eighty-five women were interviewed regarding potential reproductive, lifestyle and work history predictors of time-to-pregnancy (TTP), measured in months. Fecundability odds ratios (fOR) were estimated using a discrete time analogue of Cox's proportional hazard model. RESULTS: Associated with longer TTP were: irregular relationships with her partner (fOR 0.82, 95% CI 0.73-0.91), illness in the year prior to pregnancy (fOR 0.78, 95% CI 0.62-0.98), smoking tobacco (fOR 0.71, 95% CI 0.59-0.85), and work in flower production, less than 24 months (fOR 0.86 95% CI 0.75-0.98) or 2 years or more (fOR 0.73, 95% CI 0.63-0.84). CONCLUSIONS: Work in flower production, irregular relationship, illness and tobacco exposure would be associated with impaired fecundability.	International Archives of Occupational & Environmental Health	78	6	493-500	Self-reported exposure			Cross-sectional	Pesticides in general	reproductive	self-reported	Colombia	umic
54	A. J. Verplanke, L. J. Bloemen, E. J. Brouwer, N. J. Van Sittert, P. J. Boogaard, R. F. Herber and F. A. De Wolff	Occupational exposure to cis-1,3-dichloropropene: biological effect monitoring of kidney and liver function	2000	OBJECTIVES: To investigate the possible effects of occupational exposure to the nematocide cis-1,3-dichloropropene (cis-DCP) on function of the kidney and liver in the starch potato growing region in The Netherlands. METHODS: The study involved 13 commercial application workers exposed to cis-DCP for 117 days, and 22 matched control workers. The inhalatory exposure of the application workers was estimated from biological monitoring data. All workers collected urine and serum samples before, during, and after the fumigation season for monitoring of variables for kidney and liver function. Renal effect variables were alanine aminopeptidase (AAP), N-acetyl-beta-D-glucosaminidase (NAG), retinol binding protein (RBP), and albumin (ALB) in urine, and beta(2)-microglobulin (beta(2)M-S) and creatinine in serum (Creat-S). Liver variables were alanine aminotransferase (ALAT), aspartate aminotransferase (ASAT), gamma-glutamyltranspeptidase (GGT), alkaline phosphatase (ALP), and total bilirubin (TBIL) in serum and the urinary ratio of 6-beta-hydroxycortisol to free cortisol (betaOHC/COR). RESULTS: The geometric mean exposure of the application workers was 2.7 mg/m(3) (8 hour time weighted average (8 hour TWA)); range 0.1-9.5 mg/m(3). No differences were found between the values of the renal effect variables or the liver variables of the exposed group and the control group, except a lower urinary ratio of betaOHC/COR in the exposed group. This was not considered to be related to the exposure to cis-DCP. No dose-effect relations were found between the exposure indices and the effect variables. CONCLUSIONS: The present study does not provide evidence that occupational exposure to cis-DCP in the starch potato growing region causes adverse effects on the kidney or liver at 8 hour TWA exposure concentrations below 9.5 mg/m(3) (2 ppm).	Occupational & Environmental Medicine	57	11	745-51	Biomonitoring (urine)	Biomonitoring (blood)		Cohort (prospective)	Specific active ingredient	genitourinary	medical test result	Netherlands	hic
55	A. K. Srivastava, B. N. Gupta, V. Bihari, N. Mathur, L. P. Srivastava, B. S. Pangtey, R. S. Bharti and P. Kumar	Clinical, biochemical and neurobehavioural studies of workers engaged in the manufacture of quinalphos	2000	59 workers exposed to different chemicals during the manufacture of quinalphos, an organophosphate pesticide (OP) and 17 control subjects were studied. Despite similar blood acetylcholinestarase (AChE) levels in both the exposed and control subjects, a significant number of exposed subjects had altered plantar and ankle reflexes. Higher nervous functions such as memory, learning and vigilance were also found to be affected in these subjects. These findings were attributed to chronic low dose combined exposure to different chemicals used/formed in the manufacture of quinalphos. The study raises the doubt that monitoring of AChE alone among subjects engaged in the manufacture of OP pesticides may not be an adequate safeguard as regards to their health.	Food & Chemical Toxicology	38	1	23986	Biomonitoring (blood)			Cross-sectional	Chemical class	pesticide-related symptoms	medical test result	India	lmic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
56	A. Kimata, T. Kondo, J. Ueyama, K. Yamamoto, A. Mochizuki, K. Asai, K. Takagi, A. Okamura, D. Wang, M. Kamijima, T. Nakajima, Y. Fukaya, E. Shibata, M. Gotoh and I. Saito	Relationship between urinary pesticide metabolites and pest control operation among occupational pesticide sprayers	2009	NA	Journal of Occupational Health	51	1	100-5	Biomonitoring (urine)	Biomonitoring (blood)		Cohort (prospective)	Specific active ingredient	pesticide-related symptoms	medical test result	Japan	hic
57	A. Kourakis, M. Mouratidou, A. Barbouti and M. Dimikiotou	Cytogenetic effects of occupational exposure in the peripheral blood lymphocytes of pesticide sprayers	1996	The potential clastogenic effect of pesticides was investigated in 56 (29 indoor and 27 outdoor) agricultural workers exposed to complex chemical mixtures. Exposed and referent subjects were selected from the same geographical area located in Ionia, province of Thessaloniki, Greece. Chromosome aberrations (CA) and sister chromatid exchanges (SCE), were studied in peripheral lymphocytes. Comparison between workers and control group revealed that the individuals exposed to pesticides showed substantial clastogenic effects (CA = 2.66% compared to 0.53%, P < 0.001), in their lymphocytes without indication of increases in their basal frequency of SCE. Moreover, the condition of exposure has been found to influence the CA frequency. It was observed that individuals working exclusively in greenhouses (confined spaces) showed higher CA levels than subjects working in open fields (3.37 versus 1.88, P < 0.01). No significant difference in their expression of CA between smokers and non-smokers was found. The present chromosome study included workers living in the close vicinity of a large industrial zone near Thessaloniki. The percentage of CA in these indoor sprayers was higher compared to our previous study carried out in a different area of Thessaloniki, free of industrial plants (3.37% compared to 2.14%, P < 0.02).	Carcinogenesis	17	1	99-101	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Greece	hic
58	A. Kumar, M. Vashist and R. Rathee	Maternal factors and risk of childhood leukemia	2014	BACKGROUND: Although the cause in most cases of childhood leukemia is not known, the contribution of environmental risk factors in the context of genetic predisposition has been reported with inconsistent results. The aim of this study was to examine association of childhood leukemia with maternal factors especially during pregnancy, to help in avoiding risk factors. MATERIALS AND METHODS: This case-control study included children younger than 18 years diagnosed with leukemia from 2008 to 2012. Controls were randomly selected and individually matched to cases with respect to age, sex, and residency. All variables were compared between cases and control to determine any significant association with leukemia. RESULTS: Statistically significant associations between risk of childhood leukemia with mother's education (p=0.001), occupation (p=0.0005) and pesticides exposure (p=0.005) during pregnancy were found. However, there were no significant links with maternal age (p=0.090), history of fetal loss (0.85), history of radiography during pregnancy (p=0.400), history of drug intake (p=0.689) and infection (p=0.696) during pregnancy. CONCLUSIONS: The results showed increased risk of leukemia in children whose mothers were working in agriculture and were exposed to pesticides during pregnancy. The further study needs to be investigated to know association of various maternal risk factors with leukemia which remained unknown in this study.	Asian Pacific Journal of Cancer Prevention: Apjcp	15	2	781-4	Self-reported exposure			Case-control	Pesticides in general	offspring	doctor-diagnosed	India	lmic
59	A. L. J. Feldman, A. L.; Nise, G.; Gatz, M.; Pedersen, N. L.; Wirdefeldt, K.	Occupational exposure in parkinsonian disorders: a 43-year prospective cohort study in men	2011	BACKGROUND: Several occupations and occupational exposures have been investigated for associations with Parkinson's disease. Common findings are increased risk associated with pesticide exposure and no association between Parkinson's disease and welding. METHODS: We explored the association between a broad range of possible occupational risk factors and Parkinson's disease as well as Parkinson's disease plus other forms of Parkinsonism (referred to as Parkinsonian disorders), using prospectively collected data in the population-based Swedish Twin Registry. A cohort of 14,169 Swedish men was followed for up to 43 years. We identified 234 Parkinsonian disorder cases including 204 Parkinson's disease cases with complete data. We assessed exposure to 14 chemical and biological compounds through a job exposure matrix. Hazard ratios (HR) with 95% confidence intervals (CI) adjusted for age, smoking, and education were used to estimate the relative risk of disease associated with exposure. RESULTS: Exposure to inorganic dust was associated with increased risk of Parkinson's disease and Parkinsonian disorders, HR 1.6 (95% CI 1.1-2.4) and 1.5 (1.0-2.2) respectively. There was no association between Parkinson's disease or Parkinsonian disorders and occupational exposure to pesticides, welding smoke, metal dust, wood dust, animal handling, stone and concrete dust, chrome and nickel dust, quartz dust, organic dust, oil, asbestos, organic solvents and irritating gas. CONCLUSIONS: Inorganic dust should be explored further as a potential risk factor for Parkinson's disease. Occupational exposure to pesticides and twelve other compounds explored in this study may not be associated with risk of Parkinson's disease in Swedish men.	Parkinsonism & Related Disorders	17	9	677-82	Job exposure matrix			Cohort (prospective)	Pesticides in general	neurological	doctor-diagnosed	Sweden	hic
60	A. L. Miranda-Filho, G. T. Monteiro and A. Meyer	Brain cancer mortality among farm workers of the State of Rio de Janeiro, Brazil: a population-based case-control study, 1996-2005	2012	BACKGROUND: Farm workers seem to be at an increased risk of developing some cancers, notably in the brain. One of the hypotheses rose to explain such elevated risk is the intense exposure to pesticides. AIM: To estimate the brain cancer mortality risk among agricultural workers exposed to pesticides in the State of Rio de Janeiro, Brazil. METHODS: A case-control study based on death certificates of males, 18 years or older, resident in the State Rio de Janeiro who died between 1996 and 2005. Cases (n=2040) were defined as individuals with brain cancer as the underlying cause of death. For each case two controls (n=4140) were randomly selected in the same database, matched for age group and region of residence. Besides the descriptive analysis, crude and adjusted odds ratios and mortality odds ratio (MOR) according to quartiles of potential exposure to pesticides, were calculated. RESULTS: Agricultural workers showed higher brain cancer mortality risk estimates when compared with non-farm workers (aOR: 1.82, 95% CI 1.21-2.71). In addition, the magnitude of this association was higher among white patients, with higher education, and residence in an agricultural region. CONCLUSION: This study suggests an association between agricultural work and brain cancer mortality in Rio de Janeiro state. It also suggests that pesticide exposure may play a role in such risk.	International Journal of Hygiene & Environmental Health	215	5	496-501	Job title			Case-control	Job title	cancer	doctor-diagnosed	Brazil	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
61	A. M. Almehdi, A. Bener, M. Dogan, M. A. H. Pasha and M. A. Usmani	Pesticide exposures, cholinesterase levels and symptoms among farmers	2000	The aim of this study is to determine the effect of pesticide exposure, cholinesterase level and symptoms among farmworkers in an Arabian Gulf Country, United Arab Emirates (UAE). This case-control study consisted of 87 farmworkers (cases) and 87 nonfarmworkers (controls), matched for age, sex and nationality, and selected from Al-Ain city. The mean age of 87 farmers was 32.7<U+00AC><U+00B1>8.2 years and the mean duration of their employment was 7.7<U+00AC><U+00B1>0.6 years. The mean age of 87 nonfarmers (control group) was 34.6<U+00AC><U+00B1>9.6 years and their mean duration of employment was 6.9<U+00AC><U+00B1>0.8 years. Most of the farmers had no education or low level of education. Most of the farmers are living in prefabricated or mud houses (93.1%). Farmers were exposed to pesticides more frequently than nonfarmers through direct spraying (62.0%), smelling fumes while working (72%) or by mixing and applying pesticides (60.9%). The mean systolic blood pressures (mm Hg) of farmworkers and nonfarmers were 120.94<U+00AC><U+00B1>10.2 and 118.1<U+00AC><U+00B1>12.4 and the mean diastolic blood pressures were 81.5<U+00AC><U+00B1>12.9 and 79.7<U+00AC><U+00B1>11.2, respectively. The mean hemoglobin levels (g/dl) for the farmers and nonfarmers were 13.2<U+00AC><U+00B1>1.5 and 12.5<U+00AC><U+00B1>1.3. The mean of erythrocyte acetylcholinesterase activity (Ache, u/ml) for farmers (3.38<U+00AC><U+00B1>0.62 u/ml) was significantly lower than that for nonfarmers (4.21<U+00AC><U+00B1>0.48 u/ml). Also, the mean of hemoglobin adjusted erythrocyte cholinesterase activity (HAChE, u/g) of farmworkers (28.3<U+00AC><U+00B1>4.27 u/g) was significantly lower than that of the non farmers (32.5<U+00AC><U+00B1>5.12 u/g). Reported symptoms had higher prevalence among farmers than nonfarmers, being significantly greater for diarrhea (p<0.007); nausea/vomiting (p<0.009); rash (p<0.002); increased anxiety (p<0.003); dizziness (p<0.002); muscular symptoms (p<0.02); diagnosed asthma by doctor (p<0.001) memory loss (p<0.0001); drowsiness; (p<0.006); fatigue (p<0.001); dyspnoea (p<0.006); insomnia (p<0.001) and skin pruritis (p<0.006). In conclusion, this study determined possible pesticide exposure associated with signs/symptoms among farmers. The mean Ache for farmers was significantly lower than that of the nonfarmers. Finally, there is evidence that some of the diseases obtained in this study could be related to excessive exposure to pesticides.	Environmental Epidemiology and Toxicology	2	4	261-266	Biomonitoring (blood)			Case-control	Chemical class	pesticide-related symptoms	self-reported	UAE	hic
62	A. M. Ekstrom, M. Eriksson, L. E. Hansson, A. Lindgren, L. B. Signorello, O. Nyren and L. Hardell	Occupational exposures and risk of gastric cancer in a population-based case-control study	1999	Gastric cancer trends seem to follow improvements in the environment of blue-collar workers, but the etiological role of occupational exposures in gastric carcinogenesis is scantily investigated. The risk of gastric adenocarcinoma in 10 common occupational industries, and particularly the long-term effects of asbestos, organic solvents, impregnating agents, insecticides, and herbicides, were evaluated in a population-based case-control study, including data on most established risk factors. The study base included all individuals of ages 40-79, born in Sweden and living in either of two areas (total population, 1.3 million) with differing gastric cancer incidences, from February 1989 through January 1995. We interviewed 567 cases classified to site (cardia/noncardia) and histological type, and 1,165 population-based controls, frequency-matched for age and sex. Metal workers had a 46% excess gastric cancer risk [adjusted odds ratio (OR), 1.46; 95% confidence interval (CI), 1.10-1.94], increasing to 1.65 (95% CI, 1.17-2.32) for >10 years in the industry. The elevated risk after exposure to herbicides (OR, 1.56; 95% CI, 1.13-2.15) was attributable to phenoxyacetic acids (adjusted OR, 1.70; 95% CI, 1.16-2.48), similarly across tumor subtypes, and not modified by smoking, body mass index, or Helicobacter pylori. The absence of interaction was demonstrated by the pure multiplicative effect found among those exposed to both H. pylori and phenoxyacetic acids (OR, 3.42; 95% CI, 1.41-8.26). Organic solvents, insecticides, impregnating agents, and asbestos were not associated with gastric cancer risk. Employment in the metal industry and exposure to phenoxyacetic acids were both positively and independently associated with gastric cancer risk. The fractions of all gastric cancers attributable to these job-related exposures were small but not negligible (7 and 5%, respectively) in the Swedish population.	Cancer Research	59	23	1472841	Expert case-by-case assessment			Case-control	Type of pesticide	cancer	doctor-diagnosed	Sweden	hic
63	A. M. Garcia, F. G. Benavides, T. Fletcher and E. Orts	Paternal exposure to pesticides and congenital malformations	1998	OBJECTIVES: A case-referent study with 261 matched pairs was carried out in 8 hospitals of Comunidad Valenciana, Spain, to assess the relation between occupational exposure to pesticides and selected congenital malformations. In this paper, the results concerning paternal exposure are presented. METHODS: The parents of the case patients and the referents were interviewed to collect information about exposure to pesticides and potential confounding variables. Detailed information on direct involvement in the handling of pesticides was collected for the interviewees involved in agricultural activities during a previously defined period in relation to conception and pregnancy. Exposure data were reviewed by 2 experts who assigned ordinal scores for the probability and intensity of exposure to pesticide classes and active ingredients. RESULTS: The dichotomous analysis of exposure (absent, present) yielded some increased risks, although not statistically significant, for aliphatic hydrocarbons [adjusted odds ratio (adjusted OR) 2.05, 95% confidence interval (95% CI) 0.62-6.80], inorganic compounds (adjusted OR 2.02, 95% CI 0.53-7.72), and glufosinate (adjusted OR 2.45, 95% CI 0.78-7.70), and a significant association for pyridil derivatives (adjusted OR 2.77, 95% CI 1.19-6.44). The analysis based on the experts' scores (2 levels of exposure) showed some consistent associations for these compounds. CONCLUSIONS: This research indicates a possible risk of congenital malformations for paternal exposure to some pesticides, notably, pyridils, aliphatic hydrocarbons, inorganic compounds, and glufosinate. It did not find an increased risk for paternal exposure to pesticides in the classes of organophosphates, carbamates, organochlorines, chloroalkylthio fungicides and organosulfurs. These findings warrant further investigation.	Scandinavian Journal of Work, Environment & Health	24	6	473-80	Expert case-by-case assessment	Self-reported job history		Case-control	Specific active ingredient	offspring	doctor-diagnosed	Spain	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
64	A. M. Garcia, T. Fletcher, F. G. Benavides and E. Orts	Parental agricultural work and selected congenital malformations	1999	The authors conducted a case-control study in Comunidad Valenciana, Spain, to assess the relation between occupational exposure to pesticides, mainly as a result of agricultural work, and the prevalence of congenital malformations. A total of 261 cases and 261 controls were selected from those infants born in eight public hospitals during 1993-1994. The cases were those who were diagnosed with selected defects (nervous system, cardiovascular, oral clefts, hypospadias/epispadias, musculoskeletal, and unspecified anomalies) during their first year of life. Information on occupational exposures and potential confounding variables was collected from the parents. For the mothers who were involved in agricultural activities during the month before conception and the first trimester of pregnancy, the adjusted odds ratio was 3.16 (95% confidence interval 1.11-9.01) primarily due to an increased risk for nervous system defects, oral clefts, and multiple anomalies. Paternal agricultural work did not increase the risk, although fathers who reported ever handling pesticides had an adjusted odds ratio of 1.49 (95% confidence interval 0.94-2.35) mainly related to an increased risk for nervous system and musculoskeletal defects. Although the power of this study regarding some associations is limited, the results justify further attention to maternal agricultural work and paternal pesticide exposure.	American Journal of Epidemiology	149	1	64-74	Self-reported exposure			Case-control	Pesticides in general	offspring	doctor-diagnosed	Spain	hic
65	A. M. Malek, A. Barchowsky, R. Bowser, T. Heiman-Patterson, D. Lacomis, S. Rana, A. Youk, D. Stickler, D. T. Lackland and E. O. Talbott	Environmental and occupational risk factors for amyotrophic lateral sclerosis: a case-control study	2014	BACKGROUND/AIMS: Environmental and occupational exposures are implicated as risk factors for amyotrophic lateral sclerosis (ALS), the etiology of which is largely unknown, although no causal relationships have been established. OBJECTIVE: The aim of the study was to evaluate the associations of personal risk factors and self-reported environmental and occupational exposures with risk of ALS. METHODS: The cases involved ALS patients (n = 66) identified from major neurological centers in Pittsburgh and Philadelphia, Pa., USA, from 2008 to 2010. The age-, race- and sex-matched controls included outpatient hospital and population-based controls (n = 66). A detailed questionnaire obtaining data on occupation, vocational and avocational exposure as well as personal lifestyle factors was administered. RESULTS: Occupational exposure to metals (odds ratio, OR = 3.65; 95% CI: 1.15, 11.60) and pesticides (OR = 6.50; 95% CI: 1.78, 23.77) was related to increased risk of ALS after controlling for smoking and education. No associations were found for occupational exposure to organic or aromatic solvents. CONCLUSION: Workers exposed to metals and pesticides may be at greater risk of ALS. Future research should involve more accurate exposure assessment through the use of job exposure matrices, confirmation of occupation and biomarkers.	Neurodegenerative Diseases	14	1	43343	Self-reported exposure			Case-control	Pesticides in general	neurological	doctor-diagnosed	USA	hic
66	A. M. R. Mozzachio, J. A.; Hoppin, J. A.; Mahajan, R.; Patel, R.; Beane-Freeman, L.; Alavanja, M. C.	Chlorothalonil exposure and cancer incidence among pesticide applicator participants in the agricultural health study	2008	BACKGROUND: Chlorothalonil is a broad spectrum, non-systemic fungicide widely used to control diseases affecting over 50 fruit, vegetable, and agricultural crops. Despite its extensive use for over 30 years, little is known about the potential human carcinogenicity associated with the routine application of chlorothalonil. Rodent studies have shown evidence of renal tubular carcinomas and adenomas. We explored cancer incidence with chlorothalonil exposure using data from the Agricultural Health Study, a prospective cohort of licensed pesticide applicators in Iowa and North Carolina. METHODS: Licensed private and commercial pesticide applicators were recruited into this study from 1993 to 1997. Detailed information regarding pesticide use was obtained via self-administered questionnaires. Cancer incidence was followed through December 31, 2004. Chlorothalonil exposure was classified by lifetime exposure days and intensity-weighted lifetime exposure days, and then categorized into tertiles. The intensity-weighted lifetime exposure days metric was calculated based on a complex algorithm which includes pesticide application methods among other factors. This may increase or decrease exposure. RESULTS: Of the 47,625 pesticide applicators included in this analysis, 3657 applicators reported using chlorothalonil with a median of 3.5 application days per year. Chlorothalonil was not associated with overall cancer incidence, nor did we find any association with colon, lung, and prostate cancers--the only cancers for which we had sufficient numbers to explore associations. CONCLUSION: We did not find any strong evidence for an association between chlorothalonil and the cancers investigated. Although animal studies have suggested renal cancer may be associated with chlorothalonil, we had insufficient data to evaluate this cancer.	Environmental Research	108	3	400-3	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
67	A. M. Rosenberg, K. M. Semchuk, H. H. McDuffie, D. L. Ledingham, D. M. Cordeiro, A. J. Cessna, D. G. Irvine, A. Senthilselvan and J. A. Dosman	Prevalence of antinuclear antibodies in a rural population	1999	Exposure to environmentally and occupationally encountered toxicants can be associated with the development of certain autoimmune diseases and with the induction of antinuclear antibodies (ANA). Some chemicals used in the agricultural industry are known to affect immune function but their roles in the induction of autoimmunity in general, and ANA in particular, have not been reported previously. This study was undertaken to establish the prevalence of ANA in a rural population and to determine environmental and occupational exposures with which they are associated. This cross-sectional study represented one component of an interdisciplinary project (Prairie Ecosystem Study [PECOS], Eco-Research Program, Tri-Council Secretariat of Canada) designed to explore, in a rural population, the roles of environmental exposures as determinants of human health status. Information regarding lifetime, current, and main occupational exposures in the rural-dwelling study population was derived from a self-administered questionnaire. Sera from consenting subjects, collected during the months of February and March 1996, were assayed for ANA by indirect immunofluorescence on HEp-2 cells. The study population comprised 322 adult subjects (mean age 49.3+/-14.7 yr; range 16-87 yr). Statistical analyses adjusted for age and sex revealed that the presence of ANA among the participants was associated with a current agricultural occupation that included oilseed production, hog production, or poultry production. There was a significant association between ANA positivity and a current main farming operation of crop production. There was also an association among individual participants between lifetime exposure to the insecticide class of pesticides and the presence of ANA. In this rural study population, ANA positivity was significantly associated with lifetime exposure specifically to carbamate, organochlorine (including aldrin, chlordane, dieldrin, endrin, heptachlor, and lindane, but excluding DDT and methoxychlor), and pyrethroid insecticides and to phenoxyacetic acid herbicides, including 2,4-D. After adjustment for age, sex, and other insecticide exposures, multivariate analyses indicated that ANA positivity was associated with current oilseed production and with lifetime exposure to pyrethroid insecticides. In a rural population, ANA were associated with production of certain crops and certain animals and exposure to specific pesticides. The data indicate that some occupational exposures related to the agricultural industry are associated with the presence of ANA, a serologic expression of autoimmunity.	Journal of Toxicology & Environmental Health Part A	57	4	225-36	Self-reported exposure			Cross-sectional	Chemical class	immunological	medical test result	Canada	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
68	A. M. Ruder and J. H. Yiin	Mortality of US pentachlorophenol production workers through 2005	2011	A cohort of 2122 US pentachlorophenol (PCP) production workers from four plants in the National Institute for Occupational Safety and Health Dioxin Registry was exposed to PCP and to polychlorinated dibenzo-p-dioxin and dibenzofuran contaminants of PCP production. A subcohort of 720 was also exposed to 2,3,7,8-tetrachlorodibenzodioxin, a contaminant of trichlorophenol (TCP) while using TCP or a TCP derivative. PCP and several production contaminants have been implicated as animal carcinogens. A priori hypotheses were that the cohort would have elevated standardized mortality ratios (SMRs) for aplastic anemia, soft-tissue sarcoma, and non-Hodgkin lymphoma, as suggested by human studies, and for leukemia and liver, adrenal, thyroid, and parathyroid cancer, as suggested by animal studies. From 1940 to 2005 1165 deaths occurred with an overall SMR of 1.01 [95% confidence limits (CI), 0.95-1.07]. Overall cancer mortality (326 deaths, SMR 1.17, CI 1.05-1.31) was in statistically significant excess. There were excess deaths for trachea, bronchus and lung cancers (126 deaths, SMR 1.36, CI 1.13-1.62), non-Hodgkin lymphoma (17 deaths, SMR 1.77, CI 1.03-2.84), chronic obstructive pulmonary disease (63 deaths, SMR 1.38, CI 1.06-1.77), and medical complications (5 deaths, SMR 3.52, CI 1.14-8.22). In race- and sex-specific analyses, white males had increased non-Hodgkin lymphoma mortality (17 deaths, SMR 1.98, CI 1.15-3.17) and males of other races had increased leukemia mortality (four deaths, SMR 4.57, CI 1.25-11.7). The excess of cancers of a priori interest, non-Hodgkin lymphoma and leukemia, provide some support for the carcinogenicity of PCP, however, further studies with more detailed exposure assessment are needed.	Chemosphere	83	6	851-61	Registers			Cohort (prospective)	Specific active ingredient	mortality (all cause)	doctor-diagnosed	USA	hic
69	A. M. Ruder, M. A. Waters, M. A. Butler, T. Carreon, G. M. Calvert, K. E. Davis-King, P. A. Schulte, W. T. Sanderson, E. M. Ward, L. B. Connally, E. F. Heineman, J. S. Mandel, R. F. Morton, D. J. Reding, K. D. Rosenman, G. Talaska and G. Brain Cancer Collaborative Study	Gliomas and farm pesticide exposure in men: the upper midwest health study	2004	The National Institute for Occupational Safety and Health evaluated farm pesticide exposure and glioma risk in a study that included 457 glioma cases and 648 population-based controls, all adult men (18-80 yr old) and nonmetropolitan residents of Iowa, Michigan, Minnesota, and Wisconsin. Multiple logistic regressions were used to control for farm residence, age, age group, education, and exposure to other pesticides. No associations were found between glioma and 12 specific pesticides. We estimated adjusted odds ratios (ORs) and 95% confidence intervals (CIs) and found reduced glioma risk for insecticides (OR = 0.53, CI = 0.37-0.77), fumigants (OR = 0.57, CI = 0.34-0.95), and organochlorines (OR = 0.66, CI = 0.47-0.94). In analyses excluding proxy respondents (47% of cases) most CIs included 1.0. No positive association of farm pesticide exposure and glioma was found. Other farm exposures may explain the excess brain cancer risk seen in previous studies.	Archives of Environmental Health	59	12	650-7	Self-reported exposure			Case-control	Chemical class	cancer	doctor-diagnosed	USA	hic
70	A. M. Ruder, M. A. Waters, T. Carreon, M. A. Butler, K. E. Davis-King, G. M. Calvert, P. A. Schulte, E. M. Ward, L. B. Connally, J. Lu, D. Wall, Z. Zivkovich, E. F. Heineman, J. S. Mandel, R. F. Morton, D. J. Reding, K. D. Rosenman and G. Brain Cancer Collaborative Study	The Upper Midwest Health Study: a case-control study of primary intracranial gliomas in farm and rural residents	2006	Since several studies indicated that farmers and agricultural workers had an excess risk of brain cancer, the National Institute for Occupational Safety and Health initiated the Upper Midwest Health Study to examine risk of intracranial glioma in the non-metropolitan population. This population-based, case-control study evaluated associations between gliomas and rural and farm exposures among adults (ages 18 to 80) in four upper midwestern states (Iowa, Michigan, Minnesota, Wisconsin). At diagnosis/selection, participants lived in non-metropolitan counties where the largest population center had fewer than 250,000 residents. Cases were diagnosed 1 January 1995 through 31 January 1997. Over 90% of 873 eligible ascertained cases and over 70% of 1670 eligible controls consented to participate. Participants and nonparticipants, evaluated for "critical questions" on main and refusant questionnaires, differed significantly in farming and occupational experience, ethnicity, education, and lifestyle. The 1,175 controls were more likely than the 798 cases to have reported ever drinking alcohol (77% vs. 73%, adjusted odds ratio (OR) 0. 73, 95% confidence interval (CI) 0.59-0.92) and having had panoramic dental x-rays (34% vs. 29%, OR 0. 75, CI 0.61-0.92). Controls spent a greater percentage of their lives in non-metropolitan counties (78% vs. 75%, OR 0.81, CI 0.67-1.09). Among ever-farmers, controls were more likely to have had exposure to farm insecticides (57% vs. 50%, OR 0.75, CI 0.59-0.95) and farm animals (96% vs. 91%, OR 0.48, CI 0.25-0.90). Moving to a farm as an adolescent (ages 11 to 20) vs. as an adult was associated with a greater risk of glioma. In our study sample, farm or rural residence and summary farm exposures were associated with decreased glioma risk. However, nonparticipation by never-farming eligible controls could have affected results. Comparisons of farm chemical exposures may clarify associations between farming and glioma that others have reported.	Journal of Agricultural Safety & Health	12	4	255-74	Self-reported exposure			Case-control	Chemical class	cancer	doctor-diagnosed	USA	hic
71	A. M. Ruder, T. Carreon, M. A. Butler, G. M. Calvert, K. E. Davis King, M. A. Waters, P. A. Schulte, J. S. Mandel, R. F. Morton, D. J. Reding, K. D. Rosenman and G. Brain Cancer Collaborative Study	Exposure to farm crops, livestock, and farm tasks and risk of glioma: the Upper Midwest Health Study	2009	Some studies of brain cancer have found an excess risk for farmers. The National Institute for Occupational Safety and Health previously found no increased glioma risk for ever (vs. never) being exposed to pesticides on a farm among 798 cases and 1,175 population-based controls (adult (ages 18-80 years) nonmetropolitan residents of Iowa, Michigan, Minnesota, and Wisconsin). For this analysis (1995-1998), 288 cases and 474 controls (or their proxies) who had lived on farms at age 18 years or after were asked about exposure to crops, livestock, and farm tasks. Logistic regression was used to calculate odds ratios adjusted for age, age group, sex, state, and education. Never immediately washing up (adjusted odds ratio (OR) = 3.08, 95% confidence interval (CI): 1.78, 5.34) or changing clothes (OR = 2.84, 95% CI: 1.04, 7.78) after applying pesticides was associated with increased glioma risk. Living on a farm on which corn, oats, soybeans, or hogs were raised was associated with decreased risk (corn-OR = 0.37, 95% CI: 0.20, 0.69; oats-OR = 0.63, 95% CI: 0.40, 1.00; soybeans-OR = 0.69, 95% CI: 0.48, 0.98; hogs-OR = 0.63, 95% CI: 0.43, 0.93). Negative associations may be due to chance or a "healthy farmer" effect. Farmers' increased risk of glioma may be due to work practices, other activities, or an inverse association with allergies (reported by other investigators).	American Journal of Epidemiology	169	12	1479-91	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
72	A. M. Tawfik Khattab, A. A. Zayed, A. I. Ahmed, A. G. AbdelAal and A. A. Mekdad	The role of PON1 and CYP2D6 genes in susceptibility to organophosphorus chronic intoxication in Egyptian patients	2016	BACKGROUND: Paraoxonase-1 (PON1) activity toward organophosphorus(OP) compounds shows inter-individual variations, rendering the identification of individuals' PON1 alloxymes valuable in treating patients suffering from organophosphorus intoxication. One of the most important cytochrome P450 monooxygenases (CYPs) is CYP2D6. The CYP2D6 G1934A polymorphism leads to good, poor or no enzyme activity. Genetic testing helps identification of high risk individuals as well as management of chronic intoxicated patients. OBJECTIVE: to investigate a possible association between genetic polymorphisms of PON1 Q192R, and CYP2D6 G1934A as well as PON1 and pseudo-cholinesterase (PChE) enzyme activity levels and chronic organophosphate exposed patients, and hence, susceptibility for organophosphorus chronic poisoning. DESIGN AND METHODS: Thirty chronic organophosphate exposed farm workers were compared to 29 healthy controls as regards PON1 Q192R and CYP2D6 G1934A polymorphisms using PCR-RFLP technique. Also serum PON1 and PChE activities were determined spectrophotometrically. RESULTS: Serum PChE was significantly reduced in chronic intoxicated patients compared to the control group (p=0.02), while PON1 activity was increased, but just failed to reach significance (p=0.06). PON1 192 RR genotype and R allele were significantly increased in chronic OP intoxicated patients (p=0.005 &p=0.002 respectively). CYP2D6 1934A allele was significantly increased in chronic OP patients (p=0.045). combining the two SNPs showed a significant statistical difference between the two groups with PON1QQ and CYP2D6 GG genotypes being more represented in the healthy controls (p=0.001). Fatigue and motor weakness were the most prevalent neurological symptoms seen in chronic cases (56.7%), followed by headache and lacrimation (30% each), depression (23%), tingling and sensory symptoms (20%), sleep disorders and limb pain (13%). The mean duration of environmental exposure to organophosphates was 7.7+/-5.2years and no association was found between chronic symptoms of intoxication and duration of exposure, provided that all workers were exposed for at least 3 years. CONCLUSION: PON1 192RR genotype and CYP2D6 1934A allele were found to be related to the susceptibility to organophosphate chronic toxicity in Egyptians. Larger scale gene-environmental interaction studies are recommended to confirm results and Genotyping is recommended during selection of agricultural pesticide workers to exclude high risk group.	Neurotoxicology	53	NA	102-107	EAM not reported			Cross-sectional	NA	pesticide-related illness	medical test result	Egypt	lmic
73	A. Mannetje, A. Eng, C. Walls, E. Dryson, M. Kogevinas, C. Brooks, D. McLean, S. Cheng, A. H. Smith and N. Pearce	Sex ratio of the offspring of New Zealand phenoxy herbicide producers exposed to 2,3,7,8-tetrachlorodibenzo-p-dioxin	2017	Objectives: Exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) has inconsistently been associated with a decreased sex ratio of the offspring (number of male births divided by total births). We conducted a study among men and women who were employed in a New Zealand phenoxy herbicide production plant between 1969 and 1984, to study their offspring sex ratio in relation to their back-calculated TCDD serum concentrations determined in 2007/2008. Methods: A total of 127 men and 21 women reported that 355 children were conceived after starting employment at the plant. The association between their lipid-standardised TCDD serum concentrations back-calculated to the time of their offspring's birth and the probability of a male birth was estimated through logistic regression, adjusting for the age of the exposed parent at birth, current body mass index and smoking. Results: The overall sex ratio was 0.55 (197 boys, 158 girls). For fathers with serum TCDD concentrations <U+201A><U+00E2><U+2022>20 pg/g lipid at time of birth, the sex ratio was 0.47 (OR 0.49; 95% CI 0.30 to 0.79). The probability of a male birth decreased with higher paternal serum TCDD at time of birth (<4; 4-20; 20-100; <U+201A><U+00E2><U+2022>100 pg/g lipid), with ORs of 1.00 (reference); 1.00 (95% CI 0.50 to 2.02); 0.52 (95% CI 0.29 to 0.92); 0.45 (95% CI 0.23 to 0.89), p trend 0.007. For exposed mothers, the sex ratio was not reduced. Conclusions: This study indicates that paternal serum TCDD concentrations in excess of an estimated 20 pg/g lipid at time of conception are associated with a reduced sex ratio.	Occupational and Environmental Medicine	74	1	24-29	Algorithm/model	Biomonitoring (blood)		NA	Specific active ingredient	offspring	medical test result	New Zealand	hic
74	A. Mellemgaard, G. Engholm, J. K. McLaughlin and J. H. Olsen	Occupational risk factors for renal-cell carcinoma in Denmark	1994	OBJECTIVES: Risk factors for renal-cell carcinoma, the most frequent type of kidney cancer, remains enigmatic. Time trends in incidence and changes in the regional distribution of this cancer are suggestive of environmental risk factors. This study reports on occupational risk factors for renal-cell carcinoma in Denmark. METHODS: In a population-based study, 365 persons with histologically verified renal-cell carcinoma and 396 referents were interviewed. Information was collected on occupation, education, and occupational exposure to a number of suspected substances, including hydrocarbons, asbestos, and radiation. RESULTS: Risk of renal-cell carcinoma was found to be associated with employment as a truck driver, exposure to gasoline, other hydrocarbons, and insecticides and herbicides. The risk of renal-cell carcinoma was higher in the lower socioeconomic strata for both the men and the women. Nonsignificantly elevated risks were observed for employment in oil refineries, gasoline stations, and the iron and steel industry. No association was found for exposure to radiation or for employment in industries such as leather manufacturing and health care, which have previously been linked to an increased risk of renal-cell carcinoma. CONCLUSIONS: The risk of renal-cell carcinoma is increased in lower socioeconomic strata, and previously identified or suspected risk factors do not explain the excess in risk. This study adds additional support to the hypothesis of a link between renal-cell carcinoma and hydrocarbons and also demonstrates the need for further studies on occupational risk factors for renal-cell carcinoma.	Scandinavian Journal of Work, Environment & Health	20	3	160-5	Self-reported exposure			Case-control	Type of pesticide	cancer	doctor-diagnosed	Denmark	hic
75	A. Meyer, P. C. Alexandre, R. Chrisman Jde, S. B. Markowitz, R. J. Koifman and S. Koifman	Esophageal cancer among Brazilian agricultural workers: case-control study based on death certificates	2011	Several studies suggest that agricultural workers are at higher risk to develop and die by certain types of cancer. Esophageal cancer is not commonly listed among these types. However, some recent studies indicated that if there is an association between agricultural working and esophageal cancer, it s more likely to be observed among workers highly exposed to pesticides. In the present study, the magnitude of the association between agricultural working and esophageal cancer mortality was evaluated in a high pesticide use area in Brazil, through a death certificate-based case-control study. Cases were individuals from both genders, 30-59 years old, for whom basic cause of death was ascertained as cancer of the esophagus. For each case, one control was randomly selected from all possible controls for which the basic cause of death was ascertained as different from neoplasm and diseases of the digestive system. In addition, controls matched their cases by sex, age, year of death, and state of residence. Crude and adjusted odds ratios were then calculated to estimate the magnitude of the risk. Results showed that, in general, agricultural workers were at significantly higher risk to die by esophageal cancer, when compared to non-agricultural workers. Stratified analysis also revealed that the magnitude of such risk was slightly higher among illiterate agricultural workers, and simultaneous adjustment for several covariates showed that the risk was quantitatively higher among younger southern agricultural workers. These results suggest the esophageal cancer may be included among those types of cancer etiologically associated to agricultural working.	International Journal of Hygiene & Environmental Health	214	2	151-5	Registers			Case-control	Job title	cancer	doctor-diagnosed	Brazil	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
76	A. Meyer, S. Koifman, R. J. Koifman, J. C. Moreira, J. de Rezende Chrisman and Y. Abreu-Villaca	Mood disorders hospitalizations, suicide attempts, and suicide mortality among agricultural workers and residents in an area with intensive use of pesticides in Brazil	2010	As suicide rates have increased in rural areas in Brazil, it was postulated that pesticide exposure may play a role in this phenomenon. Our study compared the suicide mortality rates observed among agricultural workers from a pesticide-intensive area in Brazil to the suicide mortality frequency noted in three reference populations. In addition, hospitalization rates attributed to suicide attempts and mood disorders including depression in residents of the same agricultural area were compared to two reference populations. Finally, data on pesticide sales per agricultural worker were obtained for each city of Rio de Janeiro State and suicide mortality risk was then calculated according to the quartiles of pesticide sales per agricultural workers, using the first quartile as reference. Agricultural workers were at greater risk for lethality due to suicide when compared to all three reference populations. In addition, residents of the same study area showed higher hospitalization rates by suicide attempts and mood disorders than observed in comparison populations. Results also showed that the risk of death by suicide was significantly higher among agricultural workers who lived in areas of Rio de Janeiro State displaying higher rates of pesticide expenditure per agricultural worker. These results suggest that pesticide exposure may indeed increase the risk of suicide frequency, especially among agricultural workers.	Journal of Toxicology & Environmental Health Part A	73	13	866-77	Job title			Cross-sectional	Job title	other	doctor-diagnosed	Brazil	umic
77	A. Munnia, R. Puntoni, F. Merlo, S. Parodi and M. Peluso	Exposure to agrochemicals and DNA adducts in Western Liguria, Italy	1999	Pesticides are used to control pests and improve agricultural production. Despite their selectivity of action, a number of agrochemicals have been reported to be genotoxic using the (32)P-DNA postlabeling assay. Greenhouse floriculturists are suspected of being heavily exposed to agrochemicals during loading, mixing, and application of pesticides, as well as during manual activities by continuous contact with flowers and ornamental plants. We analyzed the DNA adduct formations in the white blood cells (WBCs) of 57 nonsmoker greenhouse floriculturists and 33 nonsmoker age-matched referents residing in the Western Liguria Region, Italy-the most important Italian greenhouse floriculture area. The averages of DNA adducts, expressed as relative adduct labeling (RAL), were 8.50 x 10(9) +/- 1.98 (SE) in floriculturists and 2.17 x 10(9) +/- 1.05 (SE) in referents. DNA adducts were significantly higher in floriculturists than in controls after adjustment for age and gender (P = 0.007). A specific adduct pattern, with up to six different spots, was observed in 60% of floriculturists, while no adducts were generally detected in controls. Our study represents an important contribution to the correct evaluation of the potential health risk associated with floriculture activity and supports the adoption of measures ensuring pesticide exposure reduction in greenhouses.	Environmental & Molecular Mutagenesis	34	1	19146	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Italy	hic
78	A. Olsson, C. Huoi, O. Febvey, T. Lightfoot, E. Roman, J. Clavel, B. Lacour, H. Kromhout, R. Vermeulen, S. Peters, H. Bailey and J. Sch<U+221A><U+00BA>z	Parental occupational exposure and risk of childhood central nervous system tumours: A pooled analysis of case-control studies from Germany, France, and the UK	2016	Background Central nervous system (CNS) tumours are the commonest childhood solid malignancy. We assessed the risk of childhood CNS tumours associated with parental occupational exposure to pesticides, polycyclic aromatic hydrocarbons (PAH), diesel motor exhaust (DME), asbestos, crystalline silica, and metals. Methods We pooled three population-based case-control studies from France, Germany and the UK. Cases were children below 15 years of age diagnosed with CNS tumours; controls were matched to cases by gender and age. Socio-demographic and parental occupational information was collected using study-specific standardised interviews, either face-to-face or by telephone. Each study provided occupational data coded according to their national schemes; which were harmonised into ILO's International Standard Classification of Occupations 1968 and 1988. Two general population job-exposure matrices (DOM-JEM, ALOHA+) were used to estimate parental occupational exposures. Odds ratios (ORs) and 95% confidence intervals (CI) were estimated using logistic regression. Results The study included 1,361 children with CNS tumours and 5,500 controls. ORs for paternal exposure (yes/no) around conception were as follows: PAH 1.22 (95% CI: 0.98-1.52); metals 1.18 (95% CI: 0.96-1.46); and asbestos 1.12 (95% CI: 0.95-1.32). Asbestos was the only potentially hazardous exposure were the point estimate increased at higher levels; OR 1.42 (95% CI: 0.87-2.32). Paternal exposure to pesticides, DME and silica showed no increased risk. The prevalence of maternal occupational exposures to pesticides, PAH, DME, asbestos, silica, and metals was low; and no increased ORs were observed either around the time of conception or during pregnancy. Conclusion Our large pooled study provided little evidence of an association between paternal occupational exposure to PAH, metals, and asbestos around conception and CNS tumour risk in the offspring. Previous studies have reported inconsistent results for PAH, while no studies have reported significant associations for asbestos and metals.	Occupational and Environmental Medicine	73	NA	A48	Self-reported exposure			Case-control	Pesticides in general	offspring	doctor-diagnosed	France/Germany/UK	AHIC
79	A. P. K. Starling, F.; Umbach, D. M.; Sandler, D. P.; Hoppin, J. A.	Pesticide use and incident diabetes among women in the agricultural health study	2012	Agricultural pesticides may contribute to the development of diabetes mellitus. Data from the Agricultural Health Study, a large prospective cohort in Iowa and North Carolina, were used to estimate associations between use of specific agricultural pesticides and incident diabetes in women. For comparability with previous studies of farmers, the analysis was limited to the 10,709 farmers' wives who reported ever personally mixing or applying pesticides at enrollment (1993-1997) and completed one or two follow-up interviews at approximately 5-year intervals. Lifetime use of 50 specific pesticides was obtained at enrollment. Incident diabetes was selfreported (n = 533). The mean duration of follow-up was 8.6 years. Hazard ratios (HR) and 95% confidence intervals (CI) were calculated using a Cox proportional hazards model for each pesticide, adjusted for age, state, and body mass index at enrollment. Seven pesticides were positively associated with incident diabetes: two organochlorines, DDT (HR = 1.37, 95% CI = 1.06, 1.78) and dieldrin (HR = 1.92, 95% CI = 1.02, 3.60); three organophosphates, fonofos (HR = 1.62, 95% CI = 1.12, 2.33), phorate (HR = 1.52, 95% CI = 1.06, 2.16), and parathion (HR = 1.66, 95% CI = 1.05, 2.64); and two herbicides, 2,4,5-T/2,4,5-TP (HR = 1.76, 95% CI = 1.11, 2.79) and EPTC (HR = 1.73, 95% CI = 1.14, 2.64). When adjusted for use of correlated pesticides (r > 0.3), the HRs for dieldrin, fonofos, phorate, EPTC and 2,4,5-T/2,4,5-TP remained elevated although attenuated. DDT and parathion were not correlated with other pesticides. Results are consistent with previous studies reporting an association between organochlorines and diabetes, and add to growing evidence that certain organophosphates also may increase risk.	American Journal of Epidemiology	175	NA	S66	Self-reported exposure			Cohort (prospective)	Specific active ingredient	endocrine/nutritional/metabolical	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
80	A. P. Remor, C. C. Totti, D. A. Moreira, G. P. Dutra, V. D. Heuser and J. M. Boeira	Occupational exposure of farm workers to pesticides: biochemical parameters and evaluation of genotoxicity	2009	To assess the effects of exposure to complex mixtures of pesticides in farm workers from two communities from Rio Grande do Sul, Brazil, we evaluated the activities of butyrylcholinesterase (BChE) and delta-aminolevulinic acid dehydratase (ALA-D) enzymes, hematological, lipid parameters, and genotoxicity using two tests to detect DNA damage, the Comet assay in peripheral blood leukocytes and the micronucleus (MN) test in oral mucosa cells. The use of personal protective equipment (PPE), age and smoke habits were considered in the analysis. There was a significant decrease in the BChE and ALA-D activities in farm workers (n=37) relative to the control group (n=20) (P< or =0.05 and P< or =0.001, respectively). The Comet assay in peripheral blood leukocytes showed that the Damage index and Damage frequency observed in the exposed group were significantly higher in relation to the controls (P< or =0.001, and P< or =0.05, respectively). No differences were detected regarding the hematological parameters, lipids profile, and MN frequencies. In addition, no significant differences were observed between younger (< or =38 years) and older subjects (>38 years), or between smokers and non-smokers within the groups, either by Comet assay or MN test. However, the use of PPE seems to be important in the prevention of contamination, as suggested by BChE levels and Comet assay results.	Environment International	35	2	273-8	Job title			Cross-sectional	Job title	biochemical	medical test result	Brazil	umic
81	A. P. U. Starling, D. M.; Kamel, F.; Long, S.; Sandler, D. P.; Hoppin, J. A.	Pesticide use and incident diabetes among wives of farmers in the Agricultural Health Study	2014	OBJECTIVE: To estimate associations between use of specific agricultural pesticides and incident diabetes in women. METHODS: We used data from the Agricultural Health Study, a large prospective cohort of pesticide applicators and their spouses in Iowa and North Carolina. For comparability with previous studies of farmers, we limited analysis to 13 637 farmers' wives who reported ever personally mixing or applying pesticides at enrolment (1993-1997), who provided complete data on required covariates and diabetes diagnosis and who reported no previous diagnosis of diabetes at enrolment. Participants reported ever-use of 50 specific pesticides at enrolment and incident diabetes at one of two follow-up interviews within an average of 12 years of enrolment. We fit Cox proportional hazards models with age as the time scale and adjusting for state and body mass index to estimate HRs and 95% CIs for each of the 45 pesticides with sufficient users. RESULTS: Five pesticides were positively associated with incident diabetes (n=688; 5%): three organophosphates, fonofos (HR=1.56, 95% CI 1.11 to 2.19), phorate (HR=1.57, 95% CI 1.14 to 2.16) and parathion (HR=1.61, 95% CI 1.05 to 2.46); the organochlorine dieldrin (HR=1.99, 95% CI 1.12 to 3.54); and the herbicide 2,4,5-T/2,4,5-TP (HR=1.59, 95% CI 1.00 to 2.51). With phorate and fonofos together in one model to account for their correlation, risks for both remained elevated, though attenuated compared with separate models. CONCLUSIONS: Results are consistent with previous studies reporting an association between specific organochlorines and diabetes and add to growing evidence that certain organophosphates also may increase risk.	Occupational & Environmental Medicine	71	9	629-35	Self-reported exposure			Cohort (prospective)	Specific active ingredient	endocrine/nutritional/metabolical	doctor-diagnosed	USA	hic
82	A. Pilkington, D. Buchanan, G. A. Jamal, R. Gillham, S. Hansen, M. Kidd, J. F. Hurley and C. A. Soutar	An epidemiological study of the relations between exposure to organophosphate pesticides and indices of chronic peripheral neuropathy and neuropsychological abnormalities in sheep farmers and dippers	2001	OBJECTIVES: To investigate the hypothesis that chronic low level exposure to organophosphates (OPs) in sheep dips is related to clinically detectable measures of polyneuropathy. METHODS: The design was a cross sectional exposure-response study of sheep dippers and other non-exposed groups. The study group consisted of 612 sheep dipping farmers, 53 farmers with no sheep dipping experience, and 107 ceramics workers. Retrospective exposure information was obtained by questionnaire based on stable and easily identifiable features of sheep dipping found during the first phase of the study; in particular, estimates of handling concentrate and splashing with dilute dip. Neurological assessments were based on a standard neuropathy symptoms questionnaire, and thermal and vibration quantitative sensory tests. RESULTS: Adjusted for confounders there was a weak positive association between cumulative exposure to OPs and neurological symptoms, the significance of which was dependent on the inclusion of a few individual workers with extremely high exposure. There was no evidence of an association between cumulative exposure and the thermal or vibration sensory thresholds. However, separating the effects of exposure intensity and duration showed a higher prevalence of symptoms, primarily of a sensory type, among sheep dippers who handled the OP concentrate. There was also evidence that sensory and vibration thresholds were higher among concentrate handlers, the highest exposed group of dippers. CONCLUSIONS: The findings showed a strong association between exposure to OP concentrate and neurological symptoms, but a less consistent association with sensory thresholds. There was only weak evidence of a chronic effect of low dose cumulative exposure to OPs. It is suggested that long term health effects may occur in at least some sheep dippers exposed to OPs over a working life, although the mechanisms are unclear.	Occupational & Environmental Medicine	58	11	702-10	Self-reported exposure			Cross-sectional	Chemical class	neurological	self-reported	UK	hic
83	A. Povey, R. McNamee, S. J. Stock, G. Watkins, F. Creed, A. Burns, D. Neary and R. Agius	Pesticide exposure and screen-identified neuropsychiatric disease in British sheep farmers	2011	Objectives Chronic low dose pesticide exposure, especially to organophosphates (OPs) has been associated with ill-health particularly in sheep farmers but in the absence of overt acute toxicity the epidemiological evidence linking chronic ill-health to such exposures is weak. Our aim was to determine whether neuropsychiatric disease was associated with pesticide exposure in sheep farmers. Methods 18 958 British farmers from the 1970s were identified using contemporaneous records held by the National Farmers' Union, Sheep and Cattle Associations and through Shepherd's Guides. Each farmer was sent a health and occupational questionnaire. The prevalence of screen identified depression dementia, Parkinsonism and neuropathy was determined using previously published algorithms. Associations between work activities, handling the pesticide concentrate, and screen identified ill-health were determined after adjustment for demographic variables. Results Screen-identified ill-health was associated with the somatic symptom severity score and ever seeking advice for pesticide poisoning. Handling the pesticide concentrate was associated with screen-identified Parkinsonism (ORadj 1.76 95% CI 1.06 to 2.92) and to a lesser extent with neuropathy (ORadj 1.58, 95% CI 0.96 to 2.60) but not depression or dementia. After excluding those participants who had sought advice for pesticide poisoning, risks for Parkinsonism and neuropathy remained elevated but were no longer significant. After stratification by somatic symptom severity score, associations were found only in farmers with low scores. Conclusions Results are consistent with the a priori hypothesis linking chronic low dose exposure to ill-health but require confirmation using more precise measures of exposure and outcome. Somatisation does not appear to play an important role in this population.	Occupational and Environmental Medicine	68	NA	A14	Registers			NA	Pesticides in general	neurological	self-reported	UK	hic

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84	A. Prakasam, S. Sethupathy and S. Lalitha	Plasma and RBCs antioxidant status in occupational male pesticide sprayers	2001	A total of forty-one (n=41) male, healthy agricultural sprayers, exposed to pesticides for 5 years, were compared with twenty one (n=21) controls matched for age and economic status with respect to free radical generation, lipid peroxidation, antioxidant status and concentration of cellular enzymes were determined. Significantly increased TBARS (thiobarbituric acid reactive substances) were observed (P<0.001) in sprayer populations when compared to controls. The concentration of antioxidants such as glutathione (GSH), alpha-tocopherol, ascorbic acid and ceruloplasmin were significantly altered when compared to controls, and the activities of antioxidant enzymes were remarkably elevated (P<0.001) in sprayer populations, when compared to controls.	Clinica Chimica Acta	310	2	107-12	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	NA	NA
85	A. Punjindasup, S. Sangrajrang and C. Ekpanyaskul	Occupational Risk Factors of Lymphohematopoietic Cancer in Rayong Province, Thailand	2015	BACKGROUND: The Lymphohematopoietic Cancer (LHC) incidence rate in Thailand has been rising over the past decade with unknown etiology, including Rayong province. One hypothesis of LHC risks is exposure to occupational carcinogens. OBJECTIVE: To determine the association of occupational exposure and LHC risks in Rayong province, Thailand. MATERIAL AND METHOD: This matched hospital-based case-control study was conducted in a Rayong provincial hospital from September 2009 to January 2013. One LHC case was matched with four controls in gender and age, +/-5 years. Demographic data, residential factors, behavioral factors, and occupational exposure-including chemical exposure-were obtained by interviews and collected by occupational health care officers. The risk factor was analyzed by conditional logistic regression and reported in odds ratio with 95% confidence interval. RESULTS: This study found 105 LHC cases which met the inclusion criteria and were included in the study, yielding a 66% cover rate of cases reported in the database. The histology of LHC were 51 leukemia cases (47.7%), 43 lymphoma cases (42.0%), and 11 multiple myeloma cases (10.3%). The results revealed that occupational exposure to pesticide and smoke were statistically significantly associated with LHC with adjusted ORs 2.26 (95% CI 1.30-3.91) and 1.99 (95% CI = 1.13-3.51), respectively. When stratified to histological subtype of LHC by WHO 2000, leukemia was statistically significantly associated with occupational exposure to smoke, adjusted ORs 2.43 (95% CI 1.11-5.36), with occupational pesticide exposure a significant risk of lymphoma, adjusted ORs 4.69 (95% CI 2.01-10.96). However, neither fumes, wood dust, working outdoors, cleaners, contact with animals, petroleum products and chlorine; nor occupational exposure to volatile organic compounds (VOCs) such as benzene or organic solvents, were statistically significant risk factors of LHC. In addition, there were no significant risks in the demographic data, residential factors, and behavioral factors. CONCLUSION: Occupational exposure to pesticides and smoke were important occupational risks in developing LHC in Rayong province. However, the ability or power to detect this problem due to the small sample size and recall bias from the study design could not be excluded.	Journal of the Medical Association of Thailand	98	NA	S13-22	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Thailand	umic
86	A. R. Abou El Azm, M. Yousef, N. Mansour, A. Awad, S. El Dardiry and I. Abdel Aziz	New insights on non-B non-C hepatocellular carcinoma in mid Delta Region, Egypt	2014	PURPOSE: The rate of hepatocellular carcinoma (HCC) is increasing worldwide, including in Egypt. Hepatitis B (HBV) and C (HCV) viruses are major risks. Non-B non-C HCC was reported in some countries. We investigated non-B non-C HCC-independent risk factors and associated profiles in viral hepatitis endemic region. METHODS: In a consecutive series, 281 patients were diagnosed with HCC and received for management, at Tanta University Hospitals, within the past 3 years. Demographic variables and environmental exposures were recorded by direct application of a modified questionnaire. Sera were tested for HCV (antibodies by ELISA and RNA by RT-PCR) and HBV (HBs Ag by ELISA and HBV DNA). Antinuclear antibody, serum copper, and iron were assessed in non-viral HCC. Liver biopsy was performed for HCC diagnosis and grading and liver tissue in all patients by histopathological and immunohistochemical methods to assess HBV and/or HCV etiology. RESULTS: Non-B non-C HCC patients were 13.87% of the total and were associated with multiple risks, predominantly pesticides (100%, p<0.001) and super phosphate and ammonium sulfate fertilizers (94.87%, p<0.001) with significant exposure in industry, farming, and residence. Their tumors were mainly solitary, smaller sizes, and of lower alpha-fetoprotein titers. The study showed insignificant increase in prevalence of non-B non-C HCC and had special characters. Multivariate analysis showed significance of pesticides and smoking as independent risks for non-B non-C HCC. CONCLUSIONS: Pesticides and smoking heavy exposure can be considered as primary risks for non-B non-C HCC. Phosphate and ammonium sulfate fertilizers were associations. The study will increase awareness for better prevention and management.	Journal of Gastrointestinal Cancer	45	3	276-83	Self-reported exposure			Case-control	Pesticides in general	NA	NA	Egypt	lmic
87	A. R. Bhat, M. A. Wani and A. R. Kirmani	Brain cancer and pesticide relationship inorchard farmers of kashmir	2010	Background: The increasing trend in the incidence of primary malignant brain tumors in orchard farmers and their families in Kashmir. Aim: To determine the relationship between the patients of primary malignant brain tumors and their occupation. Materials and Methods: Retrospectively, case files along with death certificates of 432 patients of primary malignant brain tumors and 457 controls (non-tumor neurologic diseases), admitted for treatment simultaneously over a period of 4 years from January 2005 to December 2008, to the Neurosurgery, Sher-i-Kashmir Institute of Medical Sciences (SKIMS), Kashmir, were studied. Follow-up and family interaction was established. Results: Analysis revealed that 90.04% (389 out of 432) patients were orchard farm workers, orchard residents and orchard playing children exposed to the high levels of multiple types of neurotoxic and carcinogenic (chlorpyriphos, dimethoate, mancozeb and captan) chemicals for more than 10 years [relative risk (RR) = 10.6; odds ratio (OR) = >10; 95% confidence interval (CI) = >25-40]. The 9.96% (43 out of 432) patients were not exposed to pesticides. On the other hand, only 19 patients out of 457 controls had recorded history of pesticide exposure and 438 were unrelated to pesticides. Out of 389 patients, 71.7% (279 out of 389) were males and 28.3% (110 out of 389), including six members of three families, were females (one male child). Conclusion: All orchard-related 389 patients had high-grade tumors as compared to the non-pesticide tumors. Mortality in pesticide-exposed tumors was 12%. The higher or upper-normal levels of serum cholinesterase (AChE) were observed in 54.7% (213 out of 389) patients and decreased levels were found in only 45.3% (176 out of 389) orchard-related patients (RR = 19.4; OR = >5; 95% CI = >1-10). Although serum AChE levels were a routine investigation in malignant brain tumors, this was not a routine in other neurological conditions (hospitalized controls). The familial gliomas have shown an emerging trend in the orchard residents of valley of Kashmir.	Indian Journal of Occupational and Environmental Medicine	14	3	78-86	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	India	lmic

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88	A. R. Greenlee, T. E. Arbuckle and P. H. Chyou	Risk factors for female infertility in an agricultural region	2003	BACKGROUND: Recent studies have suggested that agricultural occupations or exposure to pesticides may impair female fertility. METHODS: The Fertility Risk Factor Study retrospectively examined agricultural and residential exposures and the risk of female infertility. Cases and controls (N = 322 each) came from women who sought treatment at a large group medical clinic in Wisconsin. Women and their male partners provided information on health, occupational and lifestyle exposures in response to a telephone interview during 1997-2001. RESULTS: Mixing and applying herbicides 2 years before attempting conception was more common among infertile women (odds ratio [OR] = 27; 95% confidence interval [CI] = 1.9-380), as was the use of fungicides (OR = 3.3; CI = 0.8-13). Residing on a farm, ranch or in a rural area during this time period was protective of female fertility. Households supplied with central Wisconsin groundwater were at less risk for infertility than households using municipal sources (OR = 0.6; CI = 0.4-0.9). Behavioral risk factors included alcohol consumption (OR = 1.8; 1.2-2.5), smoking (1.6; 0.9-2.9), passive smoke exposure (1.8; 1.2-2.5), steady weight gain in adult life (3.5; 2.0-6.1), and having a male partner over the age of 40 (4.5; 1.2-16.3). Drinking 3 or more glasses of milk per day was protective of female fertility (0.3; 0.1-0.7). CONCLUSION: These results suggest that certain agricultural, residential and lifestyle choices may modify the risk of female infertility.	Epidemiology	14	4	429-36	Self-reported exposure			Case-control	Type of pesticide	reproductive	self-reported	USA	hic
89	A. R. Seidler, E.; Arabin, B.; Hellenbrand, W.; Walter, U.; Schwartz, F. W.	Maternal occupational exposure to chemical substances and the risk of infants small-for-gestational-age	1999	BACKGROUND: The association between maternal occupational exposure to specific chemical substances (organic solvents, carbon tetrachloride, herbicides, chlorophenols, polychlorinated biphenyls, aromatic amines, lead and lead compounds, mercury and mercury compounds) and birth of small-for-gestational-age (SGA) infants was evaluated using data from a prospective cohort study of 3,946 pregnant women in West Germany from 1987 to 1988. METHODS: Occupational, medical, and psychosocial information was gathered through a questionnaire from pregnant women who were recruited between 15 and 28 gestational weeks. Exposure to chemical substances at the current workplace was assessed by a job-exposure matrix constructed by Pannett in 1985 and weighted for the number of working hours per week. Women not working at the time of the interview, women with multiple births, and women with stillbirths were excluded from analysis. Data were analyzed using dichotomous and polytomous logistic regression to control for age, smoking status, alcohol consumption, body mass index, and number of former births. RESULTS: The results of the dichotomous logistic regression analysis suggest that leather work might be associated with the birth of infants small-for-gestational-age through exposure to chlorophenols (P = 0.02) and aromatic amines (P = 0.05). In the polytomous logistic regression analysis, only the association between exposure to mercury and growth retardation reached statistical significance (P = 0.02); however, the power of the study is limited. Further adjustment for income, shift work, and heavy physical work had no substantial effect on the results. CONCLUSIONS: These findings suggest that maternal exposure to specific chemicals at work may be a risk factor for the birth of SGA infants.	American Journal of Industrial Medicine	36	1	213-22	Job exposure matrix			Cohort (prospective)	Type of pesticide	offspring	medical test result	Germany	hic
90	A. R. Sperati, E.; Settimi, L.; Quercia, A.; Terenzoni, B.; Forastiere, F.	Mortality among male licensed pesticide users and their wives	1999	BACKGROUND: We evaluated the mortality pattern of male licensed pesticide users and their wives in central Italy. METHODS: The cohort consisted of 2978 male farmers licensed for buying and handling toxic pesticides during the period 1971-1973 and 2586 farmers' wives. The Standardized Mortality Ratio (SMRs) and their 95% Confidence Intervals (95% CI) were computed on the basis of regional death rates. RESULTS: We found a lower than expected overall and cancer mortality. Non-Hodgkin's lymphoma was increased among women (SMR = 2.29, 0.62-5.86) but not in male farmers (SMR = 0.90, 0.24-2.30), while both sexes were characterized by an increased risk of leukemia (men: SMR = 1.44, 0.69-2.64; women: SMR = 2.41, 1.04-4.76), mainly due to myeloid leukemia (men: SMR = 2.43, 0.98-5.00; women: SMR = 3.14, 1.02-7.33). CONCLUSIONS: Men and women tend to share the same mortality profile. The statistically significant increase of leukemia with a threefold increased risk of the myeloid subtype only among women suggests that different pattern of exposure or biological differences between genders should be considered in evaluating health risks in agricultural settings.	American Journal of Industrial Medicine	36	1	142-6	Job title			Cohort (prospective)	Job title	mortality (all cause)	doctor-diagnosed	Italy	hic
91	A. S. A. B. Al-Sarar, Y.; Al-Erimah, G. S.; Hussein, H. I.; Bayoumni, A. E.	Hematological and biochemical alterations in occupationally pesticides-exposed workers of Riyadh Municipality, Kingdom of Saudi Arabia	2009	To assess the adverse health effects of pesticides on occupationally exposed workers, a cohort of pesticide sprayers, employed in Riyadh municipality. were interviewed and examined for changes in hematological profile, blood AChE activity, scrum enzymes reflecting hepatotoxicity (AST, ALT and ALP) and markers of nephrotoxicity (urea and creatinine). There was a significant decrease in AChE activity (p<0.001) in pesticide workers (n = 43] relative to the control group (n = 10). No significant differences were detected in hematological para meters, except for WBC count which was significantly higher (p<0.01) in pesticides workers compared to the control group. Slight increases were observed in liver and kidney functions in the exposed group. The results indicated the need for official regulations and interventions enforced to reduce workers overexposure to pesticides throughout the Kingdom of Saudi Arabia. <U+00AC><U+00A9> 2009 Academic Journals Inc.	Research Journal of Environmental Toxicology	3	4	179-185	Self-reported exposure	Biomonitoring (urine)	Self-reported exposure	Cohort (prospective)	Pesticides in general	hematological	medical test result	Saudi Arabia	hic
92	A. S. Andrew, T. A. Caller, R. Tandan, E. J. Duell, P. L. Henegan, N. C. Field, W. G. Bradley and E. W. Stommel	Environmental and Occupational Exposures and Amyotrophic Lateral Sclerosis in New England	2017	BACKGROUND: Recent data provide support for the concept that potentially modifiable exposures are responsible for sporadic amyotrophic lateral sclerosis (ALS). OBJECTIVE: To evaluate environmental and occupational exposures as risk factors for sporadic ALS. METHODS: We performed a case-control study of ALS among residents of New England, USA. The analysis compared questionnaire responses from 295 patients with a confirmed ALS diagnosis to those of 225 controls without neurodegenerative illness. RESULTS: Self-reported job- or hobby-related exposure to one or more chemicals, such as pesticides, solvents, or heavy metals, increased the risk of ALS (adjusted OR 2.51; 95% CI 1.64-3.89). Industries with a higher toxicant exposure potential (construction, manufacturing, mechanical, military, or painting) were associated with an elevated occupational risk (adjusted OR 3.95; 95% CI 2.04-8.30). We also identified increases in the risk of ALS associated with frequent participation in water sports, particularly waterskiing (adjusted OR 3.89; 95% CI 1.97-8.44). Occupation and waterskiing both retained independent statistical significance in a composite model containing age, gender, and smoking status. CONCLUSIONS: Our study contributes to a growing body of literature implicating occupational- and hobby-related toxicant exposures in ALS etiology. These epidemiologic study results also provide motivation for future evaluation of water-body-related risk factors.	Neurodegenerative Diseases	17	2	110-116	Self-reported job history			Case-control	Pesticides in general	neurological	doctor-diagnosed	USA	hic

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93	A. S. Blair, D. P.; Tarone, R.; Lubin, J.; Thomas, K.; Hoppin, J. A.; Samanic, C.; Coble, J.; Kamel, F.; Knott, C.; Dosemeci, M.; Zahm, S. H.; Lynch, C. F.; Rothman, N.; Alavanja, M. C.	Mortality among participants in the agricultural health study	2005	PURPOSE: This analysis of the Agricultural Health Study cohort assesses the mortality experience of licensed pesticide applicators and their spouses. METHODS: This report is based on 52,393 private applicators (who are mostly farmers) and 32,345 spouses of farmers in Iowa and North Carolina. At enrollment, each pesticide applicator completed a 21-page enrollment questionnaire. Mortality assessment from enrollment (1994-1997) through 2000 provided an average follow-up of about 5.3 years, 447,154 person-years, and 2055 deaths. RESULTS: Compared with the general population in the two states, the cohort experienced a very low mortality rate. Standardized mortality ratios (SMRs) for total mortality, cardiovascular disease, diabetes, COPD, total cancer, and cancers of the esophagus, stomach, and lung were 0.6 or lower for both farmers and spouses. These deficits varied little by farm size, type of crops or livestock on the farm, years of handling pesticides, holding a non-farm job, or length of follow up. SMRs among ever smokers were not as low as among never smokers, but were still less than 1.0 for all smoking-related causes of death. No statistically significant excesses occurred, but slightly elevated SMRs, or those near 1.0, were noted for diseases that have been associated with farming in previous studies. CONCLUSIONS: Several factors may contribute to the low mortality observed in this population, including the healthy worker effect typically seen in cohorts of working populations (which may decline in future years), a short follow-up interval, and a healthier lifestyle manifested through lower cigarette use and an occupation that has traditionally required high levels of physical activity.	Annals of Epidemiology	15	4	279-85	Self-reported exposure			Cohort (prospective)	Pesticides in general	mortality (all cause)	doctor-diagnosed	USA	hic
94	A. S. Costantini, L. Miligi, D. Kriebel, V. Ramazzotti, S. Rodella, E. Scarpi, E. Stagnaro, R. Tumino, A. Fontana, G. Masala, C. Vigano, C. Vindigni, P. Crosignani, A. Benvenuti and P. Vineis	A multicenter case-control study in Italy on hematolymphopoietic neoplasms and occupation	2001	We conducted a population-based, case-control study on hematolymphopoietic malignancies in 12 areas in Italy to investigate associations between different hematolymphopoietic malignancies and exposure to solvents and pesticides. We collected all incident cases 20-74 years of age from 12 areas, with a combined population of approximately 7 million residents. The control group was formed by a random sample of the study population. Data presented in this paper refer to 2,737 interviewed cases of 3,357 eligible cases and to 1,779 of 2,391 eligible controls. We analyzed risks associated with occupation using job-title information to evaluate disease pattern according to job category. An earlier publication presented results for women; here, we report the findings for men and discuss the overall patterns in both genders. The most consistent overall finding was an approximate doubling in relative risk for all four types of malignancies among male managers and related occupations. Several additional occupations were associated with elevated risk of one or more malignancies among men. These included cooks, waiters, and bartenders, and building caretakers and cleaners, for non-Hodgkin's lymphoma; textile workers and machinery fitters for Hodgkin's lymphoma; metal processors, material handlers, rubber workers, and painters for leukemia; and hairdressers, metal processors, tailors, electrical workers, and plumbers for multiple myeloma. The finding of increased risk of non-Hodgkin's lymphoma among both male and female cooks, waiters, and bartenders has not been previously reported; nor has the elevated risk of leukemia among material handlers. Among people engaged in agriculture, those employed as tractor drivers and as "orchard, vineyard, and related tree and shrub workers" appeared to be at increased risk for hematolymphopoietic malignancies.	Epidemiology	12	1	78-87	Job title			Case-control	Job title	cancer	doctor-diagnosed	Italy	hic
95	A. S. Dhillon, G. L. Tarbutton, J. L. Levin, G. M. Plotkin, L. K. Lowry, J. T. Nalbone and S. Shepherd	Pesticide/environmental exposures and Parkinson's disease in East Texas	2008	Epidemiological evidence suggests that pesticides and other environmental exposures may have a role in the etiology of idiopathic Parkinson's disease (PD). However, there is little human data on risk associated with specific pesticide products, including organic pesticides such as rotenone with PD. Using a case-control design, this study examined self-reports of exposure to pesticide products, organic pesticides such as rotenone, and other occupational and environmental exposures on the risk of PD in an East Texas population. The findings demonstrated significantly increased risk of PD with use of organic pesticides such as rotenone in the past year in gardening (OR = 10.9; 95% CI = 2.5-48.0) and any rotenone use in the past (OR = 10.0; 95% CI = 2.9-34.3). Use of chlorpyrifos products (OR = 2.0; 95% CI = 1.02-3.8), past work in an electronics plant (OR = 5.1; 95% CI = 1.1-23.6), and exposure to fluorides (OR = 3.3; 95% CI = 1.03-10.3) were also associated with significantly increased risk. A trend of increased PD risk was observed with work history in paper/lumber mill (OR = 6.35; 95% CI = 0.7-51.8), exposure to cadmium (OR = 5.3; 95% CI = 0.6-44.9), exposure to paraquat (OR = 3.5; 95% CI = 0.4-31.6), and insecticide applications to farm animals/animal areas and agricultural processes (OR = 4.4; 95% CI = 0.5-38.1). Cigarette smoking, alcohol use, and fish intake were associated with reduced risk. In summary, this study demonstrates an increased risk of PD associated with organic pesticides such as rotenone and certain other pesticides and environmental exposures in this population.	Journal of Agromedicine	13	1	37-48	Self-reported exposure			Case-control	Specific active ingredient	neurological	doctor-diagnosed	USA	hic
96	A. S. Faustini, L.; Pacifici, R.; Fano, V.; Zuccaro, P.; Forastiere, F.	Immunological changes among farmers exposed to phenoxy herbicides: preliminary observations	1996	OBJECTIVES: To evaluate short term immunological changes after agricultural exposure to commercial formulations of chlorophenoxy herbicides. METHODS: Blood samples were collected from 10 farmers within seven days before exposure, one to 12 days after exposure, and again 50 to 70 days after exposure. Whole blood was used to count lymphocyte subsets with monoclonal antibodies. Peripheral blood mononuclear (PBM) cells were used to measure natural killer (NK) cell activity and lymphocyte response to mitogenic stimulations. Values before exposure were used as reference. RESULTS: In comparison with concentrations before exposure, a significant reduction was found one to 12 days after exposure in the following variables (P < 0.05): circulating helper (CD4) and suppressor T cells (CD8), CD8 dim, cytotoxic T lymphocytes (CTL), natural killer cells (NK), and CD8 cells expressing the surface antigens HLA-DR (CD8-DR), and lymphoproliferative response to mitogen stimulations. All immunological values found 50-70 days after exposure were comparable with concentrations before exposure, but mitogenic proliferative responses of lymphocytes were still significantly decreased. CONCLUSIONS: According to our data agricultural exposure to commercial 2,4-dichlorophenoxyacetic acid (2,4-D) and 4-chloro-2-methylphenoxyacetic acid (MCPA) formulations may exert short term immunosuppressive effects. Further studies should clarify whether the immunological changes found may have health implications and can specifically contribute to cancer aetiology.	Occupational & Environmental Medicine	53	9	583-5	Biomonitoring (blood)			Cohort (prospective)	Chemical class	immunological	medical test result	Italy	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
97	A. S. Gaikwad, P. Karunamoorthy, S. J. Kondhalkar, M. Ambikapathy and R. Beerappa	Assessment of hematological, biochemical effects and genotoxicity among pesticide sprayers in grape garden	2015	Background: Many studies revealed toxic effects of pesticides on pesticide handlers but very fewer studies have been reported among grape garden pesticide sprayers in India. The purpose of this study was to evaluate the effect of pesticides among grape garden sprayers. Methods: 27 pesticide sprayers in study group and 27 non sprayers in control group were recruited. Blood samples were analyzed for hematological profile, biochemical parameters and urine samples for oxidative stress, buccal mucosal cells for genotoxicity. For statistical analysis student's t-test and Mann Whitney U test were used. Results: White blood cell (WBC) count was significantly decreased; uric acid and Malondialdehyde (MDA) level was significantly increased among study group. In present study the Micronucleus (MN) assay for buccal mucosal cell showed significant number of micronucleated cells in study group. Conclusion: These results suggest that pesticide sprayers in grape garden are under risk which need to be monitored continuously in large population and further study is warranted to correlate the pesticide exposure by assessing acetylcholinesterase activity, pesticide residue analysis and their personal habits.	Journal of Occupational Medicine and Toxicology	10	1	NA	Job title			Cross-sectional	Job title	hematological	medical test result	India	lmic
98	A. S. Meyer, D. P.; Beane Freeman, L. E.; Hofmann, J. N.; Parks, C. G.	Pesticide Exposure and Risk of Rheumatoid Arthritis among Licensed Male Pesticide Applicators in the Agricultural Health Study	2017	BACKGROUND: The occupation of farming has been associated with rheumatoid arthritis (RA); pesticides may account for this association, but there are few studies. OBJECTIVES: We investigated associations between RA and use of pesticides in the Agricultural Health Study. METHODS: The study sample was drawn from male pesticide applicators enrolled in 1993-1997 who provided questionnaire data at baseline and at least once during follow-up (over a median 18 y; interquartile range 16-19). Incident RA cases (n=220), confirmed by physicians or by self-reported use of disease-modifying antirheumatic drugs, were compared with noncases (n=26,134) who did not report RA. Odds ratios (ORs) and 95% confidence intervals (CIs) were estimated using logistic regression, adjusting for enrollment age, state, smoking pack-years, and education. We evaluated the association of RA with the use of 46 pesticides and across 4 levels (never use and tertiles) of lifetime days of use for 16 pesticides with OR>=1.2 for ever use. RESULTS: Incident RA was associated with ever use of fonofos (OR = 1.70; 95% CI: 1.22, 2.37), carbaryl (OR = 1.51; 95% CI: 1.03, 2.23), and chlorimuron ethyl (OR = 1.45; 95% CI: 1.01, 2.07) compared with never use. Statistically significant exposure-response trends in association with RA were observed for lifetime days of use of atrazine [OR_{tertile3}= 1.62 (95% CI: 1.09, 2.40); p_{trend}=0.01] and toxaphene [OR_{tertile3}= 2.42 (95% CI: 1.03, 5.68); p_{trend}=0.02]. Exposure-response was nonlinear for fonofos [OR_{tertile1}= 2.27 (95% CI: 1.44, 3.57); OR_{tertile2}= 0.98 (95% CI: 0.54, 1.80); OR_{tertile3}= 2.10 (95% CI: 1.32, 3.36); p_{trend}=0.005] and suggestive for carbaryl (p_{trend}=0.053). CONCLUSIONS: Our results provide novel evidence of associations between exposure to some pesticides and RA in male farmers. https://doi.org/10.1289/EHP1013.	Environmental Health Perspectives	125	7	77010	Algorithm/model	Self-reported exposure		Cohort (prospective)	Specific active ingredient	muskuloskeletal	self-reported	USA	hic
99	A. S. Yadav and G. Sehrawat	Evaluation of genetic damage in farmers exposed to pesticide mixtures	2011	Environment surrounding us is being polluted day by day by various kinds of chemicals and xenobiotics. Pesticides are one such group, which are toxic in nature yet indispensable as they are used in variety of human activities such as agriculture, aquaculture and household tasks. Excessive dependency on these chemicals is a serious concern today. For the present investigation, a total of 62 individuals including 33 pesticide users (exposed) and 29 non-users (controls) gave blood samples. Comet assay being a highly sensitive and low cost technique was used to access the level of genetic damage in exposed population. Hundred cells were analysed from each individual and Damage Index (DI) was calculated using various comet parameters such as comet length, tail length, tail area, percentage DNA in tail, tail moment and olive tail moment. The mean duration of exposure to pesticides in farmers was 14.032 years. The mean value of comet length was 94.96<U+00AC><U+00B1>4.22 in exposed cases as compared to 36.56<U+00AC><U+00B1>2.11 in controls. The mean value of tail length was found to be 52.18<U+00AC><U+00B1>3.74 and 7.01<U+00AC><U+00B1>1.47 in exposed and controls, respectively. The mean value of percentage of DNA in tail in exposed and controls was 27.45<U+00AC><U+00B1>1.64, 9.04<U+00AC><U+00B1>0.67, respectively. The mean tail area was 19.23<U+00AC><U+00B1>4.75 in exposed and 1.39<U+00AC><U+00B1>0.32 in control individuals. The mean tail moment and olive tail moment were found to be 16.91<U+00AC><U+00B1>2.14, 15.58<U+00AC><U+00B1>9.07 in exposed and 1.04<U+00AC><U+00B1>0.032, 1.82<U+00AC><U+00B1>0.32 in case of control individuals. All these comet parameters were found to be statistically significant at 0.005 level using t-test. The percentage of DNA in tail was also found to increase with increase in duration of exposure. <U+00AC><U+00A9> Kamla-Raj 2011.	International Journal of Human Genetics	11	2	105-109	Job title			Case-control	Job title	genetic (biomarkers)	medical test result	India	lmic
100	A. Saad-Hussein, M. Noshy, M. Taha, H. El-Shorbagy, E. Shahy and E. A. Abdel-Shafy	GSTP1 and XRCC1 polymorphisms and DNA damage in agricultural workers exposed to pesticides	2017	Pesticide exposure may be associated with increased risk of genotoxicity and carcinogenesis. These risks may be affected by polymorphisms of genes for glutathione transferase-dependent metabolism of pesticides and for DNA repair. We studied the prevalence of GSTP1 and XRCC1 polymorphisms and their possible correlation with DNA damage following prolonged pesticide exposure. DNA damage was estimated by the comet assay in peripheral blood samples from 51 pesticide-exposed workers and 50 controls. GSTP1 (105) and XRCC1 (399 and 194) genotypes were identified by restriction fragment length analysis. Individuals carrying theGSTP1 Ile-Ile or XRCC1399 Arg-Arg genotypes showed greater DNA damage than observed for other alleles.	Mutation Research	819	NA	20-25	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	NA	NA

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
101	A. Seidler, W. Hellenbrand, B. P. Robra, P. Vieregge, P. Nischan, J. Joerg, W. H. Oertel, G. Ulm and E. Schneider	Possible environmental, occupational, and other etiologic factors for Parkinson's disease: a case-control study in Germany	1996	In a case-control study, we investigated the possible etiologic relevance to Parkinson's disease (PD) of rural factors such as farming activity, pesticide exposures, well-water drinking, and animal contacts; toxicologic exposures such as wood preservatives, heavy metals, and solvents; general anesthesia; head trauma; and differences in the intrauterine environment. We recruited 380 patients in nine German clinics, 379 neighborhood control subjects, and 376 regional control subjects in the largest case-control study investigating such factors and collected data in structured personal interviews using conditional logistic regression to control for educational status and cigarette smoking. The latter was strongly inversely associated with PD. There were significantly elevated odds ratios (OR) for pesticide use, in particular, for organochlorines and alkylated phosphates, but no association was present between PD and other rural factors. A significantly elevated OR was present for exposure to wood preservatives. Subjective assessment by the probands indicated that exposure to some heavy metals, solvents, exhaust fumes, and carbon monoxide was significantly more frequent among patients than control subjects, but this was not confirmed by a parallel assessment of job histories according to a job exposure matrix. Patients had undergone general anesthesia and suffered severe head trauma more often than control subjects, but a dose-response gradient was not present. Patients reported a significantly larger number of amalgam-filled teeth before their illness than control subjects. The frequency of premature births and birth order did not differ between patients and control subjects. Patients reported significantly more relatives affected with PD than control subjects. These results support a role for environmental and genetic factors in the etiology of PD.	Neurology	46	5	1275-84	Self-reported exposure	Job exposure matrix		Case-control	Chemical class	neurological	doctor-diagnosed	Germany	hic
102	A. Senthilselvan, J. A. Dosman, K. M. Semchuk, H. H. McDuffie, A. J. Cessna, D. G. Irvine, M. F. Crossley and A. Rosenberg	Seasonal changes in lung function in a farming population	2000	OBJECTIVE: To assess the changes in respiratory health from winter to summer seasons in a rural population. DESIGN: A longitudinal design was used in the study. SETTING: A population-based study was conducted as part of the Environmental Pesticide Exposure and Human Health component of the Prairie Ecosystem Study (PECOS) in southwestern Saskatchewan. PATIENTS: In the winter season, 358 patients participated in the study. Of these patients, 234 returned for the second assessment during the summer season. After excluding 34 children aged 17 years and under, 200 adult patients were available for analysis. MEASUREMENTS: Questionnaires were used to obtain information on demographic factors, smoking habits, occupational and environmental exposures, and respiratory conditions. Pulmonary function measurements were obtained using a volume displacement spirometer. RESULTS: Mean ages (+/- SD) of the 106 men and 94 women participating in the study were 50.1+/-13.3 and 49.0+/-13.1 years, respectively. Mean percentage changes in maximal midexpiratory flow rate from winter to summer assessments indicated an improvement for town residents and a decline for farm residents. Mean percentage changes in the ratio of forced expiratory volume in 1 s to forced vital capacity indicated an improvement for town residents who were not engaged in farming, and increasing declines for town residents engaged in farming, farm residents not engaged in farming and farm residents engaged in farming. CONCLUSIONS: Seasonal changes occurred in measurements of pulmonary function between winter and summer seasons; these changes may be related to the environmental or occupational exposures experienced by the participants during the study.	Canadian Respiratory Journal	7	4	320-5	Self-reported exposure			Cohort (prospective)	Pesticides in general	respiratory	medical test result	Canada	hic
103	A. Shirangi, L. Fritschi and C. D. Holman	Maternal occupational exposures and risk of spontaneous abortion in veterinary practice	2008	OBJECTIVES: To examine the relationship between occupational exposures and spontaneous abortion in female veterinarians. METHODS: The Health Risks of Australian Veterinarians project (HRAV) was a questionnaire-based survey of all graduates from Australian veterinary schools from 1960 to 2000. Of 5748 eligible veterinarians sent the questionnaires, 2800 replied including 1197 females (42.8%). The response rate was 59% of women veterinarians eligible to participate. The pregnancy of women was defined as the unit of analysis. We restricted analyses to pregnancies of those women who reported being employed when the pregnancy began and were working only in clinical practice. Of 1355 pregnancies, 940 were eligible for the final analysis. Self-reported occupational exposures to anaesthetic gases, x rays, pesticides and long working hours in relation to spontaneous abortion were examined. RESULTS: In a multiple logistic regression controlling for 12 potential confounders, there was a more than twofold significant increase (OR 2.49, 95% CI 1.02 to 6.04) in the risk of spontaneous abortion in women exposed to unscavenged anaesthetic gases for > or =1 h per week. Veterinarians who reported performing more than five radiographic examinations per week had a statistically significant elevated risk of spontaneous abortion compared to those who performed five or less (OR 1.82, 95% CI 1.17 to 2.82). There was also approximately a twofold significant increased risk of spontaneous abortion in women who used pesticides at work (OR 1.88, 95% CI 1.18 to 3.00). CONCLUSION: Female veterinarians, particularly those of childbearing age, should be fully informed of the possible reproductive effects of unscavenged anaesthetic gases, ionising radiation and pesticide exposure and reduce their exposure by using protective devices when they are planning to become pregnant and during pregnancy.	Occupational & Environmental Medicine	65	11	719-25	Self-reported exposure			Cross-sectional	Pesticides in general	reproductive	self-reported	Australia	hic
104	A. Shirangi, L. Fritschi, C. D. Holman and C. Bower	Birth defects in offspring of female veterinarians	2009	OBJECTIVES: To investigate the risk of birth defects in offspring of female veterinarians exposed to occupational hazards such as radiation, anesthetic gases, and pesticides in veterinary practice. METHODS: The Health Risks of Australian Veterinarians project was conducted as a questionnaire-based survey of all graduates from Australian veterinary schools during the 40-year period 1960-2000. RESULTS: In a multiple logistic regression controlling for the potential confounders, the study showed an increased risk of birth defects in offspring of female veterinarians after occupational exposure to high dose of radiation (taking more than 10 x-ray films per week, odds ratio: 5.73 95% CI: 1.27 to 25.80) and an increase risk of birth defects after occupational exposure to pesticides at least once per week (odds ratio: 2.39 95% CI: 0.99 to 5.77) in veterinarians exclusively working in small animal practice. CONCLUSION: Female veterinarians should be informed of the possible reproductive effects of occupational exposures to radiation and pesticides.	Journal of Occupational & Environmental Medicine	51	5	525-33	Self-reported exposure			Cross-sectional	Pesticides in general	offspring	self-reported	Australia	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
105	A. Smargiassi, A. Mutti, A. De Rosa, G. De Palma, A. Negrotti and S. Calzetti	A case-control study of occupational and environmental risk factors for Parkinson's disease in the Emilia-Romagna region of Italy	1998	A questionnaire-based case-control study was carried out on 86 patients with neurologist-confirmed idiopathic Parkinson's disease (PD) and 86 controls similar in sex and age. The control group was recruited in outpatient specialist centers of the same University Hospital (glaucoma, psoriasis vulgaris, essential arterial hypertension and renal diseases). Exposure was defined as occupational or residential contact with a given factor for at least 10 consecutive years prior to the onset of PD. Smoking habits were defined by exclusion of those subjects who never smoked. The following risk factors were identified: cranial trauma (OR: 2.88; 95% CI: 0.98-8.49), well water use (OR: 2.78; 95% CI: 1.46-5.28) and occupational exposure to industrial chemicals (OR: 2.13; 95% CI: 1.16-3.91). Among industrial chemicals, only organic solvents were identified as significant risk factors for PD (O.R. : 2.78, 95% C.I. : 1.23-6.26). Whereas no exposure to neurotoxic metals occurred among controls, making the assessment of the O.R. impossible, exposure pesticides and herbicides was similar in the two groups (O.R. : 1.15; 95% C. : 0.56-2-36). Smoking habits was negatively associated with PD (OR: 0.41; 95% CI: 0.22-0.75), confirming the "protective" role of tobacco smoking suggested by many studies. As a whole, these results support the role of environmental factors in the etiology of PD.	Neurotoxicology	19	4	709-12	Self-reported exposure			Case-control	Type of pesticide	neurological	doctor-diagnosed	Italy	hic
106	A. t Mannetje, D. McLean, S. Cheng, P. Boffetta, D. Colin and N. Pearce	Mortality in New Zealand workers exposed to phenoxy herbicides and dioxins	2005	AIMS: To evaluate mortality in New Zealand phenoxy herbicide producers and sprayers exposed to dioxins. METHODS: Phenoxy herbicide producers (n = 1025) and sprayers (n = 703) were followed up from 1 January 1969 and 1 January 1973 respectively to 31 December 2000. A total of 813 producers and 699 sprayers were classified as exposed to dioxin and phenoxy herbicides. Standardised mortality ratios (SMR) were calculated using national mortality rates. RESULTS: At the end of follow up, 164 producers and 91 sprayers had died. Cancer mortality was reduced for sprayers (SMR = 0.82, 95% CI 0.57 to 1.14) and increased in exposed production workers (SMR = 1.24, 95% CI 0.90 to 1.67), especially for synthesis workers (SMR = 1.69), formulation and lab workers (SMR = 1.64), and maintenance/waste treatment/cleaning workers (SMR = 1.46). Lymphohaematopoietic cancer mortality was increased in exposed production workers (SMR = 1.65, 95% CI 0.53 to 3.85), especially for multiple myeloma (SMR = 5.51, 95% CI 1.14 to 16.1). Among sprayers, colon cancer (SMR = 1.94, 95% CI 0.84 to 3.83) showed increased mortality. CONCLUSIONS: Results showed 24% non-significant excess cancer mortality in phenoxy herbicide producers, with a significant excess for multiple myeloma. Associations were stronger for those exposed to multiple agents including dioxin during production. Overall cancer mortality was not increased for producers and sprayers mainly handling final technical products, although they were likely to have been exposed to TCDD levels far higher than those currently in the general New Zealand population.	Occupational & Environmental Medicine	62	1	34-40	Registers	Expert case-by-case assessment		Cohort (prospective)	Chemical class	mortality (all cause)	doctor-diagnosed	New Zealand	hic
107	A. Thetkathuek, M. Keifer, W. Funglada, J. Kaewkungwal, C. Padungtod, B. Wilson and S. Mankhetkorn	Spectrophotometric determination of plasma and red blood cell cholinesterase activity of 53 fruit farm workers pre- and post-exposed chlorpyrifos for one fruit crop	2005	We sought to investigate the early biological effects of chlorpyrifos among 53 Thai fruit farm workers by measuring the plasma cholinesterase (PChE) and red blood cell cholinesterase (AChE) activities, a biomarker of organophosphate (OPs) pesticide during one fruit crop. The ChE activity (V(m)/K(m)) was spectrophotometrically analyzed before and after exposing to chlorpyrifos. The V(m)/K(m) values of both non-spraying and spraying seasons are found as normal distribution pattern. The median PChE and AChE activities among farm workers in the non-spraying season were 2.3 x 10(-3) s(-1) and 7.26 x 10(-5) s(-1), respectively. The median PChE and AChE activities of the farm workers in the spraying season were 2.02 x 10(-3) s(-1) and 5.95 x 10(-5) s(-1), respectively. The mean V(m)/K(m) values of PChE shifted left (t-test, p=0.013), indicating a decrease in PChE activity in the farm workers exposed to chlorpyrifos. However, the V(m)/K(m) values of AChE in nonspraying season and in the spraying season were not different (t-test, p=0.246). We propose that PChE activity can be used as a biomarker for monitoring early toxicity induced by chlorpyrifos insecticide.	Chemical & Pharmaceutical Bulletin	53	4	422-4	Job title			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	Thailand	umic
108	A. Thorn, P. Gustavsson, J. Sadigh, B. Westerlund-Hannestrand and C. Hogstedt	Mortality and cancer incidence among Swedish lumberjacks exposed to phenoxy herbicides	2000	OBJECTIVES: To determine mortality and cancer incidence relative to exposure to phenoxy herbicides. METHODS: A cohort of Swedish lumberjacks of which 261 were exposed to phenoxy herbicides, and 250 were unexposed, was followed up for mortality from 1954 to 1994, and for cancer incidence from 1958 to 1992. The number of days of exposure to phenoxy herbicides was determined from pay slips. With the county population as a reference, standardised mortality ratios and cancer incidence ratios (SMR and SIR) were calculated. RESULTS: Mortality and cancer incidence were low with two exceptions; a small but highly exposed group of foremen showed an increased cancer incidence (SIR 274, 95% confidence interval (95% CI) 100 to 596), and over all mortality (SMR 141, 95% CI 68 to 260). Of three cases of non-Hodgkin's lymphoma, two were found among the most exposed workers. CONCLUSIONS: The results provide some support to claims of previous studies that exposure to phenoxy herbicides might be related to non-Hodgkin's lymphoma and to an increased overall cancer risk.	Occupational & Environmental Medicine	57	10	718-20	Registers			Cohort (prospective)	Chemical class	mortality (all cause)	doctor-diagnosed	Sweden	hic
109	A. Tongpoo, C. Sriapha, S. Wongvisawakorn, P. Rittilert, S. Trakulsrichai and W. Wananukul	Occupational Carbamate Poisoning in Thailand	2015	Carbamate insecticide is a leading cause of poisoning in Thailand. The objective of this study was to characterize the clinical manifestations and modes of occupational exposure in carbamate poisoning cases. We retrospectively studied all the cases of carbamate poisoning due to occupational exposure recorded in the Ramathibodi Poison Center Toxic Exposure Surveillance system during 2005 to 2010. Demographic data, clinical manifestations and severity were analyzed statistically. During the study period, 3,183 cases were identified, of which 170 (5.3%) were deemed to be due to occupational exposure. Ninety-six cases (56.5%) and 35 cases (20.6%) were poisoned by carbofuran and methomyl, respectively. Carbofuran is sold as a 3% grain and applied by sowing; methomyl is sold as a liquid and is applied by spraying. The majority of poisoned patients did not wear personal protective equipment (PPE) while applying the carbamates. The clinical manifestations of occupational carbofuran poisoning recorded were nausea and vomiting (82.3%), headaches (56.3%) and miosis (19.8%). The clinical manifestations of methomyl poisoning were nausea and vomiting (74.3%), headaches (57.1%) and palpitations (11.4%). Most patients in both groups had mild symptoms. Only one case in each group required endotracheal intubation and mechanical ventilation support. There were no deaths and the lengths of hospitalization ranged from 2 hours to 2 days. Occupational carbamate poisoning cases in our series were mostly mild and the patients recovered quickly. There were only rare cases of serious symptoms. Lack of knowledge and inadequate PPE were the major factors contributing to occupational poisoning. Educating agricultural workers about correct precautions and pesticide use could minimize this type of poisoning.	Southeast Asian Journal of Tropical Medicine & Public Health	46	4	798-804	Registers			Cohort (prospective)	Specific active ingredient	pesticide-related illness	self-reported	Thailand	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
110	A. Tope, F. N. Bebe and M. Panemangalore	Micronuclei frequency in lymphocytes and antioxidants in the blood of traditional limited-resource farm workers exposed to pesticides	2006	Chronic low-level exposure to synthetic pesticides is implicated in many health conditions that result from the induction of oxidative stress, including cytogenetic damage. The objective of this study was to assess the risk of genotoxicity using micronuclei (MN) formation in lymphocytes and to determine changes in blood antioxidants superoxide dismutase (SOD) in erythrocytes (E) and glutathione (GSH) in E and plasma (PL) in farm workers for six months during a growing season. Blood and urine samples were collected once a month for six months (June to November 2003) from farm workers (n = 15) and urban unexposed controls (n = 10). Lymphocytes from blood were separated by density gradient centrifugation using Histopaque and cultured using the standard technique. There was no significant difference in the cytokinesis blocked proliferation index (CBPI) of lymphocytes between the farm workers and the control group, but there was a 76% increase in average MN frequency in lymphocytes of the farm worker group (P <or= 0.05). In addition, MN frequency peaked during August as compared to the other months and the controls (P <or= 0.05). An 18% decline was observed in the activity of E-SOD in the farm worker group (P <or= 0.05). GSH in E and PL were similar in both groups. These data suggest that the farm workers may be at a greater risk of developing genotoxicity due to continued exposure to pesticides, especially during the intensive growing season.	Journal of Environmental Science & Health - Part B: Pesticides, Food Contaminants, & Agricultural Wastes	41	6	843-53	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	USA	hic
111	A. V. Ngowi, D. N. Maeda, T. J. Partanen, M. P. Sanga and G. Mbise	Acute health effects of organophosphorus pesticides on Tanzanian small-scale coffee growers	2001	Acute health effects of organophosphorus (OP) pesticides on coffee farmworkers in 1991-1992 in Tanzania are reported to provide a basis for concern over farmworkers being overexposed during application. Workers exposed to OP pesticides (N=133) were drawn from a population of about 240,000 coffee farmers. They were interviewed on symptoms and personal protection, and their erythrocyte acetylcholinesterase (AChE) activity was determined during both spraying and nonspraying period. AChE activities during spraying and nonspraying period were comparable (mean 32.0, SD 7.8 vs. 33.0, SD 8.7 U/g HgB, P=0.26). The prevalence of cough, headache, abdominal pain, excessive sweating, nausea, excessive salivation, diarrhea, and vomiting did not differ significantly between spraying and nonspraying periods. There was no suggestion of decreased AChE in exposed subjects who complained of OP-related symptoms compared to symptomless exposed subjects. Use of gloves, long boots, head cover, face cover, and coverall was not significantly associated with AChE activity. No marked AChE depression was found during spraying season, which may explain the lack of association between symptoms and AChE. The fact that only moderately toxic OP pesticides were used may indicate that toxicity was not sufficiently high to cause depression. Experience, however, suggests that occupational poisoning remains a potential serious danger in coffee cultivation in Tanzania.	Journal of Exposure Analysis and Environmental Epidemiology	11	4	335-9	Self-reported exposure			Cross-sectional	Chemical class	pesticide-related symptoms	self-reported	Tanzania	lic
112	A. Zober, G. Hoffmann, M. G. Ott, W. Will, C. Germann and B. van Ravenzwaay	Study of morbidity of personnel with potential exposure to vinclozolin	1995	OBJECTIVES: To examine internal exposure and targeted health outcomes of employees exposed to 3-(3,5-dichlorophenyl)-5-methyl-5-vinyl-1,3-oxazolidine-2,4-dione; chemical abstracts service (CAS) number: 50471-44-8 (vinclozolin). METHODS: A cross sectional study of 67 men exposed to vinclozolin for one to 13 years during synthesis and formulation operations and 52 controls. Biomonitoring was based on determination of urinary metabolites that contained a 3,5-dichloroaniline (3,5-DCA) moiety. Targeted health endpoints were the same as in previous subchronic and chronic animal studies--namely, reversible changes in the concentrations of hormones of the adrenocorticotrophic and gonadotrophic feedback systems, signs of liver injury, haemolytic anaemia, cataract formation (uniquely in rats), and hormonally induced hyperplasia and tumours at high doses. The clinical investigation consisted of a medical and occupational history questionnaire, physical examination, laboratory determinations (including testosterone, LH, and FSH measurements), ultrasonography of the liver and prostate, a detailed eye examination, and routine spirometry. RESULTS: The mean 3,5-DCA concentration for two thirds of the study group exceeded an equivalent of the vinclozolin acceptable daily intake (ADI) used for consumer regulatory purposes. Even the highest concentrations were, however, at least 10 times below the no observable adverse effect level (NOAEL) based on animal studies. Analysis of physical examination and laboratory data provided no evidence of hormonal responses induced by vinclozolin. Furthermore, no evidence of liver injury, prostate changes, cataract formation, or haemolytic anaemia was found. CONCLUSION: There was no evidence of any health effects induced by vinclozolin among employees with potential long term exposure. In particular, no antiandrogenic effects were found.	Occupational & Environmental Medicine	52	4	233-41	Biomonitoring (urine)			Cross-sectional	Specific active ingredient	morbidity	medical test result	Germany	hic
113	Abadi-Korek, B. Stark, R. Zaizov and J. Shaham	Parental occupational exposure and the risk of acute lymphoblastic leukemia in offspring in Israel	2006	OBJECTIVE: Parental employment in occupations that have potential exposures to organic solvents or pesticides could be associated with the risk of childhood acute lymphoblastic leukemia (ALL) in their offspring. METHODS: We explored this hypothesis by studying the association with respect to exposure time windows. Our case-control study included 224 children, 112 diagnosed with ALL and 112 matched controls. RESULTS: A significantly higher odds ratio (OR) was found between childhood ALL and reported parental occupational exposures. Analysis of exposures of both parents by exposure time windows revealed significant OR during the preconception and postnatal periods separately. CONCLUSIONS: The results provide support to the association between parental occupational exposures and ALL in their children. These results should be interpreted cautiously because of the small numbers, biases characterizing case-control studies, and the use of hospital-based controls.	Journal of Occupational & Environmental Medicine	48	2	165-74	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Israel	hic
114	B. B. D. DeBeer, D.; Meyer, E. C.; Kimbrel, N. A.; Gulliver, S. B.; Morissette, S. B.	The Association Between Toxic Exposures and Chronic Multisymptom Illness in Veterans of the Wars of Iraq and Afghanistan	2017	OBJECTIVE: The purpose of this study was to determine if post-9/11 veterans deployed to the Iraq and Afghanistan conflicts experienced toxic exposures and whether they are related to symptoms of chronic multisymptom illness (CMI). METHODS: Data from 224 post-9/11 veterans who self-reported exposure to hazards in theater were analyzed using hierarchical regression. RESULTS: Of the sample, 97.2% endorsed experiencing one or more potentially toxic exposure. In a regression model, toxic exposures and CMI symptoms were significantly associated above and beyond covariates. Follow-up analyses revealed that pesticide exposures, but not smoke inhalation was associated with CMI symptoms. CONCLUSIONS: These findings suggest that toxic exposures were common among military personnel deployed to the most recent conflicts, and appear to be associated with CMI symptoms. Additional research on the impact of toxic exposures on returning Iraq and Afghanistan Veterans' health is needed.	Journal of Occupational & Environmental Medicine	59	1	54-60	Self-reported exposure			Cohort (prospective)	Pesticides in general	other	other	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
115	B. Bazylewicz-Walczak, W. Majczakowa and M. Szymczak	Behavioral effects of occupational exposure to organophosphorous pesticides in female greenhouse planting workers	1999	51 women employed in gardening enterprises were studied. Of these, 26 performed planting jobs in greenhouses and were occupationally exposed to several organophosphates. The comparison group consisted of 25 women not exposed to neurotoxic chemicals. The groups were similar in terms of age, education, place of habitation, and intake of stimulants and drugs. Exposure determinations were performed during the period when pesticides were intensively used in the greenhouses (March-June). Exposure measurements included air pollution, contamination of skin and clothes, and work timing. The level of total exposure in the planting worker group was low. Psychological examinations were conducted twice: before and after the spraying season, and the Neurobehavioral Core Test Battery recommended by the WHO was administered to all subjects. The results of the psychological tests did not reveal effects of exposure after a single spraying season. Analysis of the results, however, indicated differences between the exposed and control groups on both occasions. The exposed female workers were characterized by longer reaction times and reduced motor steadiness compared to the unexposed workers. In addition, increased tension, greater depression and fatigue, more frequent symptoms of CNS disturbances were observed in the exposed women compared to the controls.	Neurotoxicology	20	5	819-26	Biomonitoring (dermal)	Environmental air monitoring		NA	Chemical class	NA	NA	NA	NA
116	B. C. Chiu, B. J. Dave, A. Blair, S. M. Gapstur, S. H. Zahm and D. D. Weisenburger	Agricultural pesticide use and risk of t(14;18)-defined subtypes of non-Hodgkin lymphoma	2006	Pesticides have been specifically associated with the t(14;18)(q32;q21) chromosomal translocation. To investigate whether the association between pesticides and risk of non-Hodgkin lymphoma (NHL) differs for molecular subtypes of NHL defined by t(14; 18) status, we obtained 175 tumor blocks from case subjects in a population-based case-control study conducted in Nebraska between 1983 and 1986. The t(14;18) was determined by interphase fluorescence in situ hybridization in 172 of 175 tumor blocks. We compared exposures to insecticides, herbicides, fungicides, and fumigants in 65 t(14;18)-positive and 107 t(14;18)-negative case subjects with those among 1432 control subjects. Multivariate polytomous logistic regression was used to calculate odds ratios (ORs) and 95% confidence intervals (CIs). Compared with farmers who never used pesticides, the risk of t(14;18)-positive NHL was significantly elevated among farmers who used animal insecticides (OR = 2.6; 95% CI, 1.0-6.9), crop insecticides (OR = 3.0; 95% CI, 1.1-8.2), herbicides (OR = 2.9; 95% CI, 1.1-7.9), and fumigants (OR = 5.0; 95% CI, 1.7-14.5). None of these pesticides were associated with t(14;18)-negative NHL. The risk of t(14;18)-positive NHL associated with insecticides and herbicides increased with longer duration of use. We conclude that insecticides, herbicides, and fumigants were associated with risk of t(14;18)-positive NHL but not t(14;18)-negative NHL. These results suggest that defining subsets of NHL according to t(14;18) status is a useful approach for etiologic research.	Blood	108	4	1363-9	Biomonitoring (blood)			Case-control	Chemical class	cancer	doctor-diagnosed	USA	hic
117	B. C. Chiu, D. D. Weisenburger, S. H. Zahm, K. P. Cantor, S. M. Gapstur, F. Holmes, L. F. Burmeister and A. Blair	Agricultural pesticide use, familial cancer, and risk of non-Hodgkin lymphoma	2004	To investigate whether the association between agricultural pesticide use and the risk of non-Hodgkin's lymphoma (NHL) is modified by a family history of hematopoietic cancer, including leukemia, myeloma, and lymphoma, we analyzed pooled data on white men from three population-based, case-control studies of NHL conducted in Iowa/Minnesota, Kansas, and Nebraska. Information on the agricultural use of insecticides, fungicides, and herbicides; a family history of cancer; and other risk factors was obtained by interviewing 973 cases and 2,853 controls or, if deceased, their next-of-kin (37% of cases, 43% of controls). The NHL risk was estimated by odds ratios (ORs) and 95% confidence intervals (CIs), adjusted for age, state of residence, type of respondent, and use of hair dye. Compared to men with no family history of cancer, the ORs (95% CIs) of NHL was 1.5 (1.3-1.8) for men with a family history of nonhematopoietic cancer, and 2.7 (1.9-3.7) for those with a history of hematopoietic cancer among first-degree relatives. This positive association was noted for each group of NHL defined according to the Working Formulation, and was most pronounced for small lymphocytic NHL. Among direct respondents, farmers who used pesticides and had a positive family history of cancer or hematopoietic cancer were not at elevated risk of NHL, compared to nonfarmers who had no family cancer history. However, among proxy respondents, ORs were elevated for farmers who had a positive family history of hematopoietic cancer and used animal insecticides (OR = 4.6; 1.9-11.2), crop insecticides (OR = 4.7; 1.6-13.4), or herbicides (OR = 4.9; 1.7-14.2), although the interaction of family history of cancer and agricultural pesticide use was not statistically significant. In summary, the joint effects of the family cancer history and pesticide use were limited to proxy respondents with wide CIs and, thus, provide little evidence that a family history of cancer modifies the association of agricultural exposures with NHL.	Cancer Epidemiology, Biomarkers & Prevention	13	4	525-31	Self-reported exposure			Case-control	Type of pesticide	cancer	doctor-diagnosed	USA	hic
118	B. Dinham	Prolonged exposure to some agricultural pesticides may increase the risk of lung cancer in agricultural workers	2005	Question: Does exposure to agricultural pesticides increase the risk of lung cancer? Study design: Cohort study Main results: Four of the most commonly used agricultural pesticides (diazinon, dieldrin, metalochlor and pendimethalin) significantly increased the risk of lung cancer in people with the greatest exposure, compared with people who had no exposure (see results table). Three other commonly used pesticides (carbofuran, chlorpyrifos, and dicamba) also increased the risk of lung cancer, but the results were not statistically significant (see results table).There were insufficient numbers of spouses with lung cancer who were directly exposed to specific pesticides to calculate any associated risk. Authors' conclusions: Prolonged exposure to the most commonly used agricultural pesticides increased the risk of lung cancer in farmers and commercial pesticide users. However, this increased risk was only significant for prolonged exposure to diazinon, dieldrin, metalochlor and pendimethalin. It is important to note that the participants in this study were exposed to higher levels for longer periods than the general population, due to their professional, agricultural use of insecticides and herbicides. <U+00AC><U+00A9> 2005 Elsevier Ltd. All rights reserved.	Evidence-Based Healthcare and Public Health	9	3	203-205	Self-reported exposure			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
119	B. F. Lander, L. E. Knudsen, M. O. Gamborg, H. Jarventaus and H. Norppa	Chromosome aberrations in pesticide-exposed greenhouse workers	2000	OBJECTIVES: The aim of this study was to investigate the possibility of subtoxic exposure to pesticides causing chromosome aberrations in greenhouse workers. METHODS: In a cross-sectional and prospective study design chromosome aberration frequencies in cultured lymphocytes were examined for 116 greenhouse workers exposed to a complex mixture of almost 50 insecticides, fungicides, and growth regulators and also for 29 nonsmoking, nonpesticide-exposed referents. RESULTS: The preseason frequencies of chromosome aberrations were slightly but not statistically significantly elevated for the greenhouse workers when they were compared with the referents. After a summer season of pesticide spraying in the greenhouses, the total frequencies of cells with chromosome aberrations were significantly higher than in the preseason samples (P=0.02) and also higher than for the referents (P=0.05). This finding was especially due to an increased number of cells with chromatid gaps between the first and second samples (P=0.001). The results may reflect an additive genotoxic effect of the spraying season, for which the use of insecticides and growth regulators (but not fungicides) culminates. The highest elevation in the risk of chromatid gaps was observed for persons who did not use gloves during re-entry activities such as nipping, cutting, pricking, and potting (risk ratio 2.88, 95% confidence interval 1.63-5.11). CONCLUSIONS: The present results suggest a genotoxic effect from a complex subtoxic occupational pesticide exposure. In general, the findings indicate the importance of personal protection, during high-exposure re-entry activities, in preventing pesticide uptake and genetic damage.	Scandinavian Journal of Work, Environment & Health	26	5	436-42	Job title			Cohort (prospective)	Job title	genetic (biomarkers)	medical test result	Denmark	hic
120	B. Janzen, C. Karunanayake, D. Rennie, W. Pickett, J. Lawson, S. Kirychuk, L. Hagel, A. Senthilselvan, N. Koehncke, J. Dosman, P. Pahwa and T. Saskatchewan Rural Health Study	Gender Differences in the Association of Individual and Contextual Exposures with Lung Function in a Rural Canadian Population	2017	INTRODUCTION: To investigate the association of individual and contextual exposures with lung function by gender in rural-dwelling Canadians. METHODS: A cross-sectional mail survey obtained completed questionnaires on exposures from 8263 individuals; a sub-sample of 1609 individuals (762 men, 847 women) additionally participated in clinical lung function testing. The three dependent variables were forced expired volume in one second (FEV₁), forced vital capacity (FVC), and FEV₁/FVC ratio. Independent variables included smoking, waist circumference, body mass index, indoor household exposures (secondhand smoke, dampness, mold, musty odor), occupational exposures (grain dust, pesticides, livestock, farm residence), and socioeconomic status. The primary analysis was multiple linear regression, conducted separately for each outcome. The potential modifying influence of gender was tested in multivariable models using product terms between gender and each independent variable. RESULTS: High-risk waist circumference was related to reduced FVC and FEV₁ for both genders, but the effect was more pronounced in men. Greater pack-years smoking was associated with lower lung function values. Exposure to household smoke was related to reduced FEV₁, and exposure to livestock, with increased FEV₁. Lower income adequacy was associated with reduced FVC and FEV₁. CONCLUSION: High-risk waist circumference was more strongly associated with reduced lung function in men than women. Longitudinal research combined with rigorous exposure assessment is needed to clarify how sex and gender interact to impact lung function in rural populations.	Lung	195	1	43-52	Self-reported exposure			Cross-sectional	Pesticides in general	respiratory	medical test result	Canada	hic
121	B. Kocic, S. Jankovic, J. Marinkovic, S. Filipovic and B. Petrovic	Case-control study of breast cancer risk factors	1999	Purpose: In view of the geographical differences in the incidence of breast cancer, this study was undertaken to assess the association of hypothesized risk factors with the occurrence of this malignancy in Serbia. Materials and methods: This case-control study comprised 106 female patients with histologically verified breast cancer and 106 hospital controls matched with respect to age (<U+00AC><U+00B1> 3 years). The study used a targetted and detailed questionnaire to obtain information from respondents. Results: Conditional logistic regression analysis indicated that 13 variables were significantly related to the disease: vegetable fat consumption odds ratio (OR) = 0.14, 95% confidence interval (CI) = 0.01-0.36; oophoritis (OR = 10.40, 95% CI = 3.02-35.80); alcohol consumption (OR = 12.84, 95% CI = 2.99-55.03); late age at first birth (OR = 1.37, 95% CI = 1.15-1.64); mastitis (OR = 13.88, 95% CI = 2.93-65.69); frequent bread consumption (OR = 70.89, 95% CI = 4.84-1003.35); stressful life events (OR = 7.83, 95% CI = 1.84-33.29); malignancies (except breast cancer) in second degree relatives (OR = 4.88, 95% CI = 1.48-16.09); body mass index (OR = 1.19, 95% CI = 1.04-1.37); butter consumption (OR = 7.25, 95% CI = 1.22-42.94); occupational exposure to organic dust (OR = 7.47, 95% CI = 1.18-47.21); occupational exposure to pesticides (OR = 10.45, 95% CI = 1.06-102.73) and endometrial tumors (OR = 11.17, 95% CI = 0.78-159.41). Conclusion: The results of our study confirmed that the etiology of breast cancer in Serbia, as elsewhere, is complex and far from being completely solved. There is a need for further elucidation of the role of risk factors and particularly the protective action of vegetable fats.	Journal of B.U.ON.	4	4	399-403	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Serbia	umic
122	B. Konieczny, S. Kossmann and M. Makuch	Impaired respiratory muscle function in chemical plant workers producing chlorfenvinphos	1999	All employees of a chemical plant division producing chlorfenvinphos were studied, i.e. 35 males aged 25-57 years (mean 42.1); their employment period ranged from 1-15 years (mean 9.0). Chronic bronchitis was diagnosed in 13 workers (37.1%). Mean air chlorfenvinphos concentrations in the work environment estimated with gas-liquid chromatography were from 0.0008-0.0018 mg/m3 (maximum allowable concentration according to Polish standards is 0. 01 mg/m3). The activity of erythrocyte acetylcholinesterase was similar to that observed in people who were not exposed to chemicals, however, a slightly lowered activity of plasma cholinesterase in the studied population was evidently the result of mild liver impairment. Spirometric investigations performed in the studied workers revealed slight alterations manifested by increased intrathoracic gas volume (ITGV) (the value of the index was 138.6% of the mean value, 24 workers with an abnormally high index), as well as by decreased specific airway conductance (sGaw); its mean value in the studied group was 58.5% of the mean standard (11 people showed an abnormal index). Substantial functional changes were found in the respiratory muscles. Maximal inspiratory pressures (MIP = 97. 2 +/- 28.3 cm H2O) as well as maximal expiratory pressures (MEP = 113.9 +/- 44.2 cm H2O) in the studied group were significantly lower (p < 0.01) as compared to those observed in the control group (MIP = 120.7 +/- 31.7; MEP = 154.4 +/- 40.2 cm H2O) of 22 males having similar cigarette smoking habit, without occupational exposure to chemicals. It was also found that the people who had worked for more than 10 years under conditions of exposure to chlorfenvinphos showed significantly lower (p < 0.05) values of maximal inspiratory pressure (87.2 +/- 28.06 cm H2O, n = 17) compared to the workers whose period of employment was shorter than 10 years (106.6 +/- 26.8 cm H2O, n = 18). The two groups were comparable with regard to age and smoking habits. The values of maximal expiratory pressures were similar in both groups. No essential disturbances in neuro-muscular transmission were observed; only in 3 workers (8.5%) the electrostimulating myasthenic test showed some disturbances in neuro-muscular transmission. It seems that respiratory muscles impairment in humans exposed to chlorfenvinphos results from changes in the metabolism and structure of muscles, and partly from lung hyperinflation.	Annals of Agricultural & Environmental Medicine	6	1	43241	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	respiratory	medical test result	Poland	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
123	B. L. Waddell, S. H. Zahm, D. Baris, D. D. Weisenburger, F. Holmes, L. F. Burmeister, K. P. Cantor and A. Blair	Agricultural use of organophosphate pesticides and the risk of non-Hodgkin's lymphoma among male farmers (United States)	2001	OBJECTIVE: Data from three population-based case-control studies conducted in Kansas, Nebraska, Iowa, and Minnesota were pooled to evaluate the relationship between the use of organophosphate pesticides and non-Hodgkin's lymphoma (NHL) among white male farmers. METHODS: The data set included 748 cases of non-Hodgkin's lymphoma and 2236 population-based controls. Telephone or in-person interviews were utilized to obtain information on the use of pesticides. Odds ratios (OR) adjusted for age, state of residence, and respondent status, as well as other pesticide use where appropriate, were estimated by logistic regression. RESULTS: Use of organophosphate pesticides was associated with a statistically significant 50% increased risk of NHL, but direct interviews showed a significantly lower risk (OR = 1.2) than proxy interviews (OR = 3.0). Among direct interviews the risk of small lymphocytic lymphoma increased with diazinon use (OR = 2.8), after adjustment for other pesticide exposures. CONCLUSIONS: Although we found associations between the risk of NHL and several groupings and specific organophosphate pesticides, larger risks from proxy respondents complicate interpretation. Associations, however, between reported use of diazinon and NHL, particularly diffuse and small lymphocytic lymphoma, among subjects providing direct interviews are not easily discounted.	Cancer Causes & Control	12	6	509-17	Self-reported exposure			Case-control	Chemical class	cancer	doctor-diagnosed	USA	hic
124	B. M. Blatter, N. Roeleveld, G. A. Zielhuis, F. J. Gabreels and A. L. Verbeek	Maternal occupational exposure during pregnancy and the risk of spina bifida	1996	OBJECTIVES: A case-control study was carried out to explore associations between spina bifida and occupational exposure of the mother. METHODS: The cases were children with spina bifida aperta born between 1980 and 1992 from nine hospitals in the Netherlands. The controls were children born healthy in the same period as the cases, from hospitals and from the general population. Data collection was carried out in two steps. Firstly, postal questionnaires were sent to all the parents of cases and controls to gather information on occupations and potential confounders. In the second phase of the study, information on specific exposures was collected by means of job and task specific personal interviews. Interviews were performed with 55 case mothers and 66 control mothers who had occupations with a potential for chemical or physical exposure. Those exposures were assumed to be negligible for--for example, teachers and secretaries, so personal interviews were not indicated for these women. Information was collected on specific tasks in the period just after conception, and on the associated use of chemical or physical agents, frequency of exposure, and use of protective equipment. RESULTS: The analyses of occupation showed an increased risk for women working in agricultural occupations (OR = 3.4, CI:1.3-9.0), and, although less distinct, for cleaning women (OR = 1.7, CI:0.9-3.4). Only a few women seemed to be occupationally exposed to chemical or physical agents. No differences in occurrence of specific exposures could be detected between cases and controls. Besides, no differences were seen in pesticide or disinfectant exposure among case and control mothers in agricultural occupations. CONCLUSIONS: Occupational exposures of the mother during pregnancy were infrequent and did not seem to play an important part in the aetiology of spina bifida in this study. The association found between spina bifida and maternal agricultural occupations could not be explained by the use of pesticides by the mother or by any other occupational exposure.	Occupational & Environmental Medicine	53	2	29373	Self-reported exposure	Self-reported job history		Case-control	Pesticides in general	offspring	doctor-diagnosed	Netherlands	hic
125	B. M. Blatter, R. Hermens, M. Bakker, N. Roeleveld, A. L. Verbeek and G. A. Zielhuis	Paternal occupational exposure around conception and spina bifida in offspring	1997	A multi-center case-referent study was conducted on the relation between paternal occupational exposure and spina bifida in offspring. Cases were born between 1980 and 1992 in The Netherlands. Referents were recruited from hospitals and from the general population. Postal questionnaires were used to gather information on occupation and potential confounders. Through job-specific telephone interviews with 122 case fathers and 411 referent fathers, detailed exposure information was collected on specific tasks, the use of chemical or physical agents, frequency of exposure, and use of protective equipment. The study yielded statistically significant associations between spina bifida and low exposure to welding fumes (OR = 1.6, 95% CI: 1.0-2.6) and low exposure to UV radiation during welding (OR = 2.6, 95% CI: 1.2-5.6), and suggestive findings of an association between spina bifida and moderate or high exposure to cleaning agents, moderate or high pesticide exposure (OR = 1.7, 95% CI: 0.7-4.0), and stainless steel dust (OR = 2.0, 95% CI: 0.8-5.2). No associations were identified for other paternal occupational exposures, such as organic solvents.	American Journal of Industrial Medicine	32	3	283-91	Self-reported job history	Expert case-by-case assessment		Case-control	Job title	offspring	doctor-diagnosed	Netherlands	hic
126	B. M. Qaqish, O. Al-Dalahmah, Y. Al-Motassem, A. Battah and S. S. Ismail	Occupational exposure to pesticides and occurrence of the chromosomal translocation t(14;18) among farmers in Jordan	2016	Background: An increased incidence of non-Hodgkin's lymphoma (NHL) has been reported in farmers and other occupational groups working with pesticides. In these individuals, an increased prevalence of the chromosomal translocation t(14;18)(q32;q21), one of the most common chromosomal abnormalities in NHL, has been detected in peripheral blood lymphocytes. This translocation juxtaposes the antiapoptotic BCL2 protein to the immunoglobulin heavy chain gene locus (IGH) leading to overexpression of BCL2. This causes an increase in cell survival, paving the way for malignant transformation. Aim of the study: The present study aimed to evaluate the association between the occurrence of the chromosomal translocation t(14;18) and occupational exposure to pesticides among a group of Jordanian farmers. Methods: A total of 192 male subjects including 96 agricultural workers and 96 control subjects participated in this study. BCL2-IGH t(14;18) fusions were detected by a nested polymerase chain reaction (PCR) assay targeting the major breakpoint region (MBR). Results: We found that occupational exposure to pesticides in open-field farming and insecticide used on animals increased the frequency of the chromosomal translocation t(14;18). Farmers occupationally exposed to pesticides and insecticide were 13.5 times more likely to harbor t(14;18). 63.5% (61 of 96) of farmers compared to 11.5% (11 of 96) of controls carried the translocation (odds ratio: 13.5; 95% confidence interval (CI). =. 6.3-28.6). We ruled out the influence of possible confounding factors such as age, duration of sun exposure, alcohol intake, smoking, and use of personal protective equipment. Conclusion: Our results indicate that pesticides increased the frequency of chromosomal translocation in the 14q32 region. Accordingly, the presented data agrees with previous suggestions from the literature that pesticides might be involved in the development of NHL through the t(14;18) pathway.	Toxicology Reports	3	NA	225-229	Self-reported exposure			Cross-sectional	Type of pesticide	genetic (biomarkers)	medical test result	Jordan	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
127	B. Mester, A. Nieters, E. Deeg, G. Elsner, N. Becker and A. Seidler	Occupation and malignant lymphoma: a population based case control study in Germany	2006	AIMS: To identify occupations suspected to be associated with malignant lymphoma and to generate new hypotheses about occupational risks in a multicentre, population based case control study. METHODS: Male and female patients with malignant lymphoma (n = 710) aged 18-80 years of age were prospectively recruited in six study regions in Germany. For each newly recruited lymphoma case, a sex, region, and age matched control was drawn from the population registers. Odds ratios and 95% confidence intervals for major occupations and industries were calculated using conditional logistic regression analysis, adjusted for smoking (in pack-years) and alcohol consumption. Patients with specific lymphoma subentities were additionally compared with the entire control group using unconditional logistic regression analysis. RESULTS: The following economic/industrial sectors were positively associated with lymphoma: food products, beverages, tobacco; paper products, publishing and printing; and metals. Chemicals; real estate, renting, and business activities were negatively associated with lymphoma diagnosis. The authors observed an increased overall lymphoma risk among architects; maids; farmers; glass formers; and construction workers. Shoemaking and leather goods making was negatively associated with the lymphoma diagnosis (although based on small numbers). In the occupational group analysis of lymphoma subentities, Hodgkin's lymphoma was significantly associated only with rubber and plastic products making; diffuse large B cell lymphoma risk was considerably increased among metal processors; follicular lymphoma showed highly significant risk increases for several occupational groups (medical, dental, and veterinary workers; sales workers; machinery fitters; and electrical fitters); and multiple myeloma showed a particularly pronounced risk increase for farmers as well as for agriculture and animal husbandry workers. CONCLUSIONS: The results partly confirm previously defined occupational risks. Occupational risk factors for follicular lymphomas might differ from the overall risk factors for malignant lymphoma.	Occupational & Environmental Medicine	63	1	17-26	Self-reported job history			Case-control	Job title	cancer	doctor-diagnosed	Germany	hic
128	B. Negatu, H. Kromhout, Y. Mekonnen and R. Vermeulen	Occupational pesticide exposure and respiratory health: A large-scale cross-sectional study in three commercial farming systems in Ethiopia	2017	Rationale: In the last decade, due to expansion of greenhouses and irrigated farms, the use of pesticides in Ethiopia has increased 6-13-fold leading to potential health risks. Objective: To investigate if occupational exposure to pesticides is associated with respiratory health effects in farmers and farm workers from commercial farming systems. Methods: We performed two cross-sectional surveys comprising different farming systems. In the first survey we studied respiratory symptoms among 1104 subjects of which 601 were occupationally exposed to pesticides (ie, 256 pesticide applicators, 345 re-entry workers) and 503 unexposed individuals. The second survey, carried out 2 years later in the same farming regions, additionally included lung function measurement and comprised a total of 387 study subjects of which 206 were occupationally exposed to pesticides (142 applicators and 64 re-entry workers) and 180 unexposed individuals. Results: We observed increased risks for chronic cough and shortness of breath (OR=3.15, 95% CI 1.56 to 6.36 and OR=6.67, 95% CI 2.60 to 17.58) among the exposed subjects as compared with unexposed individuals in the first survey. These results were corroborated in the second survey where we also observed reductions in FEV1 (140 mL), forced expiratory flow 25%-75% (550 mL/s) and risk of FEV1/FVC ratio <0.8 (OR=4.31, 95% CI 2.11 to 8.81) among pesticide exposed workers. Conclusions These findings indicate an increased risk of adverse respiratory health among workers exposed to pesticides. As those effects occurred in young workers (mean age 27 years) and within a relative short duration of exposure (4 years) implementation of stringent occupational health measures are warranted.	Thorax	72	6	522-529	Algorithm/model			Cross-sectional	Pesticides in general	respiratory	medical test result	Ethiopia	lic
129	B. O. Baumert, C. L. Jackson and S. J. London	Pesticide exposure and sleep apnea in the agricultural lung health study	2017	Introduction: Carbamate and organophosphate pesticides inhibit acetylcholinesterase, leading to respiratory depression at high exposure. Thus, involvement in sleep apnea is plausible, but there are no studies at lower levels of exposure. Methods: To examine associations between pesticide exposure and sleep apnea, we analyzed data from 1,569 U.S. male pesticide applicators, mostly farmers, from an asthma case-control study nested within the prospective Agricultural Health Study. On questionnaires, participants reported use of specific pesticides and physician diagnosis plus prescribed treatments for sleep apnea. We used multivariable logistic regression to estimate the associations between ever-use of 63 pesticides and sleep apnea (234 cases, 1,335 non-cases). Results: Among 1,569 male pesticide applicators, the mean age was 63 years, 98% were white, and 5% were current smokers. As expected, sleep apnea cases had substantially higher mean BMI than non-cases (mean of 34.5 versus 29.7 kg/m2, respectively), and sleep apnea was more common among current asthma cases than noncases (prevalence 23.5% versus 10.8%, adjusted Odds Ratio (OR) = 2.47 [95% Confidence Interval (CI): 1.87-3.27]). The following numbers of sleep apnea cases reported use of each of the queried treatments: CPAP (n=215, 91.9%), <U+201A><U+00C4><U+00FA>surgery<U+201A><U+00C4><U+00F9> (n=16, 6.8%), <U+201A><U+00C4><U+00FA>bi-level<U+201A><U+00C4><U+00F9> (n=23, 9.8%), other oral device (n=22, 9.4%). Among 63 tested pesticides, four were associated with sleep apnea at P<0.05: two positively and two inversely. The most notable association was for carbofuran, a carbamate (100 exposed cases, OR= 1.83, 95% CI 1.34-2.51, P= 0.0002). Carbofuran use began before reported onset of sleep apnea in all cases and the P value for trend across increasing lifetime days of use was 0.003. Conclusion: In a farming population, exposure to carbofuran was positively associated with sleep apnea. This result adds to the known adverse health outcomes of exposure to carbofuran, a pesticide cancelled in the US in 2009 for use in production of foods for human consumption although still used for this purpose in other countries.	Sleep	40	NA	A173	Self-reported exposure			Case-control	Pesticides in general	circulatory	self-reported	USA	hic
130	B. P. Mishra, Z. G. Badade and S. K. Rastogi	Free radical and antioxidant status among organophosphate pesticide exposed sprayers	2012	Objective To study the antioxidant status and the extent of oxidative stress in organophosphate pesticide exposed sprayers. Material and Methods The study was conducted in 50 organophosphate pesticide (OP) poisoned sprayers. Superoxide dimutase (SOD), catalase (CAT) and malondialdehyde(MDA) were estimated as an index of antioxidant status and oxidative stress respectively and comparisons were made in the levels of cholinesterases (AChE;BuChE) and glutathione(GSH) between healthy control subjects and OP poisoned sprayers. Results There were significantly fall in both blood AChE and BuChE in the pesticide exposed group as a result of multiple exposures to mixture of OP pesticides. Blood AChE and BuChE showed decrease of 18.4% and 18% respectively in the exposed group. Blood GSH levels, an antioxidant molecule was also found to be significantly lowered in the OP pesticide exposed group. The increase in lipid peroxidation as reflected by elevated levels of MDA in the pesticide exposed group indicates oxidative stress. Exposure to OP pesticide showed elevated RBC-SOD activity in this study, SOD effectively dismutases superoxide anion into hydrogen peroxide and O2. The RBC-CAT activity was also found to be elevated in the exposed workers in this study as a result of OP pesticide induced poisoning. The increased activity of CAT seen in the poisoning cases coupled with an increase in the blood lipid peroxidation level (MDA) suggests an insufficient antioxidant defense.	Indian Journal of Forensic Medicine and Toxicology	6	1	13-16	Job title			Case-control	Chemical class	genetic (biomarkers)	medical test result	India	lmic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
131	B. Persson and M. Fredrikson	Some risk factors for non-Hodgkin's lymphoma	1999	Non-Hodgkin's lymphoma (NHL) has been subject to several epidemiological studies and various occupational and non-occupational exposures have been identified as determinants. The present study is a pooled analysis of two earlier methodologically similar case-referent studies encompassing 199 cases of NHL and 479 referents, all alive. Exposure information, mainly on occupational agents, was obtained by mailed questionnaires to the subjects. Exposure to white spirits, thinner, and aviation gasoline as well as work as a painter was connected with increased odds ratios, whereas no increased risk was noted for benzene. Farming was associated with a decreased odds ratio and exposure to phenoxy herbicides, wood preservatives, and work as a lumberjack showed increased odds ratios. Moreover, exposure to plastic and rubber chemicals and also contact with some kinds of pets appeared with increased odds ratios. Office employment and housework showed decreased odds ratios. This study indicates the importance of investigating exposures not occurring very frequently in the general population. Solvents were studied as a group of compounds but were also separated into various specific compounds. The present findings suggest that the carcinogenic property of solvents is not only related to the aromatic ones or to the occurrence of benzene contamination, but also to other types of compounds.	International Journal of Occupational Medicine & Environmental Health	12	2	135-42	Self-reported exposure			Case-control	Chemical class	cancer	doctor-diagnosed	Sweden	hic
132	B. Persson, M. Fredriksson, K. Olsen, B. Boeryd and O. Axelson	Some occupational exposures as risk factors for malignant lymphomas	1993	BACKGROUND: Malignant lymphomas (Hodgkin disease [HD] and non-Hodgkin lymphoma [NHL]) have been subject to several epidemiologic studies and found to be associated with various environmental exposures, especially solvents, wood, and phenoxy herbicides. METHODS: Various determinants for HD and NHL were evaluated in a case-referent study encompassing 31 cases of HD, 93 cases of NHL, and 204 referents, all alive. Information on these determinants, mainly occupational exposures, was obtained by mailed questionnaires. RESULTS: Crude odds ratios were increased for various occupational exposures, i.e., exposures to solvents, pesticides, metal fumes, welding, and fresh wood, and nursing. Further analyses based on logistic regression indicated exposure to phenoxy herbicides and fresh wood among sawmill workers, lumberjacks, and paper pulp workers to be significant risk factors for HD. Welding, working as a lumberjack, nursing, and ex-smoking were associated with a significantly increased risk for NHL. Radiographic examinations were negatively associated with HD, as was office work for NHL. CONCLUSIONS: The results were mainly in agreement with the findings of earlier studies, but diverging associations also appeared.	Cancer	72	5	1773-8	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Sweden	hic
133	B. R. Ritz, A. D. Manthripragada, S. Costello, S. J. Lincoln, M. J. Farrer, M. Cockburn and J. Bronstein	Dopamine transporter genetic variants and pesticides in Parkinson's disease	2009	BACKGROUND: Research suggests that independent and joint effects of genetic variability in the dopamine transporter (DAT) locus and pesticides may influence Parkinson's disease (PD) risk. Materials: METHODS: In 324 incident PD patients and 334 population controls from our rural California case-control study, we genotyped rs2652510, rs2550956 (for the DAT 5' clades), and the 3' variable number of tandem repeats (VNTR). Using geographic information system methods, we determined residential exposure to agricultural maneb and paraquat applications. We also collected occupational pesticide use data. Employing logistic regression, we calculated odds ratios (ORs) for clade diplotypes, VNTR genotype, and number of susceptibility (A clade and 9-repeat) alleles and assessed susceptibility allele-pesticide interactions. RESULTS: PD risk was increased separately in DAT A clade diplotype carriers [AA vs. BB: OR = 1.66; 95% confidence interval (CI), 1.08-2.57] and 3' VNTR 9/9 carriers (9/9 vs. 10/10: OR = 1.8; 95% CI, 0.96-3.57), and our data suggest a gene dosing effect. Importantly, high exposure to paraquat and maneb in carriers of one susceptibility allele increased PD risk 3-fold (OR = 2.99; 95% CI, 0.88-10.2), and in carriers of two or more alleles more than 4-fold (OR = 4.53; 95% CI, 1.70-12.1). We obtained similar results for occupational pesticide measures. DISCUSSION: Using two independent pesticide measures, we a) replicated previously reported gene-environment interactions between DAT genetic variants and occupational pesticide exposure in men and b) overcame previous limitations of nonspecific pesticide measures and potential recall bias by employing state records and computer models to estimate residential pesticide exposure. CONCLUSION: Our results suggest that DAT genetic variability and pesticide exposure interact to increase PD risk.	Environmental Health Perspectives	117	6	964-9	Self-reported exposure	Expert case-by-case assessment		Case-control	Specific active ingredient	neurological	doctor-diagnosed	USA	hic
134	B. T. Ji, D. T. Silverman, P. A. Stewart, A. Blair, G. M. Swanson, D. Baris, R. S. Greenberg, R. B. Hayes, L. M. Brown, K. D. Lillemoe, J. B. Schoenberg, L. M. Pottern, A. G. Schwartz and R. N. Hoover	Occupational exposure to pesticides and pancreatic cancer.[Erratum appears in Am J Ind Med 2001 Aug;40(2):225-6]	2001	BACKGROUND: An increased risk of exposure to pesticides for pancreatic cancer has been suggested in a number of epidemiologic studies. METHODS: Cases (N = 484), aged 30-79 years, were diagnosed in 1986-1989. Controls (N = 2,095) were a random sample of the general population. Information on usual occupation and potential confounding factors was obtained. A job-exposure matrix (JEM) approach was used to estimate the level of occupational exposure to pesticides. RESULTS: A significant trend in risk with increasing exposure level of pesticides was observed, with ORs of 1.3 and 1.4 for low and moderate/high exposure levels, respectively. Excess risks were found for occupational exposure to fungicides (OR = 1.5) and herbicides (OR = 1.6) in the moderate/high level after adjustment for potential confounding factors. An increased risk for insecticide exposure was disappeared after adjustment for fungicide and herbicide exposures. Results of our occupation-based analysis were consistent with those from the JEM-based analysis. CONCLUSIONS: Our results suggest that pesticides may increase risk of pancreatic cancer, and indicate the need for investigations that can evaluate risk by specific chemical exposures. Published 2001 Wiley-Liss, Inc.	American Journal of Industrial Medicine	39	1	33848	Job exposure matrix			Case-control	Type of pesticide	cancer	doctor-diagnosed	USA	hic
135	B. van Wendel de Joode, C. Wesseling, H. Kromhout, P. Monge, M. Garcia and D. Mergler	Chronic nervous-system effects of long-term occupational exposure to DDT	2001	Dichlorodiphenyltrichloroethane (DDT) is a compound with moderate toxicity that is judged to be safe for occupational use, although little is known about its long-term effects on the human nervous system. We investigated chronic nervous-system effects of long-term occupational exposure to DDT by comparing the neurobehavioural performance of retired malaria-control workers with a reference group of retired guards and drivers. DDT-exposed workers did worse on tests assessing various neurobehavioural functions than controls; performance significantly deteriorated with increasing years of DDT application. Our results could not be explained by exposure to cholinesterase-inhibiting pesticides or other potential confounding factors.	Lancet	357	9261	1014-6	Self-reported exposure	Biomonitoring (blood)		Cross-sectional	Specific active ingredient	neurological	medical test result	NA	NA

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
136	B. W. Lee, L. London, J. Paulauskis, J. Myers and D. C. Christiani	Association between human paraoxonase gene polymorphism and chronic symptoms in pesticide-exposed workers	2003	Pesticides, such as parathion, are metabolized by cytochrome p-450 system to paraoxon, which is a potent cholinesterase inhibitor. Paraoxonase (PON) catalyzes the hydrolysis of these toxic metabolites and protects against pesticide toxicity. A glutamine/arginine (Gln/Arg) polymorphism at amino acid position 192 of PON has been described. The Arg/Arg genotype is associated with higher serum paraoxonase activity compared to Gln/Gln. The Arg/Gln genotype is associated with intermediate serum PON activity. The potential association between PON genotype and symptoms of chronic pesticide toxicity was examined among 100 farm workers. As part of a cross-sectional study of pesticide toxicity among mixed-race farm workers in the Western Cape. South Africa, 100 farm workers were genotyped for polymorphism of the paraoxonase gene at amino acid position 192. Subjects with two or more of the following symptoms were considered to have evidence of chronic toxicity: abdominal pain, nausea, rhinorrhea, dizziness, headache, somnolence, fatigue, gait disturbance, limb numbness, paresthesias, limb pain, or limb weakness. In multivariable logistic regression analysis, the independent predictors of chronic toxicity were previous history of head trauma resulting in loss of consciousness (OR 2.8, 95% CI = 1.7-6.7), having worked as a pesticide applicator (OR 5.4, 95% CI = 3.2-8.9), and having one of the two "slow metabolism" (Gln/Gln or Gln/Arg) genotypes (OR 2.9, 95% CI = 1.7-6.9). Furthermore, the prevalence of chronic toxicity increased in a stepwise fashion from 15% among pesticide nonapplicators with a "fast metabolism" (Arg/Arg) genotype, to 42.9% among pesticide nonapplicators with "slow metabolism" (Gln/Gln or Gln/Arg) genotypes, to 58.8% among pesticide applicators with "fast metabolism" genotype, and 75.0% among pesticide applicators with "slow metabolism" genotypes (P = 0.001). Age, number of years on the job, smoking history, alcohol history, education level, plasma or red blood cell cholinesterase level, or previous history of acute organophosphate poisoning were not statistically significant predictors of chronic toxicity. The PON genotype is an important determinant of a farmworker's susceptibility to chronic pesticide poisoning.	Journal of Occupational & Environmental Medicine	45	2	118-22	Job title			Cross-sectional	Job title	pesticide-related symptoms	self-reported	South Africa	umic
137	B. Wieseler, K. Kuhn, G. Leng and H. Idel	Effects of pyrethroid insecticides on pest control operators	1998	NA	Bulletin of Environmental Contamination & Toxicology	60	6	837-44	Biomonitoring (urine)			Cross-sectional	Chemical class	pesticide-related symptoms	self-reported	Germany	hic
138	C. A. A. E.-E. Ellison, S. S.; Tawfik, M.; Lein, P. J.; Olson, J. R.	Allele and genotype frequencies of CYP2B6 and CYP2C19 polymorphisms in Egyptian agricultural workers	2012	Genetic variability in cytochrome P-450 (CYP) has the potential to modify pharmacological and toxicological responses to many chemicals. Both CYP2B6 and CYP2C19 are pharmacologically and toxicologically relevant due to their ability to metabolize multiple drugs and environmental contaminants, including the organophosphorus (OP) pesticide chlorpyrifos. The aim of this study was to determine the prevalence of CYP2B6 and CYP2C19 variants in an indigenous Egyptian population (n = 120) that was shown to be occupationally exposed to chlorpyrifos. Further, the genotyping data was compared for Egyptians with previously studied populations to determine between population differences. Allelic frequencies were CYP2B6 1459C > T (3.8%), CYP2B6 785A > G (30.4%), CYP2B6 516G > T (28.8%), CYP2C19 681G > A (3.8%), and CYP2C19 431G > A (0%). The most prevalent CYP2B6 genotype combinations were CYP2B6 *1/*1 (44%), *1/*6 (38%), *6/*6 (8%), and *1/*5 (6%). The frequency of the CYP2C19 genotype combinations were CYP2C19 *1/*1 (93%), *1/*2 (6%), and *2/*2 (1%). The frequency of the CYP2B6 516G > T and CYP2B6 785A > G polymorphisms in this Egyptian cohort is similar to that found North American and European populations but significantly different from that reported for West African populations, while that of CYP2B6 1459C > T is similar to that found in Africans and African Americans. The observed frequency of CYP2C19 681G > A in Egyptians is similar to that of African pygmies but significantly different from other world populations, while CYP2C19 431G > A was significantly different from that of African pygmies but similar to other world populations.	Journal of Toxicology & Environmental Health Part A	75	4	232-41	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	genetic (biomarkers)	medical test result	Egypt	lmic
139	C. A. R. Snijder, N.; Te Velde, E.; Steegers, E. A.; Raat, H.; Hofman, A.; Jaddoe, V. W.; Burdorf, A.	Occupational exposure to chemicals and fetal growth: the Generation R Study	2012	BACKGROUND: Developmental diseases, such as birth defects, growth restriction and preterm delivery, account for >25% of infant mortality and morbidity. Several studies have shown that exposure to chemicals during pregnancy is associated with adverse birth outcomes. The aim of this study was to identify whether occupational exposure to various chemicals might adversely influence intrauterine growth patterns and placental weight. METHODS: Associations between maternal occupational exposure to various chemicals and fetal growth were studied in 4680 pregnant women participating in a population-based prospective cohort study from early pregnancy onwards in the Netherlands (2002-2006), the Generation R Study. Mothers who filled out a questionnaire during mid-pregnancy (response: 77% of enrolment) were included if they conducted paid employment during pregnancy and had a spontaneously conceived singleton live born pregnancy (n = 4680). A job exposure matrix was used, linking job titles to expert judgement on exposure to chemicals in the workplace. Fetal growth characteristics were repeatedly measured by ultrasound and were used in combination with measurements at birth. Placental weight was obtained from medical records and hospital registries. Linear regression models for repeated measurements were used to study the associations between maternal occupational exposure to chemicals and intrauterine growth. RESULTS: We observed that maternal occupational exposure to polycyclic aromatic hydrocarbons, phthalates, alkylphenolic compounds and pesticides adversely influenced several domains of fetal growth (fetal weight, fetal head circumference and fetal length). We found a significant association between pesticide and phthalate exposure with a decreased placental weight. CONCLUSIONS: Our results suggest that maternal occupational exposure to several chemicals is associated with impaired fetal growth during pregnancy and a decreased placental weight. Further studies are needed to confirm these findings and to assess post-natal consequences.	Human Reproduction	27	3	910-20	Job exposure matrix			Cohort (prospective)	Pesticides in general	reproductive	medical test result	Netherlands	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
140	C. A. Wesseling, A.; Antich, D.; Rodriguez, A. C.; Castro, R.	Cancer in banana plantation workers in Costa Rica	1996	BACKGROUND: Costa Rica has population and disease registries with potential value for epidemiological research. Pesticides have been intensively used on banana plantations, for example dibromochloropropane (DBCP). This study was planned to examine the quality of the cancer and civil registries and the feasibility of record linkages, and to explore cancer patterns among a highly exposed group. METHODS: A retrospective cohort study was carried out. Workers on the payrolls of banana companies, as reported to the Social Security System at any time between 1972 and 1979, were followed up in the cancer registry between 1981 and 1992: 29 565 men and 4892 women for 407 468 person-years. The observed cases of cancer were compared to the expected values, derived from the national incidence rates. RESULTS: We identified 368 cancer cases, 292 among men (standardized incidence ratio [SIR] = 76, 95% confidence interval [CI] 67-84) and 76 among women (SIR = 116, 95% CI: 90-142). Among men increased SIR were observed for melanoma (SIR = 197, 95% CI: 94-362) and penile cancer (SIR = 149, 95% CI: 55-324); among women for cervix cancer (SIR = 182, 95% CI: 122-241) and leukaemia (SIR = 274, 95% CI: 86-639). Risk estimates for lung cancer were evaluated among male workers with the longest time of employment. CONCLUSIONS: Follow-up was difficult due to deficient identification variables in the cancer registry and to easier identification of the living compared to the decreased in the civil registry at the end of the observation period. The various systematic errors in this study are likely to produce an underestimation of the relative risk estimates. This study contributes to improvements of the registries and increases the potential for cancer epidemiology in Costa Rica and other developing countries.	International Journal of Epidemiology	25	6	1125-31	Job title			Cohort (retrospective)	Job title	cancer	doctor-diagnosed	Costa Rica	umic
141	C. Avgerinou, A. Kouraklis, S. Theodoropoulou, I. Giannezi, V. Lazaris, P. Lampropoulou, V. Labropoulou, E. Tzouvara, P. Zikos, Y. Alamanos, M. Karakantza and A. Symeonidis	Exposure to pesticides is a major risk factor for myelodysplastic syndromes (MDS) in Southwestern Greece	2013	Background: Epidemiological features of MDS may vary in different geographical areas and among different population groups. Introduction: The incidence of MDS has been increasing in Southwestern Greece throughout the last 20 years. Purpose: The objective of this study was to investigate potential risk factors for MDS in our area. Materials and Methods: Totally, 178 patients (117 cases, 61 controls) were included in this hospital-based case-control study. Cases were prevalent de novo MDS patients, diagnosed and followed up at the two major hospitals of Patras. Controls came from the Ophthalmology Department and were sex- and age-matched. They were interviewed with a questionnaire, including demographic data, family history of neoplastic disorders, occupational exposure to chemicals and pesticides, smoking and alcohol intake, diet, domestic exposure and hobbies. Logistic regression analysis was performed by IBM SPSS version 20.0. The study was approved by the Ethical and Scientific Committees of the hospitals. Results: Cases and controls did not differ by marital status, years of education, residence in rural/urban area or family history of hematological malignancies. However, family history of other cancer was more frequent in MDS patients (p=0.086). Among occupational factors, agricultural activity (p=0.05, OR=1.93, 95% CI 1.01-3.71), and especially exposure to pesticides, herbicides and insecticides (OR=3.72, 95% CI 1.90-7.27, p<0.0001) was related to MDS. Smoking (never smokers vs. ever smokers, p=0.231) was not related, but daily consumption of>2 glasses of wine was related to MDS (p=0.02, OR=2.71, 95% CI 1.17-6.31). Among dietary habits, coffee, meat and fish consumption were not significantly different between cases and controls. However, consumption of dairy products >5 times/week was related to MDS (p=0.019, OR=2.25, 95% CI 1.15-4.41), and consumption of fruit <U+201A><U+00E2><U+2022>5 times per week had a protective role (p=0.079, OR=0.49, 95% CI 0.22-1.09). Nevertheless, hair dye use, the use of electromagnetic radiation sources (mobile or wireless phone, microwave oven etc), exposure to domestic insecticides, hobbies such as gardening, and stressful life events were not different between cases and controls. We consequently performed multivariate logistic regression, which included sex and age, family history of cancer (p=0.051, OR=2.44), exposure to pesticides (p<0.0001, OR=6.24), consumption of dairy products >5 times/week (p=0.002, OR=4.38), and alcohol consumption >2 glasses/day (p=0.007, OR=5.45). Conclusions: Results from this study suggest that agricultural activity, and particularly exposure to pesticides, is a major risk factor for MDS in our area. Dietary factors and exaggerated alcohol intake may also contribute to the pathogenesis of MDS.	Leukemia Research	37	NA	S140	Self-reported exposure			Case-control	Type of pesticide	cancer	doctor-diagnosed	Greece	hic
142	C. Avgerinou, I. Giannezi, S. Theodoropoulou, V. Lazaris, G. Kolliopoulou, P. Zikos, Y. Alamanos, M. Leotsinidis and A. Symeonidis	Occupational, dietary, and other risk factors for myelodysplastic syndromes in Western Greece	2017	PURPOSE: We have observed an increasing incidence of myelodysplastic syndromes (MDS) in the geographic area of Western Greece during the past two decades. The objective of this study was to investigate potential risk factors for the manifestation of MDS in this area of Greece. METHODS: A hospital-based case-control study was conducted in the public hospitals of the region. Participants were interviewed based on a questionnaire regarding demographics, occupational exposures, smoking, alcohol consumption, dietary, and domestic factors. RESULTS: A total of 228 individuals (126 cases, 102 controls) were recruited in this study. Univariate analysis showed that risk of MDS was associated with a family history of hematologic malignancy or solid tumor, exposure to pesticides, insecticides, herbicides, increased weekly intake of meat and eggs, and increased alcohol intake, whereas fruit intake had a protective effect. Analysis by pesticide ingredient showed a weak association of exposure to paraquat and glyphosate with the occurrence of MDS. Multivariate analysis showed that independent risk factors for the manifestation of MDS were family history of solid tumor (OR 2.47, 95% CI 1.32-4.65), meat intake for >=5 days/week (OR 2.67, 95% CI 1.05-6.80) and exposure to pesticides (OR 3.25, 95% CI 1.73-6.11). CONCLUSIONS: Exposure to pesticides is a major risk factor of MDS in Western Greece. Family history of solid tumor and increased meat intake also appear to play a role in the pathogenesis of MDS. Public health authorities should implement policies to advise and protect farmers from the harmful effects of agrochemicals. Emphasis should also be given to health promotion advice including healthy eating.	Hematology	22	7	419-429	Self-reported exposure			Case-control	Type of pesticide	cancer	doctor-diagnosed	Greece	hic
143	C. B. Colosio, W.; Maroni, M.; Alcini, D.; Bersani, M.; Cavallo, D.; Galli, A.; Meroni, P.; Pastorelli, R.; Rizzardi, G. P.; Soleo, L.; Foa, V.	Immunomodulatory effects of occupational exposure to mancozeb	1996	The effects of occupational exposure to ethylene-bis-dithiocarbamate of manganese and zinc on the immune system were evaluated in a group of mancozeb-exposed manufacturers and controls. The immune system tests revealed the following: (a) lymphocyte proliferative responses triggered by different activators and mitogen-induced IL-2 production were higher in exposed subjects than in controls; (b) production of monocyte/macrophage-derived IL-1 and polyclonal IgG and IgM, by beta-lymphocytes, did not differ between exposed subjects and controls; (c) percentages and absolute numbers of total T-cells, T-helper cells, T-suppressor/cytotoxic cells, activated T-cells, total beta-cells, and natural killer cells were similar in exposed subjects and controls; (d) serum immunoglobulin classes and complement fractions were within the range of normality; and (e) rheumatoid factor and non-organ-specific serum autoantibodies were absent in exposed and control subjects. An increase in T-cell functional response was found in the exposed group, suggesting a slight immunomodulator effect of mancozeb in conditions of low-level, prolonged occupational exposure.	Archives of Environmental Health	51	6	445-51	Personal air sampling	Biomonitoring (urine)	Biomonitoring (blood)	Cohort (prospective)	Specific active ingredient	immunological	medical test result	Italy	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
144	C. B. Khayat, E. O. Costa, M. W. Goncalves, D. M. da Cruz e Cunha, A. S. da Cruz, C. O. de Araujo Melo, R. P. Bastos, A. D. da Cruz and D. de Melo e Silva	Assessment of DNA damage in Brazilian workers occupationally exposed to pesticides: a study from Central Brazil	2013	We evaluated 41 rural workers occupationally exposed to pesticides and 32 subjects as a control group, using the micronucleus (MN) and the comet assay. For the comet assay, we evaluated the peripheral blood, and for the MN, we sampled cells from the oral epithelium. Damage to DNA was measured by tail length, % DNA in tail (% tail), olive tail moment (OTM), and tail moment (TM). The exposed group presented an 8x increase in MN frequency, when compared to the control group (p <0.05). When we contrasted the MN frequencies between the individuals that use and do not use personal protective equipment, we found a mean of 7.5 MN (57 % variance) and 12.1 MN (130 % variance), respectively. The binucleated cells were 0.04 and 0.005, in the exposed and control groups, respectively, indicating 8x increase in the number of binucleated cells, when comparing the groups (p <0.05). In the comet assay, we demonstrated statistically significant differences in three parameters (% DNA, OTM, and TM) indicating that the rural workers presented high levels of genomic damages. Our results indicate that occupational exposure to pesticides could cause genome damage in somatic cells, representing a potential health risk to Brazilian rural workers that deal constantly with agrochemicals without adequate personal protection equipment.	Environmental Science & Pollution Research	20	10	7334-40	Self-reported exposure			Case-control	Pesticides in general	genetic (biomarkers)	medical test result	Brazil	umic
145	C. Beseler, L. Stallones, J. A. Hoppin, M. C. Alavanja, A. Blair, T. Keefe and F. Kamel	Depression and pesticide exposures in female spouses of licensed pesticide applicators in the agricultural health study cohort	2006	OBJECTIVE: This nested case-control study evaluated the association between depression and pesticide exposure among women. METHODS: The study population included 29,074 female spouses of private pesticide applicators enrolled in the Agricultural Health Study between 1993 and 1997. Cases were women who had physician-diagnosed depression requiring medication. Lifetime pesticide use was categorized as never mixed/applied pesticides, low exposure (up to 225 days), high exposure (>225 days), and a history of diagnosed pesticide poisoning. RESULTS: After adjustment for state, age, race, off-farm work, alcohol, cigarette smoking, physician visits, and solvent exposure, depression was significantly associated with a history of pesticide poisoning (odds ratio [OR] = 3.26; 95% confidence interval [CI] = 1.72-6.19) but not low (OR = 1.09; CI = 0.91-1.31) or high (OR = 1.09; 95% CI = 0.91-1.31) cumulative pesticide exposure. CONCLUSION: Pesticide poisoning may contribute to risk of depression.	Journal of Occupational & Environmental Medicine	48	10	1005-13	Self-reported exposure			Case-control	Pesticides in general	mental disorders	doctor-diagnosed	USA	hic
146	C. Bolognesi, E. Landini, E. Perrone and P. Roggieri	Cytogenetic biomonitoring of a floriculturist population in Italy: micronucleus analysis by fluorescence in situ hybridization (FISH) with an all-chromosome centromeric probe	2004	Flower production in greenhouses associated with a heavy use of pesticides is very wide-spread in the western part of the Ligurian region (Italy). The formation of micronuclei in peripheral blood lymphocytes is a valuable cytogenetic biomarker in human populations occupationally exposed to genotoxic compounds. In the present study we investigated the micronucleus frequency in peripheral blood lymphocytes of 52 floriculturists and 24 control subjects by use of the cytokinesis-block methodology associated with fluorescence in situ hybridization with a pan-centromeric probe that allowed to distinguish centromere-positive (C+) and centromere-negative (C-) micronuclei. The comparison between floriculturists and controls did not reveal any statistically significant difference in micronucleus frequency, although an increase was observed with increasing pesticide use, number of genotoxic pesticides used and duration of exposure. An increase in C+ as well as in C- micronuclei and in the percentage of C+ micronuclei with respect to the total number of micronuclei was detected in floriculturists, suggesting a higher contribution of C+ micronuclei in the total number scored. The percentage C+ micronuclei was not related to the duration of exposure or to the number of genotoxic pesticides used, but a higher percentage (66.52% versus 63.78%) was observed in a subgroup of subjects using benzimidazolic compounds, compared with the floriculturist population exposed to a complex pesticide mixture not including benzimidazolics. These results suggest a potential human hazard associated with the exposure to this class of aneuploidy-inducing carcinogens.	Mutation Research	557	2	109-17	Self-reported exposure			Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	Italy	hic
147	C. Bolognesi, E. Perrone and E. Landini	Micronucleus monitoring of a floriculturist population from western Liguria, Italy	2002	A biomonitoring study was carried out to investigate whether exposure to complex pesticide mixtures in ornamental crop production represents a potential genotoxic risk. Exposed and control subjects were selected in western Liguria (Italy). The area was chosen for its intensive use of pesticides. The main crops produced were roses, mimosas, carnations and chrysanthemums, as ornamental non-edible plants, and tomato, lettuce and basil, as edible ones. The levels of micronuclei (MN) were analysed in peripheral blood lymphocytes of 107 floriculturists (92 men and 15 women) and 61 control subjects (42 men and 19 women). A statistically significant increase in binucleated cells with micronuclei (BNMN) was detected in floriculturists with respect to the control population (4.41 +/- 2.14 MN/1000 cells versus 3.04 +/- 2.14, P < 0.001). The mean number of BNMN varied as a function of sex and age. Smoking habit had no effect on MN frequency. A positive correlation between years of farming and MN frequency in peripheral blood lymphocytes was observed (r = 0.30, P = 0.02). The conditions of exposure were also associated with an increase in cytogenetic damage, with a 28% higher MN frequency in greenhouse workers compared with subjects working only outdoors in fields. Workers not using protective measures during high exposure activities showed an increase in MN frequency. Our findings suggest a potential genotoxic risk due to pesticide exposure.	Mutagenesis	17	5	391-7	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Italy	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
148	C. Bolognesi, G. Carrasquilla, S. Volpi, K. R. Solomon and E. J. Marshall	Biomonitoring of genotoxic risk in agricultural workers from five colombian regions: association to occupational exposure to glyphosate	2009	In order to assess possible human effects associated with glyphosate formulations used in the Colombian aerial spray program for control of illicit crops, a cytogenetic biomonitoring study was carried out in subjects from five Colombian regions, characterized by different exposure to glyphosate and other pesticides. Women of reproductive age (137 persons 15-49 yr old) and their spouses (137 persons) were interviewed to obtain data on current health status, history, lifestyle, including past and current occupational exposure to pesticides, and factors including those known to be associated with increased frequency of micronuclei (MN). In regions where glyphosate was being sprayed, blood samples were taken prior to spraying (indicative of baseline exposure), 5 d after spraying, and 4 mo after spraying. Lymphocytes were cultured and a cytokinesis-block micronucleus cytome assay was applied to evaluate chromosomal damage and cytotoxicity. Compared with Santa Marta, where organic coffee is grown without pesticides, the baseline frequency of binucleated cells with micronuclei (BNMN) was significantly greater in subjects from the other four regions. The highest frequency of BNMN was in Boyaca, where no aerial eradication spraying of glyphosate was conducted, and in Valle del Cauca, where glyphosate was used for maturation of sugar cane. Region, gender, and older age (> or =35 yr) were the only variables associated with the frequency of BNMN measured before spraying. A significant increase in frequency of BNMN between first and second sampling was observed in Narino, Putumayo, and Valle immediately (<5 d) after spraying. In the post-spray sample, those who reported direct contact with the eradication spray showed a higher quantitative frequency of BNMN compared to those without glyphosate exposure. The increase in frequency of BNMN observed immediately after the glyphosate spraying was not consistent with the rates of application used in the regions and there was no association between self-reported direct contact with eradication sprays and frequency of BNMN. Four months after spraying, a statistically significant decrease in the mean frequency of BNMN compared with the second sampling was observed in Narino, but not in Putumayo and Valle del Cauca. Overall, data suggest that genotoxic damage associated with glyphosate spraying for control of illicit crops as evidenced by MN test is small and appears to be transient. Evidence indicates that the genotoxic risk potentially associated with exposure to glyphosate in the areas where the herbicide is applied for coca and poppy eradication is low.	Journal of Toxicology & Environmental Health Part A	72	15	986-97	Biomonitoring (blood)			Cohort (prospective)	Chemical class	genetic (biomarkers)	medical test result	Colombia	umic
149	C. Bolognesi, M. Parrini, S. Bonassi, G. Ianello and A. Salanitto	Cytogenetic analysis of a human population occupationally exposed to pesticides	1993	A great deal of the flower cultivation in Italy is carried out in the western part of the Region of Liguria. The extensive use of pesticides professionally exposes floriculturists operating in this area to a complex mixture of compounds. The frequency of micronuclei in peripheral lymphocytes has been evaluated in 71 floriculturists and in a control group of 75 healthy blood donors living in the area. No correlation between age and micronucleus frequency was found in peripheral lymphocytes of the controls while an increase in this parameter was observed in the elderly of the exposed group. Our data suggest a sex-related effect in the induction of micronuclei. The frequencies of micronucleated lymphocytes were significantly higher in females than in males in both exposed and control groups (RR = 1.45, 95% C.I. 1.25-1.67). The main result of this study, however, is the observation of a significant increase in micronucleated lymphocyte frequency in people occupationally exposed to pesticides. The micronucleus frequency was 8.57/1000 for exposed persons and 6.67/1000 for controls ($p < 0.05$). A dose-response relationship with duration of exposure was apparent with a maximum increment of 71% in the frequency of micronuclei in subjects exposed for over 30 years.	Mutation Research	285	2	239-49	Self-reported exposure			Cohort (prospective)	Pesticides in general	genetic (biomarkers)	medical test result	Italy	hic
150	C. Burns, K. Bodner, G. Swaen, J. Collins, K. Beard and M. Lee	Cancer incidence of 2,4-D production workers	2011	Despite showing no evidence of carcinogenicity in laboratory animals, the herbicide 2,4-dichlorophenoxyacetic acid (2,4-D) has been associated with non-Hodgkin lymphoma (NHL) in some human epidemiology studies, albeit inconsistently. We matched an existing cohort of 2,4-D manufacturing employees with cancer registries in three US states resulting in 244 cancers compared to 276 expected cases. The Standardized Incidence Ratio (SIR) for the 14 NHL cases was 1.36 (95% Confidence Interval (CI) 0.74-2.29). Risk estimates were higher in the upper cumulative exposure and duration subgroups, yet not statistically significant. There were no clear patterns of NHL risk with period of hire and histology subtypes. Statistically significant results were observed for prostate cancer (SIR = 0.74, 95% CI 0.57-0.94), and "other respiratory" cancers (SIR = 3.79, 95% CI 1.22-8.84; 4 of 5 cases were mesotheliomas). Overall, we observed fewer cancer cases than expected, and a non statistically significant increase in the number of NHL cases.	International Journal of Environmental Research & Public Health [Electronic Resource]	8	9	3579-90	Index			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
151	C. C. Chen, C. H. Huang, M. T. Wu, C. H. Chou, C. C. Huang, T. Y. Tseng, F. Y. Chang, Y. T. Li, C. C. Tsai, T. S. Wang and R. H. Wong	Multidrug resistance 1 gene variants, pesticide exposure, and increased risk of DNA damage	2014	The P-glycoprotein, encoded by the multidrug resistance (MDR)1 gene, extrudes fat-soluble compounds to the extracellular environment. However, the DNA damage of pesticides in subjects with genetic variation in MDR1 has not been investigated. In this study, the comet assay was applied to examine the extent of DNA damage in the peripheral blood of 195 fruit growers who had been exposed to pesticides and 141 unexposed controls. The MDR1 polymorphisms were identified. Questionnaires were administered to obtain demographic data and occupational history. Results showed subjects experiencing high (2.14mum/cell, $P < 0.01$) or low pesticide exposure (2.18mum/cell, $P < 0.01$) had a significantly greater DNA tail moment than controls (1.28mum/cell). Compared to the MDR1 T-129C (rs3213619) TC/CC carriers, the TT carriers had increased DNA tail moment in controls (1.30 versus 1.12mum/cell, $P < 0.01$). Similar results were observed in the high and low pesticide-exposed groups. Combined analysis revealed that pesticide-exposed fruit growers with MDR1 -129 TT genotype had the greatest DNA damage in the subjects with the combinations of pesticide exposure and MDR1 -129 genotypes. In conclusion, pesticide exposed individuals with susceptible MDR1 -129 genotypes may experience increased risk of DNA damage.	BioMed Research International	2014	NA	965729	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Taiwan	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
152	C. C. K. Lerro, S.; Andreotti, G.; Friesen, M. C.; Alavanja, M. C.; Blair, A.; Hoppin, J. A.; Sandler, D. P.; Lubin, J. H.; Ma, X.; Zhang, Y.; Beane Freeman, L. E.	Organophosphate insecticide use and cancer incidence among spouses of pesticide applicators in the Agricultural Health Study	2015	OBJECTIVES: Organophosphates (OPs) are among the most commonly used insecticides. OPs have been linked to cancer risk in some epidemiological studies, which have been largely conducted in predominantly male populations. We evaluated personal use of specific OPs and cancer incidence among female spouses of pesticide applicators in the prospective Agricultural Health Study cohort. METHODS: At enrolment (1993-1997), spouses provided information about ever use of specific pesticides, including 10 OPs, demographic information, reproductive health history and other potential confounders. We used Poisson regression to estimate relative risks (RRs) and 95% CIs for all cancers diagnosed through 2010 for North Carolina and through 2011 for Iowa. RESULTS: Among 30,003 women, 25.9% reported OP use, and 718 OP-exposed women were diagnosed with cancer during the follow-up period. Any OP use was associated with an elevated risk of breast cancer (RR=1.20, 95% CI 1.01 to 1.43). Malathion, the most commonly reported OP, was associated with increased risk of thyroid cancer (RR=2.04, 95% CI 1.14 to 3.63) and decreased risk of non-Hodgkin lymphoma (RR=0.64, 95% CI 0.41 to 0.99). Diazinon use was associated with ovarian cancer (RR=1.87, 95% CI 1.02 to 3.43). CONCLUSIONS: We observed increased risk with OP use for several hormonally-related cancers, including breast, thyroid and ovary, suggesting potential for hormonally-mediated effects. This study represents the first comprehensive analysis of OP use and cancer risk among women, and thus demonstrates a need for further evaluation.	Occupational & Environmental Medicine	72	10	736-44	Self-reported exposure			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
153	C. C. Lawson, T. M. Schnorr, E. A. Whelan, J. A. Deddens, D. A. Dankovic, L. A. Piacitelli, M. H. Sweeney and L. B. Connally	Paternal occupational exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin and birth outcomes of offspring: birth weight, preterm delivery, and birth defects	2004	Agent Orange is a phenoxy herbicide that was contaminated with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). We studied pregnancy outcomes among wives of male chemical workers who were highly exposed to chemicals contaminated with TCDD and among wives of nonexposed neighborhood referents. For exposed pregnancies, we estimated serum TCDD concentration at the time of conception using a pharmacokinetic model. The mean TCDD concentration for workers' births was 254 pg/g lipid (range, 3-16,340 pg/g). The mean referent concentration of 6 pg/g was assigned to pregnancies fathered by workers before exposure. A total of 1,117 live singleton births of 217 referent wives and 176 worker wives were included. Only full-term births were included in the birth weight analysis (greater than or equal to 37 weeks of gestation). Mean birth weight among full-term babies was similar among referents' babies (n = 604), preexposure workers' babies (n = 221), and exposed workers' babies (n = 292) (3,420, 3,347, and 3,442 g, respectively). Neither continuous nor categorical TCDD concentration had an effect on birth weight for term infants after adjustment for infant sex, mother's education, parity, prenatal cigarette smoking, and gestation length. An analysis to estimate potential direct exposure of the wives during periods of workers' exposure yielded a nonstatistically significant increase in infant birth weight of 130 g in the highest exposure group (TCDD concentration > 254 pg/g) compared with referents (p = 0.09). Mothers' reports of preterm delivery showed a somewhat protective association with paternal TCDD (log) concentration (odds ratio = 0.8; 95% confidence interval, 0.6-1.1). We also include descriptive information on reported birth defects. Because the estimated TCDD concentrations in this population were much higher than in other studies, the results indicate that TCDD is unlikely to increase the risk of low birth weight or preterm delivery through a paternal mechanism. Key words: birth defects, birth weight, congenital anomalies, dioxin, occupation, paternal exposure, preterm birth, TCDD.	Environmental Health Perspectives	112	14	1403-8	Algorithm/model			Cross-sectional	Chemical class	offspring	doctor-diagnosed	USA	hic
154	C. C. P. Ekenga, C. G.; Sandler, D. P.	Chemical exposures in the workplace and breast cancer risk: A prospective cohort study	2015	We investigated the relationship between workplace chemical exposures and breast cancer risk among women enrolled in the Sister Study, a prospective cohort study of US and Puerto Rican women. A total of 47,640 participants reported work outside of the home. Workplace exposure to eleven agents (acids, dyes or inks, gasoline or other petroleum products, glues or adhesives, lubricating oils, metals, paints, pesticides, soldering materials, solvents and stains or varnishes) was characterized based on self-reports of frequency and duration of use. Approximately 14% of the study population reported exposure to only one agent and 11% reported working with two or more of the 11 agents in their lifetime. Hazard ratios (HRs) and 95% confidence intervals (CIs) were estimated for each agent, adjusting for established breast cancer risk factors. During follow-up, 1,966 cases of breast cancer were reported. Although there were no significant associations between ever use of the eleven agents evaluated and breast cancer risk, women with cumulative exposure to gasoline or petroleum products at or above the highest quartile cutoff had an elevated risk of total (HR: 2.3, 95%CI: 1.1-4.9) and invasive (HR: 2.5, 95%CI: 1.1-5.9) breast cancer compared with women in the lowest quartile group (ptrend =0.03). Workplace exposure to soldering materials was associated with an increased risk of premenopausal breast cancer (HR=1.8, 95% CI=1.1-3.0). Findings support the need for further studies to elucidate the role of occupational chemicals in breast cancer etiology.	International Journal of Cancer	137	7	1765-74	Self-reported exposure			Cohort (prospective)	Pesticides in general	cancer	doctor-diagnosed	AHIC	AHIC
155	C. Celik-Ozenci, A. Tasatargil, M. Tekcan, L. Sati, E. Gungor, M. Isbir, M. F. Usta, M. E. Akar and F. Erler	Effect of abamectin exposure on semen parameters indicative of reduced sperm maturity: a study on farmworkers in Antalya (Turkey)	2012	Environmental exposure to pesticides may cause serious health risks including fertility and reproductive function. The aim of this study was to highlight whether there is a relationship between exposure to abamectin and male fertility parameters of farmworkers. Twenty male farmworkers who were using abamectin and 20 men not exposed to pesticides were recruited as experimental and control groups, respectively. Semen analysis, molecular markers of sperm maturity and serum reproductive hormone levels were evaluated. In experimental group, high plasma abamectin levels were detected. These men have decreased sperm motility. Moreover, diminished molecular markers of sperm maturity, such as decreased hyaluronic acid (HA) binding of sperm, increased numbers of aniline blue positive sperm and increased percentage of creatine kinase (CK) positive sperm, were observed in abamectin-exposed men. Their serum testosterone, LH and FSH levels did not change significantly. We conclude that exposure to abamectin may impair male fertility by effecting semen quality.	Andrologia	44	6	388-95	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	reproductive	medical test result	Turkey	umic
156	C. Colosio, M. Maroni, W. Barcellini, P. Meroni, D. Alcini, A. Colombi, D. Cavallo and V. Foa	Toxicological and immune findings in workers exposed to pentachlorophenol (PCP)	1993	Pentachlorophenol (PCP) is a pesticide used worldwide in industrial and domestic applications. Data available on the effects of technical-grade PCP on the immune system are insufficient and equivocal; some data indicate inhibitory effects, whereas others suggest stimulating effects. This study was performed to evaluate toxicological and immune findings in 32 subjects who had prolonged exposure to PCP in a wood factory and in 37 controls. PCP concentrations were determined in plasma and urine of all subjects. Lymphocyte subsets of CD3-, CD4-, and CD8-positive cells were evaluated, and the proliferative response of peripheral blood mononuclear cells (PBM) to mitogens was assessed. The results suggested the absence of major laboratory and clinical signs of PCP-dependent immune deficiency. A weak effect of long-term exposure to PCP on the functional immune response could not be ruled out because of the finding of a decreased response to 5% PHA in the high-exposure group. A weak effect against hepatocyte membrane was evidenced by the finding of raised serum concentration of glycocholic, taurodeoxycholic, and glycochenodeoxycholic acids in subjects directly exposed to PCP for more than 10 y.	Archives of Environmental Health	48	2	29799	Biomonitoring (urine)	Biomonitoring (blood)		Cross-sectional	Specific active ingredient	immunological	medical test result	Italy	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
157	C. Colosio, S. Fustinoni, E. Corsini, C. Bosetti, S. Birindelli, D. Boers, L. Campo, C. La Vecchia, J. Liesivuori, S. Pennanen, T. Vergieva, L. G. Van Amelsvoort, P. Steerenberg, G. M. Swaen, C. Zaikov and H. Van Loveren	Changes in serum markers indicative of health effects in vineyard workers following exposure to the fungicide mancozeb: an Italian study	2007	The aim of this study was to investigate the health effects induced by exposure to the fungicide mancozeb in Italian vineyard workers. Ninety-three Italian subjects entered the study - 48 vine-growers intermittently exposed to mancozeb and 45 healthy controls. The subjects were investigated three times: before the seasonal application of pesticides (T0), 30 days after the beginning of the application period (T30), and 45 days after T0 (T45). At T0 the comparison between agricultural workers and controls showed a higher prevalence of cold or flu symptoms, a statistically significant lower percentage of monocytes, higher absolute count of T lymphocytes, CD4 and natural killer cells, and lower plasma levels of IgA and IgM in workers. Such differences were not confirmed at T30 and T45. In fact at T30 in exposed workers, besides a significant increase of urinary ethylenethiourea, confirming mancozeb exposure, T lymphocytes, CD4 and natural killer cells, IgA and IgM returned to values comparable to those observed in controls. Moreover, no other differences in clinical signs, haematological, and immune parameters, such as the immune functional capability evaluated as a response to hepatitis B vaccination, was observed. Altogether the differences between exposed and controls were not consistently correlated to any clinical impairment and suggest that the seasonal application of mancozeb does not pose a significant health risk to exposed subjects.	Biomarkers	12	6	574-88	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	pesticide-related symptoms	medical test result	Italy	hic
158	C. Costa, J. P. Teixeira, S. Silva, J. Roma-Torres, P. Coelho, J. Gaspar, M. Alves, B. Laffon, J. Rueff and O. Mayan	Cytogenetic and molecular biomonitoring of a Portuguese population exposed to pesticides	2006	Widespread use of pesticides in agriculture represents a threat not only to the environment but also to human populations exposed to them. Many of these compounds are capable of inducing mutations in DNA and lead to several diseases including cancer. In the present study, cytogenetic damage in peripheral lymphocytes from 33 farmers of Oporto district (Portugal) exposed to pesticides was evaluated by means of micronuclei (MN), sister chromatid exchange (SCE) and chromosomal aberrations (CA). In addition, effect of polymorphic genes of xenobiotic metabolizing enzymes (GSTM1, GSTT1, GSTP1, CYP2E1 and EPHX1) was also evaluated. A non-exposed group from the same area and with same demographic characteristics without exposure to genotoxic compounds was studied and data obtained from both groups was compared. MN and SCE frequencies were significantly higher in the exposed group ($P < 0.005$). In what concerns CA results, no significant differences were observed. It was possible to relate a specific working environment (greenhouses) with higher levels of genetic damage. Use of personal protective equipment revealed to be important to prevent exposure and diminish genetic damage inflicted by pesticides. Allele frequencies of studied polymorphic genes obtained in this study are similar to the ones described by other authors for Caucasian populations. Despite the low number of subjects, results suggest that low mEH (microsomal epoxide hydrolase) activity as well as GSTT1 positive genotype are associated with increased cytogenetic damage.	Mutagenesis	21	5	343-50	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Portugal	hic
159	C. Costa, S. Silva, J. Neves, P. Coelho, S. Costa, B. Laffon, J. Snawder and J. P. Teixeira	Micronucleus frequencies in lymphocytes and reticulocytes in a pesticide-exposed population in Portugal	2011	A wide range of chemical products known to be acutely toxic is currently used in the agricultural sector, including numerous pesticides with different compositions. Nevertheless, the effects in human health as result of chronic exposure to low levels are not yet completely understood. The methodology for determination of micronuclei (MN) in lymphocytes (CBMN) is well established, and accumulating data demonstrated a correlation to enhanced risk of cancer development. However, analysis of MN in reticulocytes (MN-RET) in humans is a recent tool on human biomonitoring. The aim of this study was to examine the influence of pesticide exposure on MN-RET and CBMN frequencies. In total, 177 individuals were studied (93 controls and 84 exposed). All individuals included in the exposed group were exposed regularly to various chemicals. Both MN-RET and CBMN were significantly higher in the exposed subjects compared to controls. The CBMN frequencies were quantitatively higher in females than males, especially within the exposed group. Smoking habits exerted no marked influence on the frequency of the biomarkers studied. A significant and positive correlation was found between both indicators. Within the exposed group, data showed that there was a significant correlation between MN-RET and recent exposure (exposure in the previous 10 d) that is not found when considering CBMN. It is conceivable that due to the short life span of reticulocytes, MN-RET were found to be more reliable to characterize recent genetic damage as opposed to CBMN.	Journal of Toxicology & Environmental Health Part A	74	15	960-70	Job title			Cohort (prospective)	Job title	genetic (biomarkers)	medical test result	Portugal	hic
160	C. Costa, V. Rapisarda, S. Catania, C. Di Nola, C. Ledda and C. Fenga	Cytokine patterns in greenhouse workers occupationally exposed to alpha-cypermethrin: an observational study	2013	The immunotoxicity of the synthetic pyrethroid alpha-cypermethrin (alphaCYP) was assessed in 30 occupationally exposed greenhouse workers and 30 non-exposed controls by comparing plasma levels of IL-1beta, IL-2, IL-4, IL-5, IL-6, IL-8, IL-10, IL-12p70, TNF-alpha, TNF-beta and INF-gamma. Urinary 3-phenoxybenzoic acid was used as an exposure biomarker. Exposed workers showed neither clinical signs of immunosuppression nor alterations in total leukocytes or leukocyte subpopulations, whereas significant differences ($p<0.05$) were found for IL-12p70 and highly significant differences ($p<0.001$) for INF-gamma, IL-2 and IL-8, which are involved in antitumor immunity and response to infection. Proinflammatory cytokines IL-2, IL-8, IL-12p70 and IFN-gamma play a significant role against infection and cancer. We report the first data on the ability of alphaCYP to reduce proinflammatory cytokine levels in an exposed healthy human population. Findings support the hypothesis that pyrethroid exposure may reduce host defenses against infection and cancer, particularly in subjects with impaired immune capacity.	Environmental Toxicology & Pharmacology	36	3	796-800	Biomonitoring (urine)			Cross-sectional	Specific active ingredient	immunological	medical test result	Italy	hic
161	C. Cremonese, C. Piccoli, F. Pasqualotto, R. Clapauch, R. J. Koifman, S. Koifman and C. Freire	Occupational exposure to pesticides, reproductive hormone levels and sperm quality in young Brazilian men	2017	The association of occupational exposure to current-use pesticides with reproductive hormones, semen quality, and genital measures was investigated among young men in the South of Brazil. A cross-sectional study was conducted in 99 rural and 36 urban men aged 18-23 years. Information on pesticide use was obtained through questionnaire. Serum and semen samples were analyzed for sex hormones and sperm parameters, respectively, and measurement of anogenital distance (AGD) and testis volume (TV) were performed. Associations were explored using multivariate linear regression. Rural men had poorer sperm morphology, higher sperm count, and lower LH levels relative to urban subjects. Lifetime use of pesticides, especially herbicides and fungicides, was associated with poorer morphology and reduced LH and prolactin, with evidence of a linear pattern. Maternal farming during pregnancy was associated with larger AGD and TV. Chronic occupational exposure to modern pesticides may affect reproductive outcomes in young men.	Reproductive Toxicology	67	NA	174-185	Self-reported exposure			Cross-sectional	Pesticides in general	reproductive	medical test result	Brazil	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
162	C. F. Lerro, L. B.; Koutros, S.; Andreotti, G.; Hofmann, J.; DellaValle, C.; Alavanja, M.; Sandler, D.; Chen, H.; Blair, A.; Ward, M.	Pesticide use and thyroid cancer incidence among spouses of pesticide applicators in the agricultural health study	2016	Background Increasing thyroid cancer incidence in the US and other western countries suggests a role for environmental risk factors. There are few established risk factors for thyroid cancer, aside from ionising radiation exposure. Thyroid hormone disrupting chemicals, such as certain pesticides, have garnered interest as potential risk factors. We evaluated personal use of specific pesticides and thyroid cancer incidence among female spouses of pesticide applicators in the prospective Agricultural Health Study (AHS) cohort. Methods At enrollment (1993-1997) spouses provided information about ever use pesticide active ingredients and additional covariates. For 12 pesticides with ~5 exposed cases we used multivariate Poisson regression to estimate relative risks (RRs) and 95% confidence intervals (95% CIs) for incident thyroid cancers diagnosed from enrollment through 2012 (North Carolina)/2013 (Iowa), adjusted for confounders. Results Among 31,055 female spouses, 56% reported any personal use of pesticides. A total of 104 thyroid cancer cases were diagnosed during follow-up. Spouses who reported ever applying dicamba were at significantly increased risk of thyroid cancer (RR = 2.34, 95% CI: 1.03-5.35). Atrazine (RR = 2.00, 95% CI: 0.88-4.57) and metolachlor (RR = 2.22, 95% CI: 0.92-5.35) were associated with non-significantly elevated thyroid cancer risk, and carbaryl was associated with non-significantly decreased risk (RR = 0.61, 95% CI: 0.36-1.03). Conclusions Our findings suggest that personal use of specific pesticides (dicamba, atrazine, and metolachlor) may be associated with thyroid cancer risk among female spouses of pesticide applicators. We noted a significant positive association with dicamba, an herbicide previously associated with self-reported hypothyroidism among male pesticide applicators in the AHS. The potential association with atrazine, a suspected endocrine disrupting chemical, is consistent with the previously observed increased risk of thyroid cancer among male pesticide applicators who apply atrazine. This study represents the first comprehensive prospective analysis of specific pesticide active ingredients and thyroid cancer risk among women; as such, our findings warrant further evaluation.	Occupational and Environmental Medicine	73	NA	A47	Self-reported exposure			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
163	C. F. Teixeira, L. G. Da Silva Augusto and T. C. Morata	Occupational exposure to insecticides and their effects on the auditory system	2002	The objective of this investigation was to study the effects of occupational exposure to organophosphates and pyrethroid insecticides on the central auditory system. The study group consisted of 98 workers exposed to insecticides and 54 non-exposed workers. Data on work history, medical history, present diseases, occupational and non-occupational exposure to noise or chemicals and lifestyle factors were obtained through an interview. Central auditory system functions were assessed through frequency patterns and duration patterns testing. Fifty-six percent of the exposed workers had hearing dysfunction at the central level and its relative risk was 7.58 for the group with exposure to insecticides (95% CI 2.9-19.8) when compared to the non-exposed group. The group exposed to insecticides and noise had a relative risk for central disorders of 6.5 (95% CI 2.2-20.0) when compared to the non-exposed group and 9.8 (95% CI 1.4-64.5) when compared to the group exposed only to noise. The finding suggests that exposure to organophosphates and pyrethroid products can induce damage to central auditory system. Further research is needed on the ototoxic mechanisms of these chemicals, and on hearing loss prevention measurements that are applicable and adequate to such risks and populations.	Noise and Health	4	14	31-39	Self-reported exposure			Cohort (prospective)	Type of pesticide	other	other	Brazil	umic
164	C. Fenga, S. Gangemi, S. Catania, A. De Luca and C. Costa	IL-17 and IL-22 serum levels in greenhouse workers exposed to pesticides	2014	INTRODUCTION: Altered immune function may be an indicator of increased potential for the development of immunologically based diseases such as cancer, hypersensitivity and autoimmunity. MATERIALS AND METHODS: To investigate whether Th17 and Th22 cells are targeted by pesticide exposure, we analyzed IL-17 and IL-22 serum levels in a population of 64 greenhouse workers. RESULTS AND CONCLUSION: A significant increase in IL-22 concentration was observed in serum of the exposed subjects compared to controls. These findings support the hypothesis that exposure to pesticides may reduce host defenses against infections and cancer.	Inflammation Research	63	11	895-7	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Italy	hic
165	C. Fortes, S. Mastroeni, M. M. Segatto, C. Hohmann, L. Miligi, L. Bakos and R. Bonamigo	Occupational Exposure to Pesticides With Occupational Sun Exposure Increases the Risk for Cutaneous Melanoma	2016	OBJECTIVE: The objective of the study was to examine the association between occupational exposure to pesticides and cutaneous melanoma, controlling for all possible confounders. METHODS: A pooled analysis of two case-control studies was conducted in two different geographic areas (Italy and Brazil). Detailed pesticides exposure histories were obtained. RESULTS: Ever use of any pesticide was associated with a high risk of cutaneous melanoma (odds ratio 2.58; 95% confidence interval 1.18-5.65) in particular exposure to herbicides (glyphosate) and fungicides (mancozeb, maneb), after controlling for confounding factors. When subjects were exposed to both pesticides and occupational sun exposure, the risk increased even more (odds ratio 4.68; 95% confidence interval 1.29-17.0). CONCLUSIONS: The study suggests an augmented risk of cutaneous melanoma among subjects with exposure to pesticides, in particular among those exposed to occupational sun exposure.	Journal of Occupational & Environmental Medicine	58	4	370-5	Self-reported exposure			Case-control	Specific active ingredient	cancer	doctor-diagnosed	Italy/Brazil	SHIC
166	C. G. Costa, S.; Giambo, F.; Rapisarda, V.; Caccamo, D.; Fenga, C.	Oxidative stress biomarkers and paraoxonase 1 polymorphism frequency in farmers occupationally exposed to pesticides	2015	Previous evidence has demonstrated that chemical classes of pesticides, including organophosphates (OP), can induce oxidative stress in exposed workers. The resulting increase in free radicals causes damage to biological macromolecules, and promotes the formation of novel compounds, including advanced glycation end products (AGE) and advanced oxidation protein products (AOPP). The present study aimed to evaluate the common genetic polymorphisms of the paraoxonase 1 (PON1) gene in a group of 55 farmers exposed to pesticides, as well as the association between these polymorphisms and serum levels of AGE and AOPP. The 192Q wild-type (WT) allele was present at a significantly higher frequency, compared with the 192R mutated allele (0.74 and 0.26, respectively). The WT allele was predominantly represented by the homozygote 192QQ genotype (51%). The mutated 192QR heterozygotic allele was prevalent, at a frequency of 45.4%, whereas the mutated homozygotes were present at a frequency of 3.6%. A significant decrease in the levels of AGE and AOPP was observed in farmers exhibiting the homozygotic 192RR mutated genotype (14,7221 AU/ml and 0.64 nmol/ml, respectively), compared with the WT genotype (16,1400 AU/ml and 1.76 nmol/ml, respectively), and 192QR genotype (15,2312 AU/ml and 1.60 nmol/ml, respectively). Therefore, due to the high catalytic activity of PON1, the 192RR genotype provides an important genetic predictor of the toxic effects associated with OP pesticide exposure. It determines a minor risk of developing oxidative damage following pesticide exposure, and measuring the levels of AOPP may provide a novel biomarker for oxidative damage in subjects exposed to OP.	Molecular Medicine Reports	12	4	1626608	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Italy	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
167	C. G. Gross-Davis, B. , H. , K. , L. , N. , S. and F.	Occupational and genetic risk factors for myeloproliferative neoplasms (MPN): A case-control study	2013	Objectives The aetiology of a rare category of myeloproliferative neoplasms (MPN), bone marrow diseases with an excess of blood cells, is currently unknown. An MPN cluster in northeastern Pennsylvania allowed investigation of occupational risk factors and gene-environment interactions. Among our hypotheses were risks associated with aromatic and heterocyclic amines. Methods This 2011 population-based case-control study assessed lifetime occupational, residential, smoking and dietary history by telephone interview. Cases (n = 55) were identified from the Pennsylvania cancer registry and a previous MPN study. Controls (n = 473) were selected based on eligibility screening using random digit dialling. People born from 1921-1968 and residing in 3 counties with high incidence of MPN were eligible. Blood samples for genotyping were collected from 31 cases and 292 controls. Results Cases were older (median age = 71 vs 61yrs) and more likely to be male (49% vs 39%) compared to controls but otherwise demographically similar. Ever working in ten employment areas (welding, painting, degreasing, firefighting or working with glue, solvents/inks, pesticides, diesel equipment, animals, or X-rays/radioactive material at the 8 most recent jobs) were not associated with MPN. In analyses that examined the main effects of over 50 environmentally sensitive genes, the presence of NAT2 slow acetylator genotype, GSTM1 gene deletion, and GSTA1, and GSTM3 variants were associated with an increased risk for MPNs (unadjusted ORs 2.1-3.2, 95% C. I.s excluding 1.0). Results were similar for analyses restricted to JAK2 positive cases. Conclusions No relationship was found with occupations with presumed exposure to aromatic and heterocyclic amines, but our findings suggest that genotypes that modify the toxicity of these exposures may play a role in MPNs. Sources of exposures important to the pathway whereby NAT2 or other genotypes modify the effect of exposures in this population remain unclear and there is ongoing work on refining exposure assessment in the project.	Occupational and Environmental Medicine	70	NA	NA	Self-reported job history			Case-control	Job title	cancer	doctor-diagnosed	USA	hic
168	C. G. W. Parks, B. T.; Pettinger, M.; Chen, J. C.; de Roos, A. J.; Hunt, J.; Sarto, G.; Howard, B. V.	Insecticide use and risk of rheumatoid arthritis and systemic lupus erythematosus in the Women's Health Initiative Observational Study	2011	OBJECTIVE: Farming and agricultural pesticide use has been associated with 2 autoimmune rheumatic diseases, rheumatoid arthritis (RA) and systemic lupus erythematosus (SLE). However, risk associated with other residential or work place insecticide use is unknown. METHODS: We analyzed data from the Women's Health Initiative Observational Study (n=76,861 postmenopausal women, ages 50-79 years). Incident cases (n=213: 178 for RA, 27 for SLE, and 8 for both) were identified based on self-report and use of disease-modifying antirheumatic drugs at year 3 of followup. We examined self-reported residential or work place insecticide use (personally mixing/applying by self and application by others) in relation to RA/SLE risk, overall and in relation to farm history. Hazard ratios (HRs) and 95% confidence intervals (95% CIs) were adjusted for age, race, region, education, occupation, smoking, reproductive factors, asthma, other autoimmune diseases, and comorbidities. RESULTS: Compared with never used, personal use of insecticides was associated with increased RA/SLE risk, with significant trends for greater frequency (HR 2.04, 95% CI 1.17-3.56 for >=6 times/year) and duration (HR 1.97, 95% CI 1.20-3.23 for >=20 years). Risk was also associated with long-term insecticide application by others (HR 1.85, 95% CI 1.07-3.20 for >=20 years) and frequent application by others among women with a farm history (HR 2.73, 95% CI 1.10-6.78 for >=6 times/year). CONCLUSION: These results suggest residential and work place insecticide exposure is associated with the risk of autoimmune rheumatic diseases in postmenopausal women. Although these findings require replication in other populations, they support a role for environmental pesticide exposure in the development of autoimmune rheumatic diseases.	Arthritis care & research	63	2	184-94	Self-reported exposure			Cohort (prospective)	Type of pesticide	muskuloskeletal	self-reported	USA	hic
169	C. H. Christensen, E. A. Platz, G. Andreotti, A. Blair, J. A. Hoppin, S. Koutros, C. F. Lynch, D. P. Sandler and M. C. Alavanja	Coumaphos exposure and incident cancer among male participants in the Agricultural Health Study (AHS)	2010	BACKGROUND: Coumaphos is an organophosphate livestock insecticide. Previous research in the Agricultural Health Study (AHS) cohort observed a positive association between coumaphos and prostate cancer in men with a family history of prostate cancer. OBJECTIVES: This study was performed to determine the association between coumaphos and other major cancer sites and to explore the consistency of the association with prostate cancer early (1993-1999) and later (2000-2005) in AHS follow-up. METHODS: This study included 47,822 male licensed pesticide applicators. Incident cases were ascertained by linkage to state cancer registries, and exposure data were collected by enrollment questionnaire. Poisson regression was used to estimate rate ratio (RR) and 95% confidence interval (CI) of cancer for coumaphos exposure controlling for potentially confounding variables. RESULTS: Approximately 8% of applicators reported use of coumaphos; 8.5% reported a family history of prostate cancer. Cumulative exposure to coumaphos was not associated with cancer risk overall or with any major cancer site including prostate. In men with a family history of prostate cancer, we observed a positive association between ever use of coumaphos and prostate cancer in both early (RR = 2.07; 95% CI, 1.19-3.62, p-interaction = 0.005) and later (RR = 1.46; 95% CI, 0.89-2.40; p-interaction = 0.11) periods of follow-up. Across all years, this association was statistically significant (RR = 1.65; 95% CI, 1.13-2.38; p-interaction = 0.004). CONCLUSION: Coumaphos was not associated with any cancer evaluated here. In men with a family history of disease, there was evidence of an association between coumaphos and prostate cancer, possibly due to genetic susceptibility; however, other explanations, including chance, are plausible.	Environmental Health Perspectives	118	1	33756	Algorithm/model	Self-reported exposure		NA	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
170	C. Hertzman, M. Wiens, B. Snow, S. Kelly and D. Calne	A case-control study of Parkinson's disease in a horticultural region of British Columbia	1994	We compared personal histories of 127 cases and 245 controls to identify possible environmental risk factors for idiopathic parkinsonism (IP). Of our controls, 121 had cardiac disease (CD) and 124 were randomly selected from electoral lists (voters). Using logistic regression and adjusting for sex and age, we ran separate analyses: IP versus CD and IP versus voters. A full occupational history was collected, as was known contact with all pesticides associated with the tree fruit sector of the agricultural industry. We found a significant association between IP and having had an occupation in which exposure through handling or directly contacting pesticides was probable, but no specific chemicals were associated with IP. We conclude that although occupations involving the use of agricultural chemicals may predispose to the development of IP, it seems likely that the pathogenesis is multifactorial rather than related to a specific agent.	Movement Disorders	9	1	69-75	Self-reported job history			Case-control	Job title	neurological	doctor-diagnosed	Canada	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
171	C. J. Burns, J. B. Cartmill, B. S. Powers and M. K. Lee	Update of the morbidity experience of employees potentially exposed to chlorpyrifos	1998	OBJECTIVES: Chlorpyrifos, an organophosphate ingredient of several important insecticides, has been manufactured at The Dow Chemical Company for 25 years. A previous morbidity study among employees of The Dow Chemical Company found no increased prevalence of illness or symptoms among employees potentially exposed to chlorpyrifos from 1977 to 1985 compared with matched controls. The purpose of the current study was to update the original study to 1994, thereby increasing the statistical power. METHODS: In the present study, 496 potentially exposed subjects were identified and matched for age, race, sex, pay, and year of hire to 911 control subjects. Morbidity data were abstracted from company medical records. RESULTS: The prevalence of peripheral neuropathy was not significantly increased among this group of employees potentially exposed to chlorpyrifos. Significantly increased prevalence odds ratios were identified for five diagnostic categories: diseases of the ear and mastoid process; acute respiratory infections; other diseases of the respiratory system; general symptoms, signs, and ill defined conditions; and symptoms, signs, and ill defined conditions involving the digestive system. There was a strong association of diagnosis with duration of observation period, indicating that the exposed workers were more likely than unexposed workers to have a diagnosis abstracted from the company medical records due to their longer mean period of follow up. Analyses by exposure classification and mean plasma cholinesterase activity did not show a dose response. CONCLUSIONS: These data do not support a cause and effect relation of the diagnoses mentioned and exposure to chlorpyrifos.	Occupational & Environmental Medicine	55	1	65-70	Job title	Biomonitoring (blood)		Cohort (prospective)	Specific active ingredient	morbidity	medical test result	USA	hic
172	C. J. Burns, K. K. Beard and J. B. Cartmill	Mortality in chemical workers potentially exposed to 2,4-dichlorophenoxyacetic acid (2,4-D) 1945-94: an update	2001	OBJECTIVE: To update and add to a previously identified cohort of employees potentially exposed to the herbicide 2,4-dichlorophenoxyacetic acid (2,4-D). The putative association between 2,4-D and non-Hodgkin's lymphoma has been debated for more than a decade. METHODS: Cohort members were male employees of The Dow Chemical Company who manufactured or formulated 2,4-D any time from 1945 to the end of 1994. Their mortality experience was compared with national rates and with more than 40 000 other company employees who worked at the same location. RESULTS: 330 Deaths were observed among 1517 people compared with 365 expected (standardised mortality ratio (SMR)=0.90, 95% confidence interval (95% CI) 0.81 to 1.01). There were no significantly increased SMRs for any of the causes of death analyzed. When compared with the United States rates, the SMR for non-Hodgkin's lymphoma (NHL) was 1.00 (95% CI 0.21 to 2.92). The internal comparison with other Dow employees showed a non-significant relative risk of 2.63, (95% CI 0.85 to 8.33). Death was attributed to amyotrophic lateral sclerosis (ALS) for three cohort members. Compared with the other company employees, the relative risk was 3.45 (95% CI 1.10 to 11.11). The cases were employed in the manufacture or formulation of 2,4-D at different periods (1947-9, 1950-1, and 1968-86), and for varying durations of time (1.3, 1.8, and 12.5 years). CONCLUSION: There was no evidence of a causal association between exposure to 2,4-D and mortality due to all causes and total malignant neoplasms. No significant risk due to NHL was found. Although not an initial hypothesis, an increased relative risk of ALS was noted. This finding is unsupported by other animal and human studies.	Occupational & Environmental Medicine	58	1	24-30	Job exposure matrix			Cohort (prospective)	Specific active ingredient	mortality (all cause)	doctor-diagnosed	USA	hic
173	C. Jansson, N. Plato, A. L. Johansson, O. Nyren and J. Lagergren	Airborne occupational exposures and risk of oesophageal and cardia adenocarcinoma	2006	BACKGROUND: The reasons for the increasing incidence of and strong male predominance in patients with oesophageal and cardia adenocarcinoma remain unclear. The authors hypothesised that airborne occupational exposures in male dominated industries might contribute. METHODS: In a nationwide Swedish population based case control study, 189 and 262 cases of oesophageal and cardia adenocarcinoma respectively, 167 cases of oesophageal squamous cell carcinoma, and 820 frequency matched controls underwent personal interviews. Based on each study participant's lifetime occupational history the authors assessed cumulative airborne occupational exposure for 10 agents, analysed individually and combined, by a deterministic additive model including probability, frequency, and intensity. Furthermore, occupations and industries of longest duration were analysed. Relative risks were estimated by odds ratios (OR), with 95% confidence intervals (CI), using conditional logistic regression, adjusted for potential confounders. RESULTS: Tendencies of positive associations were found between high exposure to pesticides and risk of oesophageal (OR 2.3 (95% CI 0.9 to 5.7)) and cardia adenocarcinoma (OR 2.1 (95% CI 1.0 to 4.6)). Among workers highly exposed to particular agents, a tendency of an increased risk of oesophageal squamous cell carcinoma was found. There was a twofold increased risk of oesophageal squamous cell carcinoma among concrete and construction workers (OR 2.2 (95% CI 1.1 to 4.2)) and a nearly fourfold increased risk of cardia adenocarcinoma among workers within the motor vehicle industry (OR 3.9 (95% CI 1.5 to 10.4)). An increased risk of oesophageal squamous cell carcinoma (OR 3.9 (95% CI 1.2 to 12.5)), and a tendency of an increased risk of cardia adenocarcinoma (OR 2.8 (95% CI 0.9 to 8.5)), were identified among hotel and restaurant workers. CONCLUSIONS: Specific airborne occupational exposures do not seem to be of major importance in the aetiology of oesophageal or cardia adenocarcinoma and are unlikely to contribute to the increasing incidence or the male predominance.	Occupational & Environmental Medicine	63	2	107-12	Self-reported job history	Expert case-by-case assessment		Case-control	Job title	cancer	doctor-diagnosed	Sweden	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
174	C. Jayasumana, P. Paranagama, S. Agampodi, C. Wijewardane, S. Gunatilake and S. Siribaddana	Drinking well water and occupational exposure to Herbicides is associated with chronic kidney disease, in Padavi-Sripura, Sri Lanka - No section	2015	Background: The chronic kidney disease of unknown etiology (CKDu) among paddy farmers in was first reported in 1994 and has now become most important public health issue in dry zone of Sri Lanka. The objective was to identify risk factors associated with the epidemic in an area with high prevalence. Methods: A case control study was carried out in Padavi-Sripura hospital in Trincomalee district. CKDu patients were defined using health ministry criteria. All confirmed cases (N<U+201A><U+00E0><U+00E0>=<U+201A><U+00E0><U+00E0>125) fulfilling the entry criteria were recruited to the study. Control selection (N<U+201A><U+00E0><U+00E0>=<U+201A><U+00E0><U+00E0>180) was done from people visiting the hospital for CKDu screening. Socio-demographic and data related to usage of applying pesticides and fertilizers were studied. Drinking water was also analyzed using ICP-MS and ELISA to determine the levels of metals and glyphosate. Results: Majority of patients were farmers (N<U+201A><U+00E0><U+00E0>=<U+201A><U+00E0><U+00E0>107, 85.6%) and were educated up to 'Ordinary Level' (N<U+201A><U+00E0><U+00E0>=<U+201A><U+00E0><U+00E0>92, 73.6%). We specifically analyzed for the effect modification of, farming by sex, which showed a significantly higher risk for male farmers with OR 4.69 (95% CI 1.06-20.69) in comparison to their female counterparts. In the multivariable analysis the highest risk for CKDu was observed among participants who drank well water (OR 2.52, 95% CI 1.12-5.70) and had history of drinking water from an abandoned well (OR 5.43, 95% CI 2.88-10.26) and spray glyphosate (OR 5.12, 95% CI 2.33-11.26) as a pesticide. Water analysis showed significantly higher amount of hardness, electrical conductivity and glyphosate levels in abandoned wells. In addition Ca, Mg, Ba, Sr, Fe, Ti, V and Sr were high in abandoned wells. Surface water from reservoirs in the endemic area also showed contamination with glyphosate but at a much lower level. Glyphosate was not seen in water samples in the Colombo district. Conclusion: The current study strongly favors the hypothesis that CKDu epidemic among farmers in dry zone of Sri Lanka is associated with, history of drinking water from a well that was abandoned. In addition, it is associated with spraying glyphosate and other pesticides in paddy fields. Farmers do not use personnel protective equipments and wears scanty clothing due to heat when spraying pesticides.	Environmental Health: A Global Access Science Source	14	1	NA	Self-reported job history			Case-control	Specific active ingredient	genitourinary	doctor-diagnosed	Sri Lanka	lmic
175	C. Jayasumana, S. Gunatilake and S. Siribaddana	Simultaneous exposure to multiple heavy metals and glyphosate may contribute to Sri Lankan agricultural nephropathy	2015	Background: Sri Lankan Agricultural Nephropathy (SAN), a new form of chronic kidney disease among paddy farmers was first reported in 1994. It has now become the most debilitating public health issue in the dry zone of Sri Lanka. Previous studies showed SAN is a tubulo-interstitial type nephropathy and exposure to arsenic and cadmium may play a role in pathogenesis of the disease. Methods: Urine samples of patients with SAN (N = 10) from Padavi-Sripura, a disease endemic area, and from two sets of controls, one from healthy participants (N = 10) from the same endemic area and the other from a non-endemic area (N = 10; Colombo district) were analyzed for 19 heavy metals and for the presence of the pesticide- glyphosate. Results: In both cases and the controls who live in the endemic region, median concentrations of urinary Sb, As, Cd, Co, Pb, Mn, Ni, Ti and V exceed the reference range. With the exception of Mo in patients and Al, Cu, Mo, Se, Ti and Zn in endemic controls, creatinine adjusted values of urinary heavy metals and glyphosate were significantly higher when compared to non-endemic controls. Creatinine unadjusted values were significant higher for 14 of the 20 chemicals studied in endemic controls and 7 in patients, compared to non-endemic controls. The highest urinary glyphosate concentration was recorded in SAN patients (range 61.0-195.1 <U+0152><U+00BA>g/g creatinine). Conclusions: People in disease endemic area exposed to multiple heavy metals and glyphosate. Results are supportive of toxicological origin of SAN that is confined to specific geographical areas. Although we could not localize a single nephrotoxin as the culprit for SAN, multiple heavy metals and glyphosates may play a role in the pathogenesis. Heavy metals excessively present in the urine samples of patients with SAN are capable of causing damage to kidneys. Synergistic effects of multiple heavy metals and agrochemicals may be nephrotoxic.	BMC Nephrology	NA	NA	NA	Biomonitoring (urine)			Case-control	Specific active ingredient	genitourinary	doctor-diagnosed	Sri Lanka	lmic
176	C. K. Lerro, S.; Koutros, S; Andreotti, G.; Hines, C.; Lubin, J.; Ma, X; Zhang, Y.; Freeman, L. B.	Use of acetochlor and cancer incidence in the Agricultural Health Study	2015	Since its registration in 1994 acetochlor has become a commonly used herbicide in the US, yet no epidemiologic study has evaluated its carcinogenicity in humans. We evaluated the use of acetochlor and cancer incidence among licensed pesticide applicators in the Agricultural Health Study. In telephone interviews administered during 1999-2005, participants provided information on acetochlor use, use of other pesticides and additional potential confounders. We used Poisson regression to estimate relative risks (RR) and 95% confidence intervals (95% CI) for cancers that occurred from the time of interview through 2011 in Iowa and 2010 in North Carolina. Among 33,484 men, there were 4,026 applicators who used acetochlor and 3,234 incident cancers, with 304 acetochlor-exposed cases. Increased risk of lung cancer was observed among acetochlor users (RR<U+2009>=<U+2009>1.74; 95% CI: 1.07-2.84) compared to nonusers, and among individuals who reported using acetochlor/atrazine product mixtures (RR<U+2009>=<U+2009>2.33; 95% CI: 1.30-4.17), compared to nonusers of acetochlor. Colorectal cancer risk was significantly elevated among the highest category of acetochlor users (RR<U+2009>=<U+2009>1.75; 95% CI: 1.08-2.83) compared to never users. Additionally, borderline significantly increased risk of melanoma (RR<U+2009>=<U+2009>1.61; 95% CI: 0.98-2.66) and pancreatic cancer (RR<U+2009>=<U+2009>2.36; 95% CI: 0.98-5.65) were observed among acetochlor users. The associations between acetochlor use and lung cancer, colorectal cancer, melanoma and pancreatic cancer are suggestive, however the lack of exposure-response trends, small number of exposed cases and relatively short time between acetochlor use and cancer development prohibit definitive conclusions.	International Journal of Cancer	137	5	1167-75	Algorithm/model	Self-reported exposure		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
177	C. Kesavachandran, M. K. Pathak, M. F. Fareed, V. Bihari, N. Mathur and A. K. Srivastava	Health risks of employees working in pesticide retail shops: An exploratory study	2009	Background: Shop keepers dealing with pesticides are exposed to multiple pesticides that include organophosphates, organochlorines, carbamates, pyrethroids. Hence an exploratory health study was conducted on shopkeepers selling pesticides in urban areas of Lucknow and Barabanki District, Uttar Pradesh, India. Materials and Methods: Detailed information regarding socio-economic status, family history, personal habits and work practices were recorded for 20 subjects and controls by the investigator on a pre-tested questionnaire. Clinical examination including neurological studies of the shopkeepers and control subjects was done. Results: The study revealed significant slowing of motor nerve conduction velocity and low peak expiratory flow rate among shopkeepers as compared to control subjects. Prevalence of significantly higher gastro-intestinal problems was also observed among exposed subjects. Neurological, ocular, cardiovascular and musculo-skeletal symptoms were also found to be higher among shopkeepers. This was not statistically significant. Significantly higher relative risk for sickness related to systems viz., cardio-vasular, genito-urinary, respiratory, nervous and dermal was observed among exposed subjects compared to controls. Conclusions: These findings provide a prima facie evidence of clinical manifestations because of multiple exposures to pesticides and poor safety culture at work place.	Indian Journal of Occupational and Environmental Medicine	13	3	121-126	Self-reported exposure			Cross-sectional	Pesticides in general	pesticide-related symptoms	medical test result	India	lmic
178	C. Kesavachandran, V. K. Singh, N. Mathur, S. K. Rastogi, M. K. Siddiqui, M. M. Reddy, R. S. Bharti and A. M. Khan	Possible mechanism of pesticide toxicity-related oxidative stress leading to airway narrowing	2006	The study was conducted to assess the magnitude of oxidative stress and lung function abnormalities in 34 male pesticide sprayers on exposure to pesticides in mango plantations. Biochemical studies on blood antioxidant enzymes revealed an unchanged glutathione level and increased level of malondialdehyde ($P < 0.001$), which indicates that pesticide sprayers may have suffered from oxidative stress. Decreased acetyl-cholinesterase levels ($P < 0.001$) in sprayers compared to the controls suggest inhibition of cholinesterase activity. The present study shows that pesticide toxicity might lead to oxidative stress and airway narrowing resulting in decreased peak expiratory flow rate.	Redox Report	11	4	159-62	Biomonitoring (blood)			Cross-sectional	Chemical class	respiratory	medical test result	India	lmic
179	C. Kielb, S. Lin, M. Herdt-Losavio, E. Bell, B. Chapman, C. M. Rocheleau, C. Lawson, M. Waters, P. Stewart, R. S. Olney, P. A. Romitti, Y. Cao, C. Druschel and S. National Birth Defects Prevention	Maternal periconceptional occupational exposure to pesticides and selected musculoskeletal birth defects	2014	This population-based U.S. study investigated the association between major musculoskeletal malformations and periconceptional maternal occupational pesticide exposure for a wide range of occupations. We conducted a multi-site case-control analysis using data from the National Birth Defects Prevention Study among employed women with due dates from October 1, 1997 through December 31, 2002. Cases included 871 live-born, stillborn, or electively terminated fetuses with isolated craniosynostosis, gastroschisis, diaphragmatic hernia, or transverse limb deficiencies. Controls included 2857 live-born infants without major malformations. Using self-reported maternal occupational information, an industrial hygienist used a job-exposure matrix and expert opinion to evaluate the potential for exposure to insecticides, herbicides or fungicides for each job held during one month pre-conception through three months post-conception. Exposures analyzed included any exposure (yes/no) to pesticides, to insecticides only, to both insecticides and herbicides (I+H) and to insecticides, herbicides and fungicides (I+H+F). We used logistic regression to evaluate the association between exposures and defects, controlling for infant and maternal risk factors. Occupational exposure to I+H+F was associated with gastroschisis among infants of women aged 20 years or older (adjusted odds ratio [aOR]=1.88; 95% confidence interval [CI]: 1.16-3.05), but not for women under age 20 (aOR=0.48; 95% CI: 0.20-1.16). We found no significant associations for the other defects. Additional research is needed to validate these findings in a separate population.	International Journal of Hygiene & Environmental Health	217	2	248-54	Self-reported job history	Job exposure matrix		Case-control	Job title	offspring	doctor-diagnosed	USA	hic
180	C. L. Aguilar-Garduno, M.; Blanco-Munoz, J.; Rodriguez-Barranco, M.; Hernandez, A. F.; Bassol, S.; Gonzalez-Alzaga, B.; Cebrian, M. E.	Changes in male hormone profile after occupational organophosphate exposure. A longitudinal study	2013	There is a growing concern about the endocrine effects of long-term, low-level exposure to organophosphate (OP) compounds. Studies on experimental animals have found that OP pesticides have an impact on the endocrine system and a few clinical and epidemiological studies have also shown that OPs may affect the male hormone profile, although results are inconsistent. We have evaluated the effect of exposure to OP pesticides, measured through urinary levels of six dialkylphosphate (DAP) metabolites, on male hormone profile in 136 floriculture workers from the State of Mexico and Morelos during two agricultural periods with different degree of pesticide exposure. Generalized estimated equations (GEE) models were developed and adjusted for several potential confounders, including PON1 enzyme activity, as a biomarker of susceptibility, and serum levels of p,p'-DDE, a metabolite of the pesticide DDT widely used in Mexico until 1999 for control of agricultural pests and malaria. Exposure of male floriculture workers to OP pesticides was associated with increased serum levels of follicle-stimulating hormone (FSH) and prolactin and with decreased serum testosterone and inhibin B levels. Among all DAPs tested, only DETP was inversely associated with luteinizing hormone (LH). Estradiol showed a marginally significant positive trend with DEP and DETP derivatives. In conclusion, OP pesticides may have an impact on the endocrine function because of their potential to modify the male hormone profile as a function of the type of pesticide used as well as the magnitude of exposure.	Toxicology	307	NA	55-65	Biomonitoring (urine)			Cohort (prospective)	Chemical class	endocrine/nutritional/metabolical	medical test result	Mexico	umic
181	C. L. Beseler and L. Stallones	Structural equation modeling of the relationships between pesticide poisoning, depressive symptoms and safety behaviors among Colorado farm residents	2006	PURPOSE: To use structural equation modeling (SEM) to test the theory that a past pesticide poisoning may act as a mediator in the relationship between depression and safety practices. Depression has been associated with pesticide poisoning and was more strongly associated with safety behaviors than workload, social support or health status of farm residents in a previously published report. METHODS: A cross-sectional survey of farmers and their spouses was conducted in eight counties in northeastern Colorado. Depressive symptoms were assessed using the Center for Epidemiologic Studies-Depression (CES-D) scale. Exploratory and confirmatory factor analyses were used to identify symptoms most correlated with risk factors for depression and safety practices. SEM was used to examine theoretical causal models of the relationship between depression and poor health, financial difficulties, a history of pesticide poisoning, and safety practices. RESULTS: Exploratory factor analysis identified three factors in the CES-D scale. The SEM showed that poor health, financial difficulties and a history of pesticide poisoning significantly explained the depressive symptoms. Models with an excellent fit for the safety behaviors resulted when modeling the probability that the pesticide poisoning preceded depression, but no fit was possible when reversing the direction and modeling depression preceding pesticide poisoning. CONCLUSIONS: Specific depressive symptoms appeared to be significantly associated with primarily animal handling and farm machinery. The order of events, based on SEM results, was a pesticide poisoning preceding depressed mood in relation to safety behaviors.	Journal of Agromedicine	11	3	35-46	Self-reported exposure			Cross-sectional	Pesticides in general	mental disorders	self-reported	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
182	C. L. Beseler and L. Stallones	A cohort study of pesticide poisoning and depression in Colorado farm residents	2008	PURPOSE: Depressive symptoms have been associated with pesticide poisoning among farmers in cross-sectional studies, but no longitudinal studies have assessed the long-term influence of poisoning on depressive symptoms. The purpose of this study was to describe the associations between pesticide poisoning and depressive symptoms in a cohort of farm residents. METHODS: Farm operators and their spouses were recruited in 1993 from farm truck registrations using stratified probability sampling. The Center for Epidemiologic Studies-Depression scale was used to evaluate depression in participants using generalized estimating equations. Baseline self-reported pesticide poisoning was the exposure of interest in longitudinal analyses. RESULTS: Pesticide poisoning was significantly associated with depression in three years of follow-up after adjusting for age, gender, and marital status (odds ratio [OR] 2.59; 95% confidence interval [CI] 1.20-5.58). Depression remained elevated after adjusting for health, decreased income, and increased debt (OR 2.00; CI 0.91-4.39) and was primarily due to significant associations with the symptoms being bothered by things (OR 3.29; CI 1.95-5.55) and feeling everything was an effort (OR 1.93; CI 1.14-3.27). CONCLUSIONS: Feeling bothered and that everything was an effort were persistently associated with a history of pesticide poisoning, supportive of the hypothesis that prolonged irritability may result from pesticide poisoning.	Annals of Epidemiology	18	10	768-74	Self-reported exposure			Cohort (prospective)	Pesticides in general	mental disorders	self-reported	USA	hic
183	C. L. Beseler, L. Stallones, J. A. Hoppin, M. C. Alavanja, A. Blair, T. Keefe and F. Kamel	Depression and pesticide exposures among private pesticide applicators enrolled in the Agricultural Health Study	2008	BACKGROUND: We evaluated the relationship between diagnosed depression and pesticide exposure using information from private pesticide applicators enrolled in the Agricultural Health Study between 1993 and 1997 in Iowa and North Carolina. METHODS: There were 534 cases who self-reported a physician-diagnosed depression and 17,051 controls who reported never having been diagnosed with depression and did not feel depressed more than once a week in the past year. Lifetime pesticide exposure was categorized in three mutually exclusive groups: low (< 226 days, the reference group), intermediate (226-752 days), and high (> 752 days). Two additional measures represented acute high-intensity pesticide exposures: an unusually high pesticide exposure event (HPEE) and physician-diagnosed pesticide poisoning. Logistic regression analyses were performed relating pesticide exposure to depression. RESULTS: After adjusting for state, age, education, marital status, doctor visits, alcohol use, smoking, solvent exposure, not currently having crops or animals, and ever working a job off the farm, pesticide poisoning was more strongly associated with depression [odds ratio (OR) = 2.57; 95% confidence interval (CI), 1.74-3.79] than intermediate (OR = 1.07; 95% CI, 0.87-1.31) or high (OR = 1.11; 95% CI, 0.87-1.42) cumulative exposure or an HPEE (OR = 1.65; 95% CI, 1.33-2.05). In analysis of a subgroup without a history of acute poisoning, high cumulative exposure was significantly associated with depression (OR = 1.54; 95% CI, 1.16-2.04). CONCLUSION: These findings suggest that both acute high-intensity and cumulative pesticide exposure may contribute to depression in pesticide applicators. Our study is unique in reporting that depression is also associated with chronic pesticide exposure in the absence of a physician-diagnosed poisoning.	Environmental Health Perspectives	116	12	1713-9	Self-reported exposure			Case-control	Pesticides in general	mental disorders	doctor-diagnosed	USA	hic
184	C. L. Callahan, M. Al-Batanony, A. A. Ismail, G. Abdel-Rasoul, O. Hendy, J. R. Olson, D. S. Rohlman and M. R. Bonner	Chlorpyrifos exposure and respiratory health among adolescent agricultural workers	2014	Chlorpyrifos (CPF) is a commonly used organophosphate insecticide (OP). In adults, exposure to OPs has been inconsistently associated with reduced lung function. OP exposure and lung function has not been assessed in adolescents. The objective of this study was to assess CPF exposure and lung function among Egyptian adolescents. We conducted a 10-month study of male adolescent pesticide applicators (n = 38) and non-applicators of similar age (n = 24). Urinary 3,5,6-trichloro-2-pyridinol (TPCy), a CPF-specific metabolite, was analyzed in specimens collected throughout the study. Spirometry was performed twice after pesticide application: day 146, when TCPy levels were elevated and day 269, when TCPy levels were near baseline. Applicators had higher levels of TCPy (mean cumulative TCPy day 146 = 33,217.6; standard deviation (SD) = 49,179.3) than non-applicators (mean cumulative TCPy day 146 = 3290.8; SD = 3994.9). Compared with non-applicators, applicators had higher odds of reporting wheeze, odds ratio = 3.41 (95% CI: 0.70; 17.41). Cumulative urinary TCPy was inversely associated with spirometric measurements at day 146, but not at day 269. Although generally non-significant, results were consistent with an inverse association between exposure to CPF and lung function.	International Journal of Environmental Research & Public Health [Electronic Resource]	11	12	13117-29	Biomonitoring (urine)			Cohort (prospective)	Specific active ingredient	respiratory	medical test result	Egypt	lmic
185	C. Le Cornet, B. Fervers, S. O. Dalton, M. Feychting, E. Pukkala, T. Tynes, J. Hansen, K. C. Nordby, R. Beranger, T. Kauppinen, S. Uuksulainen, P. Wiebert, T. Woldbaek, N. E. Skakkebaek, A. Olsson and J. Schuz	Testicular germ cell tumours and parental occupational exposure to pesticides: a register-based case-control study in the Nordic countries (NORD-TEST study)	2015	OBJECTIVES: A potential impact of exposure to endocrine disruptors, including pesticides, during intrauterine life, has been hypothesised in testicular germ cell tumour (TGCT) aetiology, but exposure assessment is challenging. This large-scale registry-based case-control study aimed to investigate the association between parental occupational exposure to pesticides and TGCT risk in their sons. METHODS: Cases born in 1960 or onwards, aged between 14 and 49 years, and diagnosed between 1978 and 2013 in Denmark, Finland, Norway or Sweden, were identified from the respective nationwide cancer registries. Four controls per case were randomly selected from the general national populations, matched on year of birth. Information on parental occupation was collected through censuses or Pension Fund information and converted into a pesticide exposure index based on the Finnish National Job-Exposure Matrix. RESULTS: A total of 9569 cases and 32,028 controls were included. No overall associations were found for either maternal or paternal exposures and TGCT risk in their sons, with ORs of 0.83 (95% CI 0.56 to 1.23) and of 1.03 (0.92 to 1.14), respectively. Country-specific estimates and stratification by birth cohorts revealed some heterogeneity. Cryptorchidism, hypospadias and family history of testicular cancer were risk factors but adjustment did not change the main results. CONCLUSIONS: This is the largest study on prenatal exposure to pesticides and TGCT risk, overall providing no evidence of an association. Limitations to assess individual exposure in registry-based studies might have contributed to the null result.	Occupational & Environmental Medicine	72	11	805-11	Registers	Job exposure matrix		Case-control	Job title	offspring	doctor-diagnosed	AHIC	AHIC

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
186	C. Ledda, M. Fiore, L. Santarelli, M. Bracci, G. Mascali, G. D'Agati M, A. Bus<U+221A><U+2020>, M. Ferrante and V. Rapisarda	Gestational Hypertension and Organophosphorus Pesticide Exposure: A Cross-Sectional Study	2015	Hypertension is the most common medical problem encountered during pregnancy, complicating 2-3% of pregnancies. High blood pressure (BP) with diastolic BP <U+201A><U+00E2><U+2022> 90 mm Hg and/or systolic BP <U+201A><U+00E2><U+2022> 140 mm Hg arising after week 22 of pregnancy and resolving after delivery is defined as gestational hypertension (GHY). The aim of this cross-sectional study was to investigate whether occupational and/or environmental exposure to organophosphorus (OP) pesticide affects GHY. Women at approximately 22 weeks of gestation were recruited. OP pesticide exposure in the first trimester of pregnancy was classified into four categories: no exposure, indirect exposure, domestic exposure, and occupational exposure. Application of the exclusion criteria left 2203 participants (mean age 30.4 <U+00AC><U+00B1> 11.6 years). Data analysis showed that in women with indirect OP pesticide exposure the incidence of GHY was slightly higher than that in the world population, whereas domestic exposure involved a 7% increase and occupational exposure a 12% increase. Analysis of the pesticides used by participants highlighted a possible role for malathion and diazinon (adjusted OR 1.09 and 1.14, resp.). Further investigation of exposed workers and the general population is clearly warranted given the broad diffusion of OP pesticides and their possible public health impact, maybe by including a wider range of health outcomes.	BioMed Research International	2015	NA	NA	Self-reported exposure			Cross-sectional	Chemical class	circulatory	doctor-diagnosed	Italy	hic
187	C. M. Bulka, M. L. Daviglus, V. W. Persky, R. A. Durazo-Arvizu, M. L. Avil<U+221A><U+00A9>s-Santa, L. C. Gallo, H. D. Hosgood, R. H. Singer, G. A. Talavera, B. Thyagarajan, D. Zeng and M. Argos	Occupational Exposures and Metabolic Syndrome among Hispanics/Latinos	2017	Objective: We assessed the cross-sectional relationships of self-reported current occupational exposures to solvents, metals, and pesticides with metabolic syndrome and its components among 7127 participants in the Hispanic Community Health Study/Study of Latinos. Methods: Metabolic syndrome was defined as a clustering of abdominal obesity, high triglycerides, low high-density lipoprotein cholesterol, high blood pressure, and/or high fasting glucose. Regression models that incorporated inverse probability of exposure weighting were used to estimate prevalence ratios. Results: Solvent exposure was associated with a 32% higher prevalence of high blood pressure (95% confidence interval: 1.09 to 1.60) than participants not reporting exposure. No associations were observed for occupational exposures with abdominal obesity, high triglycerides, low high-density lipoprotein, or metabolic syndrome. Conclusion: Our findings suggest that solvent exposure may be an important occupational risk factor for high blood pressure among Hispanics/Latinos in the United States.	Journal of Occupational and Environmental Medicine	59	11	1047-1055	Self-reported exposure			Cross-sectional	Pesticides in general	endocrine/nutritional/metabolical	doctor-diagnosed	USA	hic
188	C. M. Bulka, M. L. Daviglus, V. W. Persky, R. A. Durazo-Arvizu, T. Elfassy, J. P. Lash, D. J. Lee, A. R. Ramos, W. Tarraf and M. Argos	Association of occupational exposures with cardiovascular disease among hispanics/latinos: Results from the hispanic community health study/study of Latinos	2017	Background: Cardiovascular disease (CVD) is a leading cause of mortality and morbidity in the US. Acute, high-dose exposures to some solvents, metals, and pesticides can be cardiotoxic, but little is known about the cardiovascular effects of chronic, low-level exposures. Thus, we evaluated cross-sectional associations of self-reported occupational exposures to solvents, metals, and pesticides with CVD prevalence among diverse Hispanics/Latinos in the US. Methods: The analyses included baseline data from 7,404 currently employed participants, ages 18-74 years, from the HCHS/SOL. CVD was defined as the presence of one or more of the following: coronary heart disease (self-reported angina, myocardial infarction, coronary bypass surgery, balloon angioplasty, or stent placement in coronary arteries, or electrocardiogram [ECG] evidence of major Q wave abnormalities or minor Q, QS waves with ST, T abnormalities); atrial fibrillation (self-reported or ECG evidence of atrial fibrillation or flutter); heart failure (self-reported); or cerebrovascular disease (self-reported stroke or transient ischemic attack). Survey-weighted Poisson regression models were used to estimate prevalence ratios (PR) and 95% confidence intervals (CIs) for each occupational exposure, adjusted for sociodemographic (age, gender, field center, Hispanic/Latino background, health insurance), acculturation (language, years of duration in the US), lifestyle (smoking, alcohol, physical activity, diet), and occupational (full-or part-time employment) characteristics. Results: Overall, 6.1% of participants had any prevalent CVD; coronary heart disease (4.3%) was most common, followed by cerebrovascular disease (1.0%), heart failure (0.8%), and atrial fibrillation (0.7%). Current occupational exposures to solvents, metals, and pesticides were reported by 6.5%, 8.5%, and 4.7% of participants, respectively. The prevalence of any CVD (PR: 2.18, 95% CI: 1.34-3.55), coronary heart disease (PR: 2.20, 95% CI: 1.31-3.71), and atrial fibrillation (PR: 5.92, 95% CI: 1.89-18.61) were significantly elevated for participants who reported current occupational pesticide exposure compared to no exposure. Current occupational metal exposure was associated with a greater prevalence of atrial fibrillation (PR: 3.78, 95% CI: 1.24-11.46). Further adjustment for hypertension, hypercholesterolemia, diabetes, or body mass index did not appreciably change the results. Current occupational solvent exposure was not associated with CVD prevalence. Conclusions: Occupational exposure to pesticides and metals is associated with higher CVD prevalence at baseline. These cross-sectional associations do not appear to be attenuated by hypertension, hypercholesterolemia, diabetes, or obesity. Further research is needed to examine other biologic mechanisms that may underlie these associations.	Circulation	135	NA	NA	Self-reported exposure			Cross-sectional	Pesticides in general	circulatory	doctor-diagnosed	USA	hic
189	C. M. Mahan, T. A. Bullman, H. K. Kang and S. Selvin	A case-control study of lung cancer among Vietnam veterans	1997	Because of concerns among veterans over Agent Orange exposure, the Department of Veterans Affairs (VA) has conducted a series of studies of specific cancers among Vietnam veterans. Lung cancer is the topic of investigation in this report. The VA's Patient Treatment File (PTF) was used to identify 329 Vietnam era veterans with a diagnosis of lung cancer made between 1983 and 1990. The PTF is a computerized hospitalized database of inpatient records, including patients' demographic data, and diagnoses. A record is created for each patient discharged from any one of the VA's Medical Centers. Variables abstracted from the military record include education, race, branch of service, Military Occupational Specialty Code, rank, and units served within Vietnam. Two hundred sixty-nine controls were randomly selected from the PTF file of men hospitalized for a reason other than cancer. A second control group numbering 111 patients with colon cancer was also selected from the PTF file. Data were also gathered on exposure to Agent Orange through the location of each individual ground troop veteran's unit in relation to an area sprayed and the time elapsed since that area was sprayed. The crude odds ratio between service in Vietnam and lung cancer was of borderline significance (odds ratio = 1.39 with 95% confidence interval = 1.01-1.92). The relationship disappeared when the confounder year of birth was considered. We conclude from these data that there is no evidence of increased risk in lung cancer associated with service in Vietnam at this time.	Journal of Occupational & Environmental Medicine	39	8	740-7	Registers			Case-control	Chemical class	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
190	C. M. Rocheleau, P. A. Romitti, W. T. Sanderson, L. Sun, C. C. Lawson, M. A. Waters, P. A. Stewart, R. S. Olney and J. Reefhuis	Maternal occupational pesticide exposure and risk of hypospadias in the National Birth Defects Prevention Study	2011	BACKGROUND: Hypospadias is a common congenital malformation among men in which the urethral opening is ventrally displaced. Pesticide exposure has been suggested as a possible etiologic factor, but previous epidemiologic studies have produced inconsistent results. METHODS: We used data from the National Birth Defects Prevention Study (NBDPS), a population-based case-control study, to examine maternal occupational exposure to fungicides, insecticides, and herbicides among 647 hypospadias case infants and 1496 unaffected male control infants with estimated delivery dates from October 1997 to December 2002. Periconceptional (1 month before conception through the first trimester of pregnancy) pesticide exposures were assigned by an expert rater, assisted by a job-exposure matrix (JEM), from a job history completed by mothers during a telephone interview. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated with multivariable logistic regression, and adjusted for relevant covariates. RESULTS: Maternal periconceptional occupational exposure to any pesticides (yes/no) was not associated with an increased risk of hypospadias (OR = 0.78; 95% CI = 0.61-1.01). Maternal occupational periconceptional pesticide exposure type (insecticides, fungicides, and herbicides) and estimated quantity also showed no significantly increased risk of hypospadias and no evidence of a dose-response relationship; however, the estimated pesticide exposure levels in this population were low. CONCLUSION: Using broad classes of insecticides, herbicides, and fungicides, we found no evidence that low intensity maternal periconceptional occupational pesticide exposure was a risk factor for hypospadias.	Birth Defects Research	91	11	927-36	Job exposure matrix			Case-control	Type of pesticide	offspring	doctor-diagnosed	USA	hic
191	C. M. Rocheleau, S. J. Bertke, C. C. Lawson, P. A. Romitti, W. T. Sanderson, S. Malik, P. J. Lupo, T. A. Desrosiers, E. Bell, C. Druschel, A. Correa, J. Reefhuis and S. National Birth Defects Prevention	Maternal occupational pesticide exposure and risk of congenital heart defects in the National Birth Defects Prevention Study	2015	BACKGROUND: Congenital heart defects (CHDs) are common birth defects, affecting approximately 1% of live births. Pesticide exposure has been suggested as an etiologic factor for CHDs, but previous results were inconsistent. METHODS: We examined maternal occupational exposure to fungicides, insecticides, and herbicides for 3328 infants with CHDs and 2988 unaffected control infants of employed mothers using data for 1997 through 2002 births from the National Birth Defects Prevention Study, a population-based multisite case-control study. Potential pesticide exposure from 1 month before conception through the first trimester of pregnancy was assigned by an expert-guided task-exposure matrix and job history details self-reported by mothers. Odds ratios (ORs) and 95% confidence intervals (CIs) were estimated using multivariable logistic regression. RESULTS: Maternal occupational exposure to pesticides was not associated with CHDs overall. In examining specific CHD subtypes compared with controls, some novel associations were observed with higher estimated pesticide exposure: insecticides only and secundum atrial septal defect (OR=1.8; 95% CI, 1.3-2.7, 40 exposed cases); both insecticides and herbicides and hypoplastic left heart syndrome (OR=5.1; 95% CI, 1.7-15.3, 4 exposed cases), as well as pulmonary valve stenosis (OR=3.6; 95% CI, 1.3-10.1, 5 exposed cases); and insecticides, herbicides, and fungicides and tetralogy of Fallot (TOF) (OR=2.2; 95% CI, 1.2-4.0, 13 exposed cases). CONCLUSION: Broad pesticide exposure categories were not associated with CHDs overall, but examining specific CHD subtypes revealed some increased odds ratios. These results highlight the importance of examining specific CHDs separately. Because of multiple comparisons, additional work is needed to verify these associations.	Birth Defects Research	103	10	823-33	Task exposure matrix	Self-reported job history		Case-control	Type of pesticide	offspring	doctor-diagnosed	USA	hic
192	C. M. Samanic, A. J. De Roos, P. A. Stewart, P. Rajaraman, M. A. Waters and P. D. Inskip	Occupational exposure to pesticides and risk of adult brain tumors	2008	The authors examined incident glioma and meningioma risk associated with occupational exposure to insecticides and herbicides in a hospital-based, case-control study of brain cancer. Cases were 462 glioma and 195 meningioma patients diagnosed between 1994 and 1998 in three US hospitals. Controls were 765 patients admitted to the same hospitals for nonmalignant conditions. Occupational histories were collected during personal interviews. Exposure to pesticides was estimated by use of a questionnaire, combined with pesticide measurement data abstracted from published sources. Using logistic regression models, the authors found no association between insecticide and herbicide exposures and risk for glioma and meningioma. There was no association between glioma and exposure to insecticides or herbicides, in men or women. Women who reported ever using herbicides had a significantly increased risk for meningioma compared with women who never used herbicides (odds ratio = 2.4, 95% confidence interval: 1.4, 4.3), and there were significant trends of increasing risk with increasing years of herbicide exposure (p = 0.01) and increasing cumulative exposure (p = 0.01). There was no association between meningioma and herbicide or insecticide exposure among men. These findings highlight the need to go beyond job title to elucidate potential carcinogenic exposures within different occupations.	American Journal of Epidemiology	167	8	976-985	Registers	Self-reported exposure		Case-control	Type of pesticide	cancer	doctor-diagnosed	USA	hic
193	C. M. Tanner, F. Kamel, G. W. Ross, J. A. Hoppin, S. M. Goldman, M. Korell, C. Marras, G. S. Bhudhikanok, M. Kasten, A. R. Chade, K. Comyns, M. B. Richards, C. Meng, B. Priestley, H. H. Fernandez, F. Cambi, D. M. Umbach, A. Blair, D. P. Sandler and J. W. Langston	Rotenone, paraquat, and Parkinson's disease	2011	BACKGROUND: Mitochondrial dysfunction and oxidative stress are pathophysiologic mechanisms implicated in experimental models and genetic forms of Parkinson's disease (PD). Certain pesticides may affect these mechanisms, but no pesticide has been definitively associated with PD in humans. OBJECTIVES: Our goal was to determine whether pesticides that cause mitochondrial dysfunction or oxidative stress are associated with PD or clinical features of parkinsonism in humans. METHODS: We assessed lifetime use of pesticides selected by mechanism in a case-control study nested in the Agricultural Health Study (AHS). PD was diagnosed by movement disorders specialists. Controls were a stratified random sample of all AHS participants frequency-matched to cases by age, sex, and state at approximately three controls:one case. RESULTS: In 110 PD cases and 358 controls, PD was associated with use of a group of pesticides that inhibit mitochondrial complex I [odds ratio (OR)=1.7; 95% confidence interval (CI), 1.0-2.8] including rotenone (OR=2.5; 95% CI, 1.3-4.7) and with use of a group of pesticides that cause oxidative stress (OR = 2.0; 95% CI, 1.2-3.6), including paraquat (OR=2.5; 95% CI, 1.4-4.7). CONCLUSIONS: PD was positively associated with two groups of pesticides defined by mechanisms implicated experimentally-those that impair mitochondrial function and those that increase oxidative stress-supporting a role for these mechanisms in PD pathophysiology.	Environmental Health Perspectives	119	6	866-72	Self-reported exposure			Case-control	Specific active ingredient	neurological	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
194	C. M. Tanner, G. W. Ross, S. A. Jewell, R. A. Hauser, J. Jankovic, S. A. Factor, S. Bressman, A. Deligtisch, C. Marras, K. E. Lyons, G. S. Bhudhikanok, D. F. Roucoux, C. Meng, R. D. Abbott and J. W. Langston	Occupation and risk of parkinsonism: a multicenter case-control study	2009	BACKGROUND: We examined risk of parkinsonism in occupations (agriculture, education, health care, welding, and mining) and toxicant exposures (solvents and pesticides) putatively associated with parkinsonism. OBJECTIVE: To investigate occupations, specific job tasks, or exposures and risk of parkinsonism and clinical subtypes. DESIGN: Case-control. SETTING: Eight movement disorders centers in North America. PARTICIPANTS: Inclusion criteria were parkinsonism (>or=2 cardinal signs), diagnosis within 8 years of recruitment (to minimize survival bias), and ability to participate in detailed telephone interviews. Control subjects were primarily nonblood relatives or acquaintances of patients. MAIN OUTCOME MEASURES: This multicenter case-control study compared lifelong occupational and job task histories to determine associations with parkinsonism and certain clinical subtypes (postural instability and gait difficulty and age at diagnosis <or=50 years). RESULTS: Findings in 519 cases and 511 controls were analyzed. Work in agriculture, education, health care, or welding was not associated with increased risk of parkinsonism. Unexpected increased risks associated with legal, construction and extraction, or religious occupations were not maintained after adjustment for duration. Risk of parkinsonism increased with pesticide use (odds ratio, 1.90; 95% confidence interval, 1.12-3.21), use of any of 8 pesticides mechanistically associated with experimental parkinsonism (2.20; 1.02-4.75), and use of 2,4-dichlorophenoxyacetic acid (2.59; 1.03-6.48). None of the specific occupations, job tasks, or task-related exposures were associated with younger age at diagnosis (<or=50 years). Ever working in business and finance, legal occupations, construction and extraction, or transportation and material moving was associated with postural instability and gait difficulty subtype of parkinsonism. Tobacco use was inversely associated with parkinsonism risk. CONCLUSION: The association of disease risk with pesticides support a toxicant-induced cause of parkinsonism.	Archives of Neurology	66	9	1106-13	Self-reported exposure			Case-control	Specific active ingredient	neurological	doctor-diagnosed	USA/Canada	AHIC
195	C. M. Vajdic, L. Fritschi, A. E. Grulich, J. M. Kaldor, G. Benke, A. Kricker, A. M. Hughes, J. J. Turner, S. Milliken, C. Goumas and B. K. Armstrong	Atopy, exposure to pesticides and risk of non-Hodgkin lymphoma	2007	Pesticide exposure has been associated with non-Hodgkin lymphoma (NHL) risk in a number of studies, and two recent studies suggest that the increased risk may be confined to those with a history of asthma. We examined the interaction between occupational pesticide exposure and atopy on risk of NHL in an Australian population-based case-control study. Incident cases (n = 694) were diagnosed in New South Wales or the Australian Capital Territory between 2000 and 2001 and controls (n = 694) were randomly selected from electoral rolls and frequency-matched to cases by age, sex and state of residence. Occupational pesticide exposure was determined by an expert occupational hygienist's assessment of job-specific questionnaires administered by telephone. History of atopy (asthma, hay fever, eczema and food allergy) was self-reported. Logistic regression models included the three matching variables, ethnicity and sun exposure. The OR for NHL with substantial pesticide exposure and any history of asthma was 3.07 (95% CI 0.55-17.10) and with substantial pesticide exposure and no asthma history it was 4.23 (95% CI 1.76-10.16). The p-value for interaction was 0.29. A similar pattern of risk was observed for each of the pesticide subtypes; for asthma at various times of life; for hay fever, eczema, food allergy and any atopy, in men only and for follicular lymphomas only. Although this study had limited power, the findings do not suggest modification of the association between pesticide exposure and NHL risk by asthma or atopic disease more generally.	International Journal of Cancer	120	10	135597	Expert case-by-case assessment			Case-control	Pesticides in general	cancer	doctor-diagnosed	Australia	hic
196	C. M. Wilhelm, A. K. Calsing and L. B. da Silva	Assessment of DNA damage in floriculturists in southern Brazil	2015	The aim of this study was to assess possible genotoxic effects on floriculturists in a region of the state of Rio Grande do Sul, in the south of Brazil, using the micronucleus test (MN) and comet assay. Thirty-seven floriculturists and 37 individuals not exposed to pesticides participated in the study. The micronucleus test was performed with epithelial cells of the oral mucosa. In the microscopic analysis, 2000 cells were evaluated per subject, verifying the frequency of MN and the frequency of other nuclear abnormalities (nuclear buds, binucleated cells, and karyorrhexis). For the comet assay in the peripheral blood lymphocytes, 100 cells were classified in five classes, according to the migration of DNA fragments, thereby generating the frequency of damaged cells and the damage index. There was no difference between the exposed and control groups in the frequencies of MN and other nuclear abnormalities in the epithelial cells of the oral mucosa. However, the comet assay showed that both the frequency of DNA damaged cells and the damage index were significantly greater in the exposed group. The results therefore indicate that floriculturists are exposed to mixtures of pesticides with genotoxic potential.	Environmental Science & Pollution Research	22	11	2294699	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Brazil	umic
197	C. Marquez, C. Villalobos, S. Poblete, E. Villalobos, M. de Los Angeles Garcia and S. Duk	Cytogenetic damage in female Chilean agricultural workers exposed to mixtures of pesticides	2005	The VIII Region of Bio-Bio is a major fruit-growing area of Chile that makes intensive use of agricultural pesticides. The cytogenetic damage associated with exposure to mixtures of pesticides was evaluated by comparing peripheral blood lymphocyte micronucleus (MN) frequencies in a group of 64 female agricultural workers and 30 female controls. The exposed subjects worked during the spring and summer in thinning and pruning fruit trees and in harvesting and packing different fruits, such as raspberries, grapes, apples, and kiwis. They did not use any protective measures during their work activities. A significant increase in the frequency of binucleated cells with micronuclei (BNMN) was found in the exposed women as compared with the controls (36.94 +/- 14.47 vs. 9.93 +/- 6.17 BNMN/1000 BN cells; P < 0.001). The frequency of BNMN varied as a function of age in both the exposed and control groups, but no correlation was found between BNMN frequency and the duration of exposure. Also, smoking and other habits had no effect on MN frequency. Our study confirms that occupational exposure to pesticide mixtures results in cytogenetic damage.	Environmental & Molecular Mutagenesis	45	1	43107	Self-reported exposure			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Chile	hic
198	C. Martinez, E. Garcia-Martin, H. Alonso-Navarro, J. Benito-Leon, I. Puertas, L. Rubio, T. Lopez-Alburquerque, J. A. Agundez and F. J. Jimenez-Jimenez	Glutathione-S-transferase P1 polymorphism and risk for essential tremor	2008	Glutathione-S-transferases (GST) are polymorphic enzymes that participate in the metabolism of carcinogens (including those of tobacco smoke) and pesticides. We investigated the possible association between the GSTP1 genotype and allelic variants and the risk for essential tremor (ET). We studied the frequency of the GSTP1 genotypes and allelic variants in 200 patients with ET and 220 healthy controls using PCR-RFLP method. The association between GSTP1 polymorphism and the exposure to some environmental factors (agricultural work, pesticides, well-water and smoking-cigarettes habit) was also studied in a subgroup of patients. The frequencies of the GSTP1 genotypes and allelic variants did not differ significantly between patients with ET and controls or between patients with ET exposed to agricultural work, well water and cigarette smoking versus those non-exposed. Mutated allelic variants were significantly more frequent in patients with ET exposed to pesticides versus those non-exposed. GSTP1 polymorphism was unrelated with the age of onset of ET. GSTP1 genotypes and allelic variants were not related with the risk for ET with the possible exception of those patients exposed to pesticides.	European Journal of Neurology	15	3	234-8	Self-reported exposure			Case-control	Pesticides in general	neurological	doctor-diagnosed	Spain	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
199	C. Nisse, J. M. Haguenoer, B. Grandbastien, C. Preudhomme, B. Fontaine, J. M. Brillet, R. Lejeune and P. Fenaux	Occupational and environmental risk factors of the myelodysplastic syndromes in the North of France	2001	Aetiological factors of the myelodysplastic syndromes (MDS) are largely unknown, with the exception of alkylating agents, ionizing radiation and benzene. Some other risk factors have been suggested by the few epidemiological studies reported (solvents, ammonia, exhaust gases, metals, pesticides, alcohol). We performed a case-control study to assess the relationship between occupational or environmental factors and MDS. Two hundred and four patients with newly diagnosed MDS, and 204 sex- and age-matched controls were included. Medical history, demographic data, lifetime exposure and hobbies were obtained. Qualitative and quantitative exposure to chemical and physical hazards were evaluated with the patients and reviewed by a group of experts in occupational exposure. The median age was 70 years and 62% of the patients were men. In univariate analyses, we found relationships between MDS and smoking habits, gardening, occupations such as health professionals, technical and sale representatives, machine operators, agricultural workers, textile workers, qualitative occupational exposures (exposed/non-exposed) to oil, solvents, ammonia, pesticides, fertilizers, cereal dusts, contact with poultry or livestock and infective risk, and lifetime cumulative exposure to solvents, oil, textile dust and infective risk. The main risk factors of MDS determined by multivariate analyses (conditional logistic regression) were, being an agricultural worker [odds ratio (OR) = 3.66; 95% confidence interval (CI) 1.9-7.0], textile operator (OR = 3.66; 95% CI 1.9-7.9), health professional (OR = 10.0; 95% CI 2.1-48.7), commercial and technical sale representative (OR = 4.45; 95% CI 1.4-14.6), machine operator (OR = 2.69; 95% CI 1.2-6.0), living next to an industrial plant (OR = 2.45; 95% CI 1.5-4.1), smoking (OR = 1.74; 95% CI 1.1-2.7) and lifetime cumulative exposure to oil (OR = 1.1; 95% CI 1.0-1.2). Further studies should be performed to assess specific exposures more precisely and it would be of interest to develop a map of haematological malignancies according to industrial background.	British Journal of Haematology	112	4	927-35	Expert case-by-case assessment			Case-control	Pesticides in general	cancer	doctor-diagnosed	France	hic
200	C. O'Callaghan-Gordo, P. Singh, S. , S. Singh, J. S. Thakur, N. Pearce and P. K. Dhillon	Occupation and risk of breast cancer in Punjab, India: A multi-centre case-control study	2016	The incidence of breast cancer has increased in India in the last decades. Breast cancer is the most common cancer in women in urban areas and the second most common in rural areas of India. Changes in women's life style (e.g. in physical activity, diet and reproductive behaviours) may account in part for the increasing incidence. However, environmental and occupational exposures, such as exposure to pesticides, may be also associated with the increasing incidence, especially in rural area where many women do not present risk factors related to reproductive behaviours or body composition. There have been relatively few studies of these issues in low-and-middle-income countries such as India, where occupational and environmental exposures may be high. The aim of our study is to investigate environmental and occupational risk factors for breast cancer in women aged 30-64 years in an agricultural region of India. The current report focuses on the findings for woman's occupation and husband's occupation. Between 2012-2015 we enrolled 404 hospital-based breast cancer cases (International Classification of Diseases for Oncology code C5) and 361 hospital-based and population-based controls matched by age and hospital/district and area type (i.e urban, semi-urban, rural). We collected information of both participant and husband's lifetime occupation, according to India's National Classification of Occupations (comparable to ISCO), through interviewer-administrated questionnaire. Detailed information on demographic characteristics, medical history, lifestyle and reproductive behaviours was also collected, and objective anthropometric measures were recorded. We are currently preparing the data set to conduct the analysis. We will conduct logistic regression adjusted for potential confounders (including area type, age at diagnosis, first birth and number of children, breastfeeding, hours of rigorous physical activity, total fat and kilocalorie intake) and we will evaluate dose-response relationships according to duration, frequency and intensity of exposure. Results will we availabe before the EPICOH conference.	Occupational and Environmental Medicine	73	NA	A164	Self-reported job history			Case-control	Pesticides in general	cancer	doctor-diagnosed	India	lmic
201	C. P. Karunanayake, J. A. Dosman and P. Pahwa	Non-hodgkin<U+201A><U+00C4><U+2264>s lymphoma and work in agriculture: Results of a two case-control studies in Saskatchewan, Canada	2013	Objectives: The objective was to examine the association between non-Hodgkin<U+201A><U+00C4><U+2264>s lymphoma (NHL) and farming-related activities, gender, pesticides exposure, and exposure to chemicals other than pesticides in Saskatchewan. Materials and Methods: Male and female study participants were taken from two separate case-control studies conducted in Saskatchewan province, Canada. A case was defined as any man or woman aged 19 years and older with a first diagnosis of NHL registered by the Saskatchewan Cancer Agency during the study period. Conditional logistic regression was used to fit the statistical models. Results: Farming exposure and exposure to pesticides-contaminated cloths were related to an increased risk of NHL. Exposure to pesticides was strongly associated with an increased risk of NHL, especially for men. Conclusion: For men, the incidence of NHL was associated with exposure to pesticides after adjusting for other independent predictors.	Indian Journal of Occupational and Environmental Medicine	17	3	114-121	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Canada	hic
202	C. P. Karunanayake, J. J. Spinelli, J. R. McLaughlin, J. A. Dosman, P. Pahwa and H. H. McDuffie	Hodgkin lymphoma and pesticides exposure in men: a Canadian case-control study	2012	The objective of this study was to investigate the putative associations of specific pesticides with Hodgkin lymphoma. A population-based, case-control study of Hodgkin lymphoma was conducted among males in six regions of Canada. Data were collected by a mailed questionnaire followed by a telephone interview to obtain detailed exposures data for those reporting >= 10 hours per year of pesticide exposure. Conditional logistic regression was used to fit statistical models. Comparisons of 316 Hodgkin lymphoma cases and 1506 controls identified several factors as predictors for increased Hodgkin lymphoma risk: family history of cancer, exposure to the insecticide chlorpyrifos [OR (95% CI) = 1.19 (1.03, 1.37)], and previous diagnosis of acne or shingles. The increased risk of developing Hodgkin lymphoma detected among Canadian men who used chlorpyrifos must be interpreted cautiously; however the strength of its association indicates that it requires investigation in other populations.	Journal of Agromedicine	17	1	43373	Self-reported exposure	Self-reported exposure		Case-control	Specific active ingredient	cancer	doctor-diagnosed	Canada	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
203	C. P. Piel, C.; Tual, S.; Migault, L.; Lemarchand, C.; Carles, C.; Boulanger, M.; Gruber, A.; Rondeau, V.; Marcotullio, E.; Lebailly, P.; Baldi, I.; group, Agrican	Central nervous system tumors and agricultural exposures in the prospective cohort AGRICAN	2017	Studies in farmers suggest a possible role of pesticides in the occurrence of Central Nervous System (CNS) tumors but scientific evidence is still insufficient. Using data from the French prospective agricultural cohort AGRICAN (Agriculture & Cancer), we investigated the associations between exposure of farmers and pesticide users to various kinds of crops and animal farming and the incidence of CNS tumors, overall and by subtypes. Over the 2005-2007, 181,842 participants completed the enrollment questionnaire that collected a complete job calendar with lifetime history of farming types. Associations were estimated using proportional hazards models with age as underlying timescale. During a 5.2 years average follow-up, 273 incident cases of CNS tumors occurred, including 126 gliomas and 87 meningiomas. Analyses showed several increased risks of CNS tumors in farmers, especially in pesticide users (hazard ratio=1.96; 95% confidence interval: 1.11-3.47). Associations varied with tumor subtypes and kinds of crop and animal farming. The main increases in risk were observed for meningiomas in pig farmers and in farmers growing sunflowers, beets and potatoes and for gliomas in farmers growing grasslands. In most cases, more pronounced risk excesses were observed among pesticide applicators. Even if we cannot completely rule out the contribution of other factors, pesticide exposures could be of primary concern to explain these findings.	International Journal of Cancer	141	9	1771-1782	Self-reported exposure			Cohort (prospective)	Pesticides in general	cancer	doctor-diagnosed	France	hic
204	C. Padungtod, B. L. Lasley, D. C. Christiani, L. M. Ryan and X. Xu	Reproductive hormone profile among pesticide factory workers	1998	Serum follicle-stimulating hormone (FSH), luteinizing hormone (LH), and testosterone levels, as well as urinary levels of FSH, LH, and E1C, a metabolite of testosterone, were measured to investigate the adverse reproductive effects of organophosphate pesticides among Chinese factory workers who were occupationally exposed to ethylparathion and methamidophos. Thirty-four exposed workers were randomly chosen and recruited from a large pesticide factory, and 44 unexposed workers were selected from a nearby textile factory. A quantitative pesticide exposure assessment was performed among a subset of the exposed and unexposed workers. Information on potential confounders was collected in an interview. A single blood sample was collected at the end of a work shift, when each subject also donated a semen sample. Three first-voided urine samples were collected from each worker on 3 consecutive days. Urinary p-nitrophenol level at 1 hour after the work shift correlated with serum (r = 0.71, P < 0.01) and urinary (r = 0.51, P = 0.04) FSH levels. Stratifying by the subjects' exposure status, we found a significant negative correlation among the exposed group between urinary FSH level and sperm count (r = -0.61, P < 0.01) and between urinary FSH level and sperm concentration (r = -0.53, P = 0.03). Pesticide exposure alone was significantly associated with serum LH level (beta [coefficient of exposure effect] = 0.79; 95% confidence interval [CI] = 0.42, 1.16) but not with serum FSH or testosterone or with any urinary hormone levels. With adjustment for age, rotating shift work, current cigarette smoking, and current alcohol consumption, exposure significantly increased the serum LH level by 1.1 mIU/mL (95% CI = 0.34, 1.82). Meanwhile, the serum FSH level was slightly elevated (beta [coefficient of exposure effect] = 1.38; 95% CI = -0.09, 2.85) and the serum testosterone level was decreased (beta = -55.13; 95% CI = -147.24, 37) with increased pesticide exposure. Age and rotating shift work appeared to act as confounders. We conclude that organophosphate pesticides have a small effect on male reproductive hormones, suggestive of a secondary hormonal disturbance after testicular damage.	Journal of Occupational & Environmental Medicine	40	12	1038-47	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	reproductive	medical test result	China	umic
205	C. Padungtod, T. Niu, Z. Wang, D. A. Savitz, D. C. Christiani, L. M. Ryan and X. Xu	Paraoxonase polymorphism and its effect on male reproductive outcomes among Chinese pesticide factory workers	1999	BACKGROUND: Serum paraoxonase has been associated with the metabolism of organophosphate pesticides in humans. Molecular analysis of the human paraoxonase gene (PON1) has revealed that Arg192 homozygotes have a greater detoxifying capability than Gln192 homozygotes. We examined the effects of PON1 genotypes on male reproductive outcomes and its interaction with exposure to organophosphate pesticides. METHODS: We studied 60 Chinese pesticide-factory workers and 89 textile-factory workers who were unexposed to pesticides. The respective allele frequencies of Arg192 and Gln192 were 0.62 and 0.38. Pesticide exposure among 36 exposed subjects and 12 unexposed subjects, regardless of gender, was assessed by personal measurement of pesticide residues over an entire 8-hr shift and measurement of urinary p-nitrophenol level over a 24-hr period. We analyzed semen and hormone data collected from male subjects. RESULTS: When the three PON1 genotypes were analyzed separately, a gene dose effect was not detected. We used the unexposed Arg192 homo/heterozygotes as the reference group, and re-analyzed the data. Exposed Arg192 homo/heterozygotes had significantly lower sperm count (chi 2 = 9.01, P < 0.01) and lower percentage of sperm with normal morphology (chi 2 = 4.18, P < 0.05) than the reference group. Both unexposed Gln192 homozygotes (chi 2 = 4.90, P < 0.05) and exposed Arg192 homo/heterozygotes (chi 2 = 10.00, P < 0.01) showed significantly lower sperm concentrations than the reference group. In addition, exposed Arg192 homo/heterozygotes had significantly higher serum LH levels (chi 2 = 7.94, P < 0.01) than the reference group. CONCLUSIONS: Because of a small sample size, our findings are highly preliminary. Nevertheless, it calls for further investigation of the interaction between the PON1 genotype and organophosphate pesticide exposure on male reproductive outcomes.	American Journal of Industrial Medicine	36	3	379-87	Biomonitoring (urine)			Cohort (prospective)	Specific active ingredient	reproductive	medical test result	China	umic
206	C. Paz-y-Mino, G. Bustamante, M. E. Sanchez and P. E. Leone	Cytogenetic monitoring in a population occupationally exposed to pesticides in Ecuador	2002	We analyzed the incidence of structural and numerical chromosomal aberrations (CAs) in workers of a plantation of flowers located in Quito, Ecuador, in South America. This study included 41 individuals occupationally exposed to 27 pesticides, some of which are restricted in many countries and are classified as extremely toxic by the World Health Organization; among these are aldicarb and fenamiphos. The same number of individuals of the same age, sex, and geographic area were selected as controls. Workers exposed to these pesticides showed an increased frequency of CA compared with control group (20.59% vs. 2.73%; p < 0.001). We conclude that screening for CA is an adequate biomarker for evaluating and detecting genotoxicity resulting from exposure to pesticides. Levels of erythrocyte acetylcholinesterase were also determined as a complementary metabolic study. Levels below the optimal (> 28 U/mL blood) were found in 88% of exposed individuals; this clearly shows the effect of organophosphate pesticides. When comparing the levels of acetylcholinesterase and structural CA frequencies, there was a negative linear correlation (r = 0.416; p < 0.01). We conclude that by using both analyses it may be possible to estimate damage produced by exposure to organophosphate pesticides.	Environmental Health Perspectives	110	11	1077-80	Registers			Cohort (prospective)	Specific active ingredient	genetic (biomarkers)	medical test result	Ecuador	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
207	C. Paz-y-Mino, M. Arevalo, M. E. Sanchez and P. E. Leone	Chromosome and DNA damage analysis in individuals occupationally exposed to pesticides with relation to genetic polymorphism for CYP 1A1 gene in Ecuador	2004	DNA damage was measured by using the alkaline comet assay and the chromosomal aberration (CA) test using peripheral blood samples from 45 pesticide sprayers from Cayambe, Ecuador. From a total of approximately 200 nuclei scored for each donor with the comet assay, a highly significant increase in DNA migration was observed when compared with a similar unexposed control population. Additionally, in the CA test, the exposed individuals were found to be significantly different when compared to the control population. Polymorphisms for the CYP 1A1 (Msp I and Ile/Val) in exposed individuals were analyzed by PCR-RFLP and allele-specific PCR techniques. No association was found between the polymorphisms and higher levels of DNA damage as assessed by the comet assay.	Mutation Research	562	1	77-89	Registers			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Ecuador	umic
208	C. Perrotta, S. Kleefeld, A. Staines, P. Tewari, A. J. De Roos, D. Baris, B. Birmann, B. Chiu, W. Cozen, N. Becker, L. Foretova, M. Maynadie, A. Nieters, S. de Sanjose, L. Miligi, A. Seniori Costantini, M. Purdue, J. Spinelli and P. Cocco	Multiple myeloma and occupation: a pooled analysis by the International Multiple Myeloma Consortium	2013	OBJECTIVE: We investigated occupational risk of multiple myeloma (MM) in a pooled analysis of five international case-control studies. METHODS: We calculated the odds ratio and its 95% confidence interval for selected occupations with unconditional regression analysis in 1959 MM cases and 6192 controls, by pooling study-specific risks using random-effects meta-analysis. Exposure to organic solvents was assessed with a job-exposure matrix (JEM). RESULTS: Gardeners and nursery workers combined, most likely exposed to pesticides, showed a 50% increase in risk (OR = 1.50, 95% CI 0.9-2.3), while other farming jobs did not. Metal processors (OR = 1.55, 95% CI 0.9-2.3), female cleaners (OR = 1.32, 95% CI 1.0-1.8), and high level exposure to organic solvents (OR = 1.38, 95% CI 0.96-1.8) also showed moderately increased risks. CONCLUSIONS: Additional case-control studies of MM aetiology are warranted to further investigate the nature of the repeatedly reported increase in MM risk in several occupational groups.	Cancer Epidemiology	37	3	300-5	Job exposure matrix			Case-control	Pesticides in general	cancer	doctor-diagnosed	AHIC	AHIC
209	C. Piccoli, C. Cremonese, R. J. Koifman, S. Koifman and C. Freire	Pesticide exposure and thyroid function in an agricultural population in Brazil	2016	Although numerous pesticides may interfere with thyroid function, however, epidemiological evidence supporting this relationship is limited, particularly regarding modern non-persistent pesticides. We sought to evaluate the association of agricultural work practices, use of contemporary-use pesticides, and OC pesticides residue levels in serum with circulating thyroid hormone levels in an agricultural population. A cross-sectional study was conducted with a random sample of 275 male and female farm residents in Farroupilha, South of Brazil. Information on sociodemographics, lifestyle and agricultural work was obtained through questionnaire. Blood samples were collected on all participants and analyzed for cholinesterase activity, serum residues of OC pesticides, and levels of free T4 (FT4), total T3 (TT3) and TSH. Non-persistent pesticides exposure assessment was based on questionnaire information on current use of pesticides, and frequency and duration of use, among others. Associations were explored using multivariate linear regression models. Total lifetime years of use of fungicides, herbicides and dithiocarbamates in men was associated with increased TSH accompanied by decrease in FT4, with evidence of a linear trend. In addition, there was an association between being sampled in the high pesticide-use season and increased TSH levels. Conversely, farm work and lifetime use of all pesticides were related with slight decrease in TSH and increased TT3 and FT4, respectively. In general, pesticide use was not associated with thyroid hormones in women. Subjects with detected serum concentrations of beta-hexachlorocyclohexane, endrin, dieldrin, heptachlor epoxide B, gamma-chlordane, transnonachlor, heptachlor, p,p'-dichlorodiphenylethane and endosulfan II experienced slight changes in TT3; however, associations were weak and inconsistent. These findings suggest that both cumulative and recent occupational exposure to agricultural pesticides may affect the thyroid function causing hypothyroid-like effects, particularly in men.	Environmental Research	151	NA	389-398	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	endocrine/nutritional/metabolical	medical test result	Brazil	umic
210	C. R. Garcia-Garcia, T. Parron, M. Requena, R. Alarcon, A. M. Tsatsakis and A. F. Hernandez	Occupational pesticide exposure and adverse health effects at the clinical, hematological and biochemical level	2016	AIMS: Although epidemiological studies have investigated associations between occupational pesticide exposures and different adverse health outcomes, they have rarely assessed individuals at two time-points of a same crop season with different pesticide use. MATERIAL AND METHODS: Clinical symptoms, physical examination signs, hematological and clinical chemistry parameters were measured in 189 intensive agriculture workers and 91 healthy control subjects from Almeria coastline (Southeastern Spain) to evaluate potential effects of pesticide exposure. KEY FINDINGS: Greenhouse workers showed an increased risk of ocular and skin signs relative to controls at the period of high pesticide exposure (OR: 4.80 and 2.87, respectively); however, no differences were observed for clinical symptoms. A greater risk for ECG changes (OR: 3.35) and altered spirometry (OR: 5.02) was found at the period of low exposure. Erythrocyte acetylcholinesterase was significantly decreased in greenhouse workers relative to controls in both periods. Assessment of hematological parameters revealed increased counts of erythrocytes, leukocytes, platelets and hemoglobin in greenhouse workers relative to controls, and also in the period of high versus low pesticide exposure. Changes in clinical chemistry parameters included decreased levels of glucose, creatinine, total cholesterol, triglyceride and alkaline phosphatase in greenhouse workers relative to controls; however, these parameters were raised in the period of high versus low pesticide exposure. SIGNIFICANCE: These findings suggest that chronic occupational exposure to pesticides of lower toxicity than former compounds under integrated production systems elicit mild toxic effects, particularly targeting the skin and eyes, as well as subtle subclinical (biochemical) changes of unknown long-term consequences.	Life Sciences	145	NA	274-83	Job title			Cohort (prospective)	Job title	pesticide-related symptoms	medical test result	Spain	hic
211	C. R. Gracia, M. D. Sammel, C. Coutifaris, D. S. Guzick and K. T. Barnhart	Occupational exposures and male infertility	2005	The purpose of this study was to determine the association between male occupational exposures and infertility. A retrospective case-control study was performed using data collected between 1991 and 1997 at nine US clinical sites as part of a previously conducted large multicenter trial. Cases were defined as infertile males whose partner had an infertility evaluation with normal results, and controls were defined as fertile males whose partner became pregnant within 2 years. Exposures were assessed by means of self-report questionnaires. Bivariate, stratified, and multivariable analyses were performed. A total of 650 infertile cases and 698 fertile controls were compared. In the final model, a protective association with infertility was observed for occupational exposures to radiation (odds ratio=0.21, 95% confidence interval: 0.06, 0.77) and video display terminals (odds ratio=0.30, 95% confidence interval: 0.13, 0.68). No significant associations were noted between infertility and exposure to shift work, metal fumes, electromagnetic fields, solvents, lead, paint, pesticides, work-related stress, or vibration. Overall, no clear, clinically important associations between occupational exposures and male infertility could be identified in this study.	American Journal of Epidemiology	162	8	729-33	Self-reported exposure			Case-control	Pesticides in general	reproductive	self-reported	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
212	C. R. Samanic, J.; Dosemeci, M.; Hou, L.; Hoppin, J. A.; Sandler, D. P.; Lubin, J.; Blair, A.; Alavanja, M. C.	Cancer incidence among pesticide applicators exposed to dicamba in the agricultural health study	2006	BACKGROUND: Dicamba is an herbicide commonly applied to crops in the United States and abroad. We evaluated cancer incidence among pesticide applicators exposed to dicamba in the Agricultural Health Study, a prospective cohort of licensed pesticide applicators in North Carolina and Iowa. METHODS: Detailed pesticide exposure information was obtained through a self-administered questionnaire completed from 1993 to 1997. Cancer incidence was followed through 31 December 2002 by linkage to state cancer registries. We used Poisson regression to estimate rate ratios and 95% confidence intervals for cancer subtypes by tertiles of dicamba exposure. Two dicamba exposure metrics were used: lifetime exposure days and intensity-weighted lifetime exposure days (lifetime days x intensity score). RESULTS: A total of 41,969 applicators were included in the analysis, and 22,036 (52.5%) reported ever using dicamba. Exposure was not associated with overall cancer incidence nor were there strong associations with any specific type of cancer. When the reference group comprised low-exposed applicators, we observed a positive trend in risk between lifetime exposure days and lung cancer (p = 0.02), but none of the individual point estimates was significantly elevated. We also observed significant trends of increasing risk for colon cancer for both lifetime exposure days and intensity-weighted lifetime days, although these results are largely due to elevated risk at the highest exposure level. There was no apparent risk for non-Hodgkin lymphoma. CONCLUSIONS: Although associations between exposure and lung and colon cancer were observed, we did not find clear evidence for an association between dicamba exposure and cancer risk.	Environmental Health Perspectives	114	10	1521-6	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
213	C. R. Sharpe, E. L. Franco, B. de Camargo, L. F. Lopes, J. H. Barreto, R. R. Johnsson and M. A. Mauad	Parental exposures to pesticides and risk of Wilms' tumor in Brazil	1995	Wilms' tumor is one of the most common abdominal childhood malignancies. Wilms' tumor rates in Brazil are among the highest in the world. This prompted the Brazilian Wilms' Tumor Study Group to conduct a hospital-based, multicenter, case-control investigation of environmental risk factors for the disease. Between April 1987 and January 1989, the authors collected information on relevant occupational exposures by interviewing the parents of 109 Wilms' tumor cases admitted to hospitals in Sao Paulo, Salvador, Belo Horizonte, and Jau. Also interviewed were the parents of 218 age- and sex-matched control children who had been admitted for treatment of nonneoplastic diseases to the same or nearby hospitals. Odds ratios (ORs) adjusted for income and education were calculated by conditional logistic regression. Consistently elevated risks were seen for farm work involving frequent use of pesticides by both the father (OR = 3.24, 95% confidence interval (CI) 1.2-9.0) and the mother (OR = 128.6, 95% CI 6.4-2,569). These risk elevations were restricted to cases diagnosed after 2 years of age (ORs > 4), for paternal exposure, and after 4 years of age (OR = 14.8, 95% CI 2.2-98.8), for maternal exposure. Risk elevations were also more pronounced among boys (paternal exposure OR = 8.56, 95% CI 2.1-35.1; maternal exposure OR = 4.60, 95% CI 0.8-26.4) than among girls (paternal exposure OR = 1.31, 95% CI 0.4-4.1; maternal exposure OR = 2.03, 95% CI 0.5-8.9).	American Journal of Epidemiology	141	3	210-7	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Brazil	umic
214	C. S. Fong, C. W. Cheng and R. M. Wu	Pesticides exposure and genetic polymorphism of paraoxonase in the susceptibility of Parkinson's disease	2005	PURPOSE: The manifestation of Parkinson's disease (PD) is characterized by bradykinesia, resting tremor, and rigidity. The etiology of PD remains unknown. Recently several studies suggest that some environmental and genetic factors may be related to the cause of PD. Genetic variation in xenobiotic metabolizing enzymes involved in the disposition of pesticides, such as paraoxonase I (PON 1), may increase the risk of PD. We investigated the association between PON1 polymorphism, pesticides exposure and risk of Parkinson's disease in Taiwanese population. METHODS: We enrolled 162 controls and 125 patients with idiopathic PD. Histories of exposures to environmental factors and other information were collected with a questionnaire filled out during a face-to-face interview with the subject. The data included years of farming, drinking water sources, occupational exposures to pesticides, duration and the initial age of the pesticides exposure. Buccal mucosa cells are collected from each subject and PON1 polymorphism at codon 54 (L and M alleles) is studied with PCR-based restriction fragment length polymorphism (RFLP) analysis. RESULTS: There is significant association between the risk of PD and exposure to pesticides (OR=1.72, 95% CI=1.07-2.75). On the otherhand, no significant differences are found in PON1 genotype or allelic distribution between PD and control groups. We further investigated participants who had reported exposure to pesticides and found that the frequency distribution of PON1 genotypes did not differ significantly between patients and controls. CONCLUSION: The present survey reveals the close relationship between exposure to pesticides and Parkinson's disease. There are no significant differences in the distribution of PON1 genotypes between cases and controls.	Acta Neurologica Taiwanica	14	2	55-60	Self-reported exposure			Case-control	Pesticides in general	neurological	doctor-diagnosed	Taiwan	hic
215	C. S. Fong, R. M. Wu, J. C. Shieh, Y. T. Chao, Y. P. Fu, C. L. Kuao and C. W. Cheng	Pesticide exposure on southwestern Taiwanese with MnSOD and NQO1 polymorphisms is associated with increased risk of Parkinson's disease	2007	BACKGROUND: Hypothetic mechanism of the individual vulnerability to oxidative stress through metabolism of environmental xenobiotics and genotypic polymorphisms has been considered to promote the development of Parkinson's disease (PD). In this case-control study, we determined the role of manganese-containing superoxide dismutase (MnSOD) and NAD(P)H: quinone oxidoreductase 1 (NQO1) genes in PD risk in a population with high prevalence of pesticide exposure. METHODS: From southwestern region of Taiwan, we enrolled 153 patients with idiopathic PD and 155 healthy control subjects matched for age, sex and origin. Detailed questionnaires of face-to-face interviews among these subjects were collected. PCR-based restriction fragment length polymorphism (RFLP) assays were used to determine the genotypes of MnSOD (-9 T>C) and NQO1 (609 C>T) genes. RESULTS: Exposure to pesticides associated with PD was significant among patients with an increased odds ratio (OR) of 1.69 (95%CI, 1.07-2.65), and this association remained significant after adjustment for age, sex, and cigarette smoking (aOR=1.68, 95%CI, 1.03-2.76, P=0.023). Considering genetic factors, there were no significant differences in frequencies of both genotypes of MnSOD and NQO1 polymorphisms between PD patients and the control subjects (P>0.05). However, this difference in genotype distribution was significant among subjects who had been exposed to pesticide, with aOR of 2.49 (95%CI, 1.18-5.26, P=0.0072) for MnSOD C allele and aOR of 2.42 (95%CI, 1.16-4.76, P=0.0089) for NQO1 T allele, respectively. Moreover, among subjects exposed to pesticide, the combined MnSOD/NQO1 variant genotype was significantly associated with a 4.09-fold increased risk of PD (95%CI, 1.34-10.64, P=0.0052). CONCLUSION: Susceptible variants of MnSOD and NQO1 genes may interact with occupational pesticide exposure to increase PD risk in southwestern Taiwanese.	Clinica Chimica Acta	378	1	136-41	Self-reported exposure	Self-reported exposure		NA	Pesticides in general	NA	NA	Taiwan	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
216	C. S. Padungtod, D. A.; Overstreet, J. W.; Christiani, D. C.; Ryan, L. M.; Xu, X.	Occupational pesticide exposure and semen quality among Chinese workers	2000	This study investigated the association between occupational pesticide exposure and semen quality among Chinese workers. Male workers, 32 who were exposed to organophosphate pesticides and 43 who were not exposed were recruited from two nearby factories and interviewed. Following a work shift, semen and urine samples were collected for pesticide metabolite analysis. Semen samples were analyzed for sperm concentration, percentage of motility, and percentage of normal structure. Within the exposed group, the mean end-of-shift urinary p-nitrophenol levels were 0.22 and 0.15 mg/L for the high- and low-exposure subgroups, respectively. Linear regression analysis of individual semen parameters revealed a significant reduction of sperm concentration (35.9 x 10(6) vs 62.8 x 10(6), p < 0.01) and percentage of motility (47% vs 57%, p = 0.03) but not percentage of sperm with normal structure (57% vs 61%, p = 0.13). Multivariate modeling showed a significant overall shift in the mean semen parameter. Occupational exposure to ethylparathion and methamidophos seems to have a moderately adverse effect on semen quality.	Journal of Occupational & Environmental Medicine	42	10	982-92	Biomonitoring (urine)			Cross-sectional	Chemical class	reproductive	medical test result	China	umic
217	C. Salerno, A. Carcagni, S. Sacco, L. A. Palin, K. Vanhaecht, M. Panella and D. Guido	An Italian population-based case-control study on the association between farming and cancer: Are pesticides a plausible risk factor?	2016	This population-based case-control study investigated the association between farming (a proxy for pesticide exposure) and cancer in the Vercelli suburban area (northwest Italy). The residents, aged 25 to 79 years, in the above-mentioned area during the period 2002-2009 were considered. Cases were all the first hospital admissions for cancer. Controls were all the subjects not included in the cases and not excluded from the study. Cases and controls were classified according to whether they occupationally resulted farmers or nonfarmers during the period 1965-2009. Cancer odds ratios (ORs) between farmers and nonfarmers were calculated with generalized linear mixed models adjusted by gender and age. Farmers showed higher odds for all cancers (OR=1.459; p < .001), nonmelanoma skin cancer, colorectal cancer, and breast cancer. The results suggest a plausible association between pesticide exposure and cancer occurrence.	Archives of Environmental & Occupational Health	71	3	147-56	Job title			Case-control	Job title	cancer	doctor-diagnosed	Italy	hic
218	C. Salerno, S. Sacco, M. Panella, P. Berchialla, K. Vanhaecht and L. A. Palin	Cancer risk among farmers in the Province of Vercelli (Italy) from 2002 to 2005: an ecological study	2014	BACKGROUND: As the link between agricultural pesticides and numerous types of human cancers is wellknown. Farmers living in the Province of Vercelli (Italy) were observed to verify if they have a higher cancer risk than the rest of the local employed population. Literature showed a well-known excess of cancer morbidity and mortality in the Province of Vercelli, but only few studies focused on cancer incidence in local farmers. Studying farmers could allow to assess the causal importance respectively of environmental pressure and professional exposure factors in explaining cancer excesses in the above-mentioned area. MATERIALS AND METHODS: The present ecological study considered all cancer new cases recorded among the mean employed population with a range of age from 25 to 84 years and resident in the Province of Vercelli during the four-year period 2002-2005. Cancer odds ratios, by gender and type of cancer, between farmers and non-farmers were calculated. RESULTS: Farmers showed a higher risk for the following tumors: colorectal (OR 2.38, IC95%: 1,76-2,87), leaukaemia (OR 2.65, IC95%:2,12-2,89), digestive system (OR 2.16, IC95% 1,92-2,33), lymphoma OR 2.08, IC95%:1,99-2,23), melanoma (OR 2.90, IC95%:2,54-3,15), myeloma OR 3.55, IC95%:3,23-3,70), pancreas OR 3.38, IC95%:3,14-3,61), lung (1.59, IC95%:1,12-2,38) and kidney (2.70, IC95%:2,41-2,99). Males showed a higher risk for lung cancer, females for liver neoplasm, melanoma and lymphoma. CONCLUSIONS: Farmers showed a higher risk for several cancers. Further studies are needed, in order to examine in detail the issue, to encourage the use of personal protective equipment and to promote a more responsible pesticides use.	Annali di Igiene	26	3	255-63	Registers			Cohort (prospective)	Job title	cancer	doctor-diagnosed	Italy	hic
219	C. Solomon, J. Poole, K. T. Palmer, R. Peveler and D. Coggon	Acute symptoms following work with pesticides	2007	BACKGROUND: Serious accidental poisoning by pesticides is rare in the UK, but more minor pesticide-related illness may be under-reported. Anecdotally, use of sheep dip has been linked with flu-like symptoms. AIM: To explore the frequency, nature and determinants of acute symptoms following work with pesticides. METHODS: A postal survey of men in three rural areas of England and Wales provided data on occupational use of five categories of pesticide, occurrence of 12 specified symptoms within 48 h of using pesticides and tendency to somatize. Risk factors for pesticide-related symptoms were assessed by modified Cox regression. RESULTS: Of 10 765 responders (response rate = 31%), 4108 had at some time used pesticides occupationally, including 935 (23%) who reported symptoms following such work on at least one occasion. In two areas, acute symptoms were most frequent following use of sheep dip (29 and 32% of users), but in the third area the rate was significantly lower (13% of users). The relative frequency of symptoms was similar for all five categories of pesticide, and flu-like symptoms did not cluster unusually among users of sheep dip. Risk of pesticide-related symptoms increased with somatizing tendency (prevalence ratio for highest versus lowest category 2.4, 95% confidence interval 2.0-3.0) and was higher in men who had used pesticides most often or handled concentrate. CONCLUSION: Acute symptoms are common following work with pesticides, but in many cases the illness may arise through psychological rather than toxic mechanisms.	Occupational Medicine (Oxford)	57	7	505-11	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	UK	hic
220	C. Solomon, J. Poole, K. T. Palmer, R. Peveler and D. Coggon	Neuropsychiatric symptoms in past users of sheep dip and other pesticides	2007	OBJECTIVES: To explore the prevalence and pattern of neuropsychiatric symptoms in past users of sheep dip and other pesticides. METHODS: From a postal survey of men born between 1933 and 1977 and resident in three rural areas of England and Wales (response rate 31%), data were obtained on lifetime history of work with pesticides, neurological symptoms in the past month, current mental health and tendency to be troubled by non-neurological somatic symptoms (summarised as a somatising tendency score). Risk factors for current neuropsychiatric symptoms were assessed by modified Cox regression. RESULTS: Data were available for 9844 men, including 1913 who had worked with sheep dip, 832 with other insecticides but not sheep dip and 990 with other pesticides but never with sheep dip or insecticides. Neurological symptoms were consistently 20-60% more common in past users of sheep dip than in men who had never worked with pesticides, but their prevalence was also higher in men who had worked only with pesticides other than sheep dip or insecticides. They clustered strongly within individuals, but this clustering was not specific to men who had worked with sheep dip. Reporting of three or more neurological symptoms was associated with somatising tendency (prevalence ratio (PR) 15.0, 95% CI 11.4 to 19.5, for the highest vs the lowest category of somatisation) and was more common in users of sheep dip (PR 1.3, 95% CI 1.0 to 1.6), other insecticides (PR 1.4, 95% CI 1.0 to 1.8) and other pesticides (PR 1.3, 95% CI 1.0 to 1.7) than in non-users. Among users of sheep dip, prevalence was higher in men who had dipped most often, but not in those who had worked with sheep dip concentrate. Past use of pesticides was not associated with current anxiety or depression. CONCLUSION: Neurological symptoms are more common in men who have worked with sheep dip, but the association is not specific to sheep dip or insecticides. A toxic cause for the excess cannot be ruled out, but several features of our observations suggest that psychological mechanisms have a role.	Occupational & Environmental Medicine	64	4	259-66	Self-reported exposure			Cross-sectional	Type of pesticide	NA	self-reported	UK	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
221	C. T. Lemarchand, S.; Boulanger, M.; Carles, C.; Lev<U+221A><U+2122>que-Morlais, N.; St<U+221A><U+00A9>phanie, P.; Clin, B.; Guizard, A. V.; Velten, M.; Marcotullio, E.; Baldi, I.; Lebailly, P.	Occupational exposure to organochlorine insecticides and prostate cancer risk in AGRICAN	2016	Introduction Farming and pesticide use have been repeatedly and consistently associated with prostate cancer risk but analysis on the role of specific active ingredients remain scarce and results inconclusive. We assessed associations between occupational exposure to specific organochlorines and prostate cancer in the agricultural cohort AGRICAN. Methods The AGRICAN cohort consisted of 181,842 participants, affiliated for at least 3 years to the French agricultural health insurance. Data on pesticide use on 6 crops, including years of beginning and ending, were collected from the enrolment questionnaire. Exposure to organochlorine insecticides and duration of exposure between 1950 and 2010 was assessed with the help of a crop-exposure matrix (PESTIMAT). Associations with prostate cancer were estimated using a Cox regression analysis with attained age as time scale. Results From enrolment (2005-2007) to 2009, 1 672 incident prostate cancer cases among 98,974 male participants were identified through linkage with cancer registries. A nearly significant increase in prostate cancer risk was observed when considering organochlorines as a group (HR 1.15, 95% CI: 0.99-1.32; 463 cases) with no linear relationship with duration of exposure. A significant association was observed for eight individual organochlorine pesticides (out of 18) and a significant relationship with duration of exposure was observed for 6 of them (aldrin, chlordane, dieldrin, DDD, toxaphene and HCH). When adjusting for exposure to the 5 other organochlorines, a greater prostate cancer risk remained among men with the highest duration of exposure to HCH and DDD. Conclusions Our study provides new results concerning the association between pesticide exposure and prostate cancer, especially for two organochlorines: DDD (a DDT metabolite) and HCH (a mix of isomers including g-HCH also called lindane).	Occupational and Environmental Medicine	73	NA	A43	Crop exposure matrix			Cohort (prospective)	Chemical class	cancer	doctor-diagnosed	France	hic
222	C. T. Lemarchand, S.; Lev<U+221A><U+2122>que-Morlais, N.; Perrier, S.; Guizard, A. V.; Velten, M.; Rigaud, E.; Baldi, I.; Lebailly, P.	Prostate cancer risk among French farmers in the AGRICAN cohort	2014	Objectives Prostate cancer is one of the most frequent cancers worldwide. Its aetiology is largely unknown with farming being suspected. Our aim was to identify occupational risk factors for prostate cancer in farmers in the French prospective cohort study AGRICAN. Method During the period from enrollment (2005-2007) to 31 December 2009, 1664 incident prostate cancer cases were identified in the cohort (n = 92669) by linkage with cancer registries. Data on occupational history and agricultural exposures during lifetime on 13 types of crops and 5 types of animals were collected by the enrollment questionnaire. Hazard ratios (HR) were estimated using Cox regression analysis with attained age as underlying time scale. Results Elevated risks were found for six agricultural activities: cattle, hogs, horses, grassland, wheat/barley and tobacco (HR=1.07 to 1.16; p = 0.07 to 0.23). Prostate cancer risk was related to duration of work in wheat/barley and tobacco productions, number of cattle and hogs, and grassland area. We also observed an increased risk for fruit growing, with both duration and area. Increased prostate cancer risk was associated with applying pesticides on wheat/barley (HR=1.40, p = 0.06) with a duration relationship, and with making hay (HR=1.16, p = 0.03). Conclusions Our analysis suggests that the risk of prostate cancer is increased in some farming activities, mainly in crops. This work will be completed by a multivariate analysis, with variables positively associated with the outcome in the previous analysis. The possible association between use of some chemical classes of pesticides and prostate cancer occurrence will be analysed through a crop-exposure matrix (PESTIMAT).	Occupational and Environmental Medicine	71	NA	A86-A87	Self-reported exposure			Cohort (prospective)	Pesticides in general	cancer	doctor-diagnosed	France	hic
223	C. T. Lemarchand, S.; Leveque-Morlais, N.; Perrier, S.; Belot, A.; Velten, M.; Guizard, A. V.; Marcotullio, E.; Monnereau, A.; Clin, B.; Baldi, I.; Lebailly, P.; group, Agrican	Cancer incidence in the AGRICAN cohort study (2005-2011)	2017	BACKGROUND: Numerous studies have been conducted among farmers, but very few of them have involved large prospective cohorts, and few have included a significant proportion of women and farm workers. Our aim was to compare cancer incidence in the cohort (overall, by sex, and by work on farm, occupational status and pesticide use) within the general population. METHODS: More than 180,000 participants in the AGRICAN cohort were matched to cancer registries to identify cancer cases diagnosed from enrolment (2005-2007) to 31st December 2011. We calculated standardized incidence ratios (SIRs) and 95% confidence intervals (95%CIs). RESULTS: Over the period, 11,067 incident cancer cases were identified (7304 men and 3763 women). Overall cancer incidence did not differ between the cohort and the general population. Moreover, SIRs were significantly higher for prostate cancer (SIR=1.07, 95%CI 1.03-1.11) and non-Hodgkin lymphoma (SIR=1.09, 95%CI 1.01-1.18) among men, skin melanoma among women (SIR=1.23, 95%CI 1.05-1.43) and multiple myeloma (men: SIR=1.38, 95%CI 1.18-1.62; women: SIR=1.26, 95%CI 1.02-1.54). In contrast, SIRs were lower for upper aerodigestive tract and respiratory cancers. Increase in risk was greater in male farm workers for prostate and lip cancer, in female farm workers for skin melanoma, and in male farm owners for multiple myeloma. Moreover, incidence of multiple myeloma and skin melanoma was higher among male and female pesticide users respectively. CONCLUSION: We found a decreased incidence for tobacco-related cancers and an increased incidence of prostate cancers, skin melanoma and multiple myeloma. Specific subgroups had a higher cancer incidence related to occupational status and pesticide use.	Cancer Epidemiology	49	NA	175-185	Self-reported exposure			Cohort (prospective)	Pesticides in general	cancer	doctor-diagnosed	France	hic
224	C. Udom, P. Janwantanakul and R. Kanlayanaphotporn	The prevalence of low back pain and its associated factors in Thai rubber farmers	2016	OBJECTIVES: Low back pain (LBP) is one of the most prevalent musculoskeletal disorders in the general population, especially among manual laborers. Moreover, it often brings about lost wages and additional medical expenses. However, the potential risk factors for LBP are unknown. This study aimed to estimate the prevalence of LBP and to determine the individual, occupational, and psychosocial factors associated with LBP among rubber farmers. METHODS: A cross-sectional survey was conducted among 450 Thai rubber farmers using cluster random sampling. Data were collected using face-to-face interviews and objective examination and were analyzed using multivariate logistic regression. RESULTS: Of the 433 rubber farmers, the point and 12-month prevalence of LBP in rubber farmers was 33% and 55.7%, respectively. BMI, primary school education, exposure to pesticides, and tapping below knee level were statistically associated with LBP after controlling for other variables. CONCLUSIONS: Low back pain is common among rubber farmers. Only four factors were identified as being associated with the high prevalence of LBP. However, these factors might be altered if more variables are taken into account. Further research investigating the causal relation between these factors and LBP should be conducted.	Journal of Occupational Health	58	6	534-542	Self-reported exposure			Cross-sectional	Pesticides in general	muskuloskeletal	self-reported	Thailand	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
225	C. W. Martinez-Valenzuela, S. M.; Amador-Munoz, O.; Meza, E.; Calderon-Segura, M. E.; Zenteno, E.; Huichapan-Martinez, J.; Caba, M.; Felix-Gastelum, R.; Longoria-Espinoza, R.	Aerial pesticide application causes DNA damage in pilots from Sinaloa, Mexico	2017	The use of pesticides in agricultural production originates residues in the environment where they are applied. Pesticide aerial application is a frequent source of exposure to pesticides by persons dedicated to agricultural practices and those living in neighboring communities of sprayed fields. The aim of the study was to assess the genotoxic effects of pesticides in workers occupationally exposed to these chemicals during their aerial application to agricultural fields of Sinaloa, Mexico. The study involved 30 pilots of airplanes used to apply pesticides via aerial application and 30 unexposed controls. Damage was evaluated through the micronucleus assay and by other nuclear abnormalities in epithelial cells of oral mucosa. The highest frequency ratios (FR) equal to 269.5 corresponded to binucleated cells followed by 54.2, corresponding to cells with pyknotic nuclei, 45.2 of cells with chromatin condensation, 3.7 of cells with broken-egg, 3.6 of cells with micronucleus, and 2.0 of karyolytic cells. Age, worked time, smoking, and alcohol consumption did not have significant influence on nuclear abnormalities in the pilots studied. Pesticide exposure was the main factor for nuclear abnormality results and DNA damage. Marked genotoxic damage was developed even in younger pilots with 2 years of short working period, caused by their daily occupational exposure to pesticides.	Environmental Science & Pollution Research	24	3	2412-2420	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Mexico	umic
226	C. Wesseling, A. Aragon, M. Gonzalez, I. Weiss, J. Glaser, C. J. Rivard, C. Roncal-Jimenez, R. Correa-Rotter and R. J. Johnson	Heat stress, hydration and uric acid: a cross-sectional study in workers of three occupations in a hotspot of Mesoamerican nephropathy in Nicaragua.[Erratum appears in BMJ Open. 2017 Jan 25;7(1):e011034corr1; PMID: 28122838]	2016	OBJECTIVES: To study Mesoamerican nephropathy (MeN) and its risk factors in three hot occupations. DESIGN: Cross-sectional. SETTING: Chinandega and Leon municipalities, a MeN hotspot on the Nicaraguan Pacific coast, January-February 2013. PARTICIPANTS: 194 male workers aged 17-39 years: 86 sugarcane cutters, 56 construction workers, 52 small-scale farmers. OUTCOME MEASURES: (1) Differences between the three occupational groups in prevalences/levels of socioeconomic, occupational, lifestyle and health risk factors for chronic kidney disease (CKD) and in biomarkers of kidney function and hydration; (2) differences in prevalences/levels of CKD risk factors between workers with reduced estimated glomerular filtration rate (eGFR_{CKD-EPI} <80 mL/min/1.73 m²) and workers with normal kidney function (eGFR_{CKD-EPI} >=80 mL/min/1.73 m²). RESULTS: Sugarcane cutters were more exposed to heat and consumed more fluid on workdays and had less obesity, lower blood sugar, lower blood pressure and a better lipid profile. Reduced eGFR occurred in 16%, 9% and 2% of sugarcane cutters, construction workers and farmers, respectively (trend cane > construction > farming, p=0.003). Significant trends (cane > construction > farming) were also observed for high serum urea nitrogen (blood urea nitrogen (BUN) >20 mg/dL), high serum creatinine (SCr >1.2 mg/dL), low urinary pH (<=5.5) and high BUN/SCr ratio (>20) but not for high urinary specific gravity (>=1.030). Sugarcane cutters also more often had proteinuria and blood and leucocytes in the urine. Workers with eGFR <80 mL/min/1.73 m² reported a higher intake of water and lower intake of sugary beverages. Serum uric acid levels related strongly and inversely to eGFR levels (adj beta -10.4 mL/min/1.73 m², 95% CI -12.2 to -8.5, p<0.001). No associations were observed for other metabolic risk factors, pesticides, non-steroidal anti-inflammatory drugs or alcohol. Among cane cutters, consumption of electrolyte hydration solution appeared preventive (adj beta 8.1 mL/min/1.73 m², p=0.09). CONCLUSIONS: Heat stress, dehydration and kidney dysfunction were most common among sugarcane cutters. Kidney dysfunction also occurred to a lesser extent among construction workers, but hardly at all among small-scale farmers. High serum uric acid was associated with reduced kidney function.	BMJ Open	6	12	e011034	Self-reported exposure			Cross-sectional	Pesticides in general	genitourinary	doctor-diagnosed	Nicaragua	lmic
227	C. Wesseling, B. van Wendel de Joode, M. Keifer, L. London, D. Mergler and L. Stallones	Symptoms of psychological distress and suicidal ideation among banana workers with a history of poisoning by organophosphate or n-methyl carbamate pesticides	2010	OBJECTIVES: Neuropsychiatric disorders and increased suicide rates have been associated with exposure to cholinesterase inhibiting organophosphates. This study examined symptoms of psychological distress, including suicidal ideation, among banana workers in Costa Rica previously exposed to a cholinesterase inhibiting pesticide. METHODS: 78 workers who had received medical attention 1-3 years previously for occupational pesticide poisoning were recruited: 54 had been exposed to organophosphate, 24 to carbamate, and 43 and 35, respectively, had single and multiple poisoning episodes with a cholinesterase inhibitor. Referents were 130 non-poisoned workers randomly selected from company payrolls. Psychological distress symptoms during the month prior to interview were obtained using the Brief Symptom Inventory (BSI), which has a general severity index and nine subscale scores. Differences in abnormal BSI scores (T score>=63) were assessed through multivariate logistic regression for all poisoned and for subcategories of poisoned as compared to non-poisoned workers. RESULTS: Organophosphate poisoned workers reported significantly more symptoms than non-poisoned on all but one symptom dimension. Significant trends of increasing symptoms with increasing number of previous poisonings were seen for somatisation, obsessive-compulsiveness, interpersonal sensitivity, depression and anxiety. Carbamate poisoned workers only had increased scores for somatisation. The ORs for suicidal thoughts were: all poisoned 3.58 (95% CI 1.45 to 8.84); organophosphate poisoned 3.72 (1.41 to 9.81); carbamate poisoned 2.57 (0.73 to 9.81); and 2.65 and 4.98, respectively for 1 and >=2 poisonings (trend p=0.01). CONCLUSIONS: This cross-sectional study showed a relationship between acute occupational poisoning with organophosphates and psychological distress including suicidal ideation. Stronger designs are needed to address causality.	Occupational & Environmental Medicine	67	11	778-84	Biomonitoring (blood)			Cross-sectional	Chemical class	NA	self-reported	Costa Rica	umic
228	C. Wesseling, L. Castillo and C. G. Elinder	Pesticide poisonings in Costa Rica	1993	A descriptive epidemiologic study, conducted in Costa Rica, investigated the incidence of pesticide poisonings with special attention to agricultural workers and occupational exposure. Information from three national registers (occupational accident and disease reports, hospitalizations, and deaths) were used. During 1986, 1800 occupational accidents caused by pesticides were reported; between 1980 and 1986 altogether 3330 persons were hospitalized and 429 died. Cholinesterase inhibitors caused 71% of the reported occupational accidents, 63% of the hospitalizations, and 36% of the deaths. Paraquat caused 21% of the occupational accidents, 24% of the hospitalizations, and 60% of the deaths. Hospitalizations and deaths were 13 and 11 times, respectively, more frequent among agricultural workers than among the rest of the population. High-risk groups for occupational poisonings included agricultural workers aged 15-29 years, female workers, and banana plantation workers. The yearly incidence of symptomatic occupational pesticide poisonings among agricultural workers was estimated at 4.5%.	Scandinavian Journal of Work, Environment & Health	19	4	227-35	Registers			Cohort (prospective)	Specific active ingredient	pesticide-related illness	doctor-diagnosed	Costa Rica	umic

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229	C. Wesseling, M. Keifer, A. Ahlbom, R. McConnell, J. D. Moon, L. Rosenstock and C. Hogstedt	Long-term neurobehavioral effects of mild poisonings with organophosphate and n-methyl carbamate pesticides among banana workers	2002	Organophosphate poisoning has been associated with chronic neurobehavioral dysfunction, but no epidemiologic data exist with regard to long-term consequences from carbamate poisoning. This cross-sectional study evaluated the neurobehavioral performances of 81 banana workers who, on average 27 months earlier, had received medical attention not requiring hospitalization for mild occupational poisoning by either an organophosphate or a carbamate pesticide. These performances were compared with those of 130 banana workers who had never sought medical attention for pesticide poisoning. Poisoned subjects did less well than controls on tests measuring psychomotor and visuomotor skills, language function, and affect, the differences being significant for coding skills on the Digit-Symbol test and two tests of neuropsychiatric symptoms. These deficits, in particular a marked increase of neuropsychiatric symptoms, occurred among the organophosphate-poisoned subjects, but small deficits in performance were also seen in the carbamate-poisoned subjects. The performances of the previously poisoned subjects who had had contact with cholinesterase inhibitors within three months before testing were particularly poor. These findings in workers with mild poisoning are consistent with previous findings of persistent damage to the central nervous system from organophosphate poisoning. The possibility of persistent neurobehavioral effects associated with poisonings by nmethyl carbamate insecticides cannot be excluded. Workers with histories of poisoning may be more susceptible to neurobehavioral effects with subsequent exposures.	International Journal of Occupational & Environmental Health	8	1	27-34	Self-reported exposure			Cross-sectional	Pesticides in general	neurological	self-reported	NA	NA
230	C. Wohlfahrt-Veje, H. R. Andersen, I. M. Schmidt, L. Aksglaede, K. Sorensen, A. Juul, T. K. Jensen, P. Grandjean, N. E. Skakkebaek and K. M. Main	Early breast development in girls after prenatal exposure to non-persistent pesticides	2012	Contemporary American and European girls experience breast development at earlier ages compared with 15-20 years ago. Alterations in BMI alone cannot account for these changes. Several currently used pesticides possess endocrine disrupting properties and may interfere with reproductive development, but human data are sparse. We examined girls whose mothers worked in greenhouses in the first trimester of pregnancy to assess the long-term effects of prenatal pesticide exposure on puberty. Mothers were prenatally categorized as exposed or unexposed to pesticides. We studied the offspring of these greenhouse workers, and evaluated the anthropometry, pubertal staging in the girls, and blood samples were drawn at 3 months of age (n = 90) and again once at school age (6-11 years, n = 83). No clinical and biochemical differences were found between the exposed and unexposed girls at 3 months of age. Mean onset of B2+ was 8.9 years (95% CI: 8.2; 9.7) in prenatally exposed girls, compared with 10.4 years (9.2; 17.6) in the unexposed (p = 0.05), and 10.0 (9.7-10.3) years in a Danish reference population (p = 0.001). Exposed girls had higher serum androstenedione levels (geometric means: 0.58 vs. 0.79 nmol/L, p = 0.046) and lower Anti-Mullerian Hormone (AMH) compared with the unexposed (geometric means: 16.4 vs. 21.3 pmol/L, p > 0.05) and the reference group (20.2 pmol/L, p = 0.012). Levels of testosterone, estradiol, prolactin, FSH, LH, SHBG, DHEAS, DHT, Inhibin A and Inhibin B did not differ between the groups. In conclusion, our findings suggest that prenatal exposure to currently approved pesticides may cause earlier breast development in girls. This association appeared not to be because of changes in gonadotropins, but rather to higher androgen levels, which indirectly may increase oestrogens through aromatization. In addition, lower serum AMH levels indicated a reduced pool of antral ovarian follicles. The long-term consequences of our findings with regard to establishment of future reproductive function still remain unknown.	International Journal of Andrology	35	3	273-82	Self-reported job history	Expert case-by-case assessment		Cohort (prospective)	Pesticides in general	offspring	medical test result	Denmark	hic
231	C. Wohlfahrt-Veje, H. R. Andersen, T. K. Jensen, P. Grandjean, N. E. Skakkebaek and K. M. Main	Smaller genitals at school age in boys whose mothers were exposed to non-persistent pesticides in early pregnancy	2012	Endocrine disrupting chemicals are believed to play a role in the development of the testicular dysgenesis syndrome. Many pesticides are known to have endocrine disrupting abilities. In a previous study, sons of women who were occupationally exposed to non-persistent pesticides in early pregnancy showed signs of impaired reproductive function (reduced genital size and altered serum hormone concentrations) at three months of age. To assess the possible long-term effects of prenatal pesticide exposure, the boys were re-examined at 6-11 years. The 94 boys (59 exposed, 35 unexposed) underwent genital examinations including ultrasound of testicular volumes, puberty staging (Tanner), anthropometry, and blood sampling. Only a few of the boys had reached puberty (n = 3). Among prepubescent boys, testicular volume and penile length (age- and weight-adjusted) were reduced if mothers were exposed to pesticides. The effects were associated with the maternal exposure levels, so that high-exposed boys had smaller genitals than medium-exposed boys, who had smaller genitals than those who were unexposed. Boys of mothers in the high exposure group (n = 23) had 24.7% smaller testes (95% CI: -62.2; -10.1) and 9.4% shorter penile length (95% CI: -16.8; -1.1) compared with the unexposed. The testicular volume and penile length at school age could be tracked to measures from the same boys made at 3 months, e.g. those that had small testes at school age also had small testes at 3 months. Pituitary and testicular hormone serum concentrations did not differ between exposed and unexposed boys. Eight prenatally exposed boys had genital malformations (no unexposed). These boys had smaller testis, shorter penile length and lower inhibin B concentrations than prepubertal boys without genital malformations. The findings support the results obtained at three months of age and indicate that prenatal pesticide exposure has long-term effects on reproductive function in boys.	International Journal of Andrology	35	3	265-72	Expert case-by-case assessment	Self-reported job history		Cohort (prospective)	Pesticides in general	offspring	medical test result	Denmark	hic
232	D. A. Khan, I. Hashmi, W. Mahjabeen and T. A. Naqvi	Monitoring health implications of pesticide exposure in factory workers in Pakistan	2010	The study aimed to determine the hazardous health effects of pesticides exposure in the factory workers by measuring plasma cholinesterase (PChE), pesticides residues, and renal and hepatic biochemical markers. In addition, we also assessed the knowledge, attitudes, and safety practices adopted by the industrial workers. The study was conducted in three different sizes of factories located in Lahore (large), Multan (medium), and Karachi (small) in Pakistan. Total 238 adult males consisting of 184 pesticide industrial workers (exposed group) from large-sized (67), medium-sized (61), small-sized (56) industrial formulation factories, and 54 controls (unexposed) were included in the study. All the participants were male of aged 18 to 58 years. PChE levels were estimated by Ellmann's method. Plasma pesticides residue analysis was performed by using reverse phase C-18 on high-performance liquid chromatograph and GC with NPD detector. Plasma alanine aminotransferase (ALT), aspartate aminotransferase (AST), creatinine, urea, and gamma glutamyltransferase (GGT) were measured on Selectra E auto analyzer. Plasma and C-reactive protein was analyzed by Immulite 1000. The results revealed a significant decrease in plasma post exposure PChE levels (<30%) as compared to baseline in the workers of small (29%) and medium (8%) industrial units (p < 0.001). Plasma cypermethrin, endosulfan, imidacloprid, thiodicarb, carbofuran, and methamidophos levels were found to be higher than allowable daily intake. Serum AST, ALT, creatinine GGT, malondialdehyde, total antioxidant, and CRP were significantly raised among the workers of small and medium pesticide formulation factories as compared to large industrial unit and controls (p < 0.001). The study demonstrated that unsafe practices among small- and medium-sized pesticides industrial workers cause significant increase in pesticide exposure, oxidative stress, and derangement of hepatic and renal function.	Environmental Monitoring & Assessment	168	1	231-40	Job title			Cross-sectional	Job title	genitourinary	medical test result	Pakistan	lmic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
233	D. A. Khan, K. Ahad, W. M. Ansari and H. Khan	Pesticide exposure and endocrine dysfunction in the cotton crop agricultural workers of southern Punjab, Pakistan	2013	This study evaluated pesticide effects on reproductive and thyroid hormones of cotton farmers of southern Punjab, Pakistan. A total of 88 cotton farmers (42 spray applicators and 46 cotton pickers) were randomly included with an equal number of age- and sex-matched controls. Sampling was done in high spraying and peak picking seasons. Serum levels of luteinizing hormone (LH), follicle-stimulating hormone (FSH), testosterone, prolactin, thyroid-stimulating hormone (TSH), total triiodothyroxine (TT3), and free thyroxine (fT4) were carried out by enzymatic immunoassay. Plasma cholinesterase (PChE) levels were measured by Ellman's method. Serum FSH, LH, and testosterone levels were significantly high in spray applicators (P < .01).Serum FSH and testosterone levels were significantly raised in cotton pickers (P < .01). Serum prolactin was decreased significantly in both groups (P < .01).Serum fT4 was significantly reduced in cotton pickers (P < .01). Pesticide exposure is associated with thyroid and reproductive hormone levels disturbance.	Asia-Pacific Journal of Public Health	25	2	181-91	Biomonitoring (blood)			Cohort (prospective)	Chemical class	endocrine/nutritional/metabolical	medical test result	Pakistan	lmic
234	D. A. Savitz, T. Arbuckle, D. Kaczor and K. M. Curtis	Male pesticide exposure and pregnancy outcome	1997	Potential health effects of agricultural pesticide use include reproductive outcomes. For the Ontario Farm Family Health Study, the authors sampled Ontario farms from the 1986 Canadian Census of Agriculture, identified farm couples, and obtained questionnaire data concerning farm activities, reproductive health experience, and chemical applications. Male farm activities in the period from 3 months before conception through the month of conception were evaluated in relation to miscarriage, preterm delivery, and small-for-gestational-age births. Among the 1,898 couples with complete data (64% response), 3,984 eligible pregnancies were identified. Miscarriage was not associated with chemical activities overall but was increased in combination with reported use of thiocarbamates, carbaryl, and unclassified pesticides on the farm. Preterm delivery was also not strongly associated with farm chemical activities overall, except for mixing or applying yard herbicides (odds ratio = 2.1, 95% confidence interval 1.0-4.4). Combinations of activities with a variety of chemicals (atrazine, glyphosate, organophosphates, 4-[2,4-dichlorophenoxy] butyric acid, and insecticides) generated odds ratios of two or greater. No associations were found between farm chemicals and small-for-gestational-age births or altered sex ratio. Based on these data, despite limitations in exposure assessment, the authors encourage continued evaluation of male exposures, particularly in relation to miscarriage and preterm delivery.	American Journal of Epidemiology	146	12	1025-1036	Self-reported exposure			Cross-sectional	Specific active ingredient	reproductive	self-reported	USA	hic
235	D. B. Hancock, E. R. Martin, G. M. Mayhew, J. M. Stajich, R. Jewett, M. A. Stacy, B. L. Scott, J. M. Vance and W. K. Scott	Pesticide exposure and risk of Parkinson's disease: a family-based case-control study	2008	BACKGROUND: Pesticides and correlated lifestyle factors (e.g., exposure to well-water and farming) are repeatedly reported risk factors for Parkinson's disease (PD), but few family-based studies have examined these relationships. METHODS: Using 319 cases and 296 relative and other controls, associations of direct pesticide application, well-water consumption, and farming residences/occupations with PD were examined using generalized estimating equations while controlling for age-at-examination, sex, cigarette smoking, and caffeine consumption. RESULTS: Overall, individuals with PD were significantly more likely to report direct pesticide application than their unaffected relatives (odds ratio = 1.61; 95% confidence interval, 1.13-2.29). Frequency, duration, and cumulative exposure were also significantly associated with PD in a dose-response pattern (p </= 0.013). Associations of direct pesticide application did not vary by sex but were modified by family history of PD, as significant associations were restricted to individuals with no family history. When classifying pesticides by functional type, both insecticides and herbicides were found to significantly increase risk of PD. Two specific insecticide classes, organochlorines and organophosphorus compounds, were significantly associated with PD. Consuming well-water and living/working on a farm were not associated with PD. CONCLUSION: These data corroborate positive associations of broadly defined pesticide exposure with PD in families, particularly for sporadic PD. These data also implicate a few specific classes of pesticides in PD and thus emphasize the need to consider a more narrow definition of pesticides in future studies.	BMC Neurology	8	NA	6	Self-reported exposure			Case-control	Type of pesticide	neurological	doctor-diagnosed	USA	hic
236	D. B. Richardson, C. Terschuren and W. Hoffmann	Occupational risk factors for non-Hodgkin's lymphoma: a population-based case-control study in Northern Germany	2008	OBJECTIVES: To identify occupational factors associated with non-Hodgkin's lymphoma (NHL). METHODS: A population-based case-control study was conducted in which incident cases of high-malignancy NHL (NHL(high)), low-malignancy NHL (NHL(low)), and chronic lymphocytic leukemia (CLL) were ascertained during the period 1986-1998 among men and women aged 15-75 years residing in six German counties; controls were drawn from population registries. Occupational histories were collected and agent-specific exposures were estimated via a job-exposure-matrix. Odds ratios were estimated by conditional logistic regression. RESULTS: A total of 858 cases were included in these analyses. Agricultural workers [odds ratio (OR) = 2.67, 95% confidence interval (CI): 0.99, 7.21) and farmers (OR = 1.98, 95% CI: 0.98, 3.98] had elevated risk of NHL(high). Risk of NHL(low) was elevated among agricultural workers (OR = 2.46, 95% CI: 1.17, 5.16), and among blacksmiths, toolmakers, and machine tool operators (OR = 3.12, 95% CI: 1.31, 7.47). Workers in sales and construction had elevated risks of NHL(high) and NHL(low). Exposure to arsenic compounds, chlorophenols, diesel fuel, herbicides, nitrites/nitrates/nitrosamines, and organic dusts were associated with NHL(high) and NHL(low), while exhibiting little association with CLL. A positive monotonic trend in NHL(low) risk across tertiles of cumulative diesel fuel exposure was observed [P-value for test of linear trend (P) = 0.03]. CONCLUSIONS: These findings provide insights into several potential occupational risk factors for NHL and suggest some specific occupational agents for further investigation.	American Journal of Industrial Medicine	51	4	258-68	Job exposure matrix			Case-control	Specific active ingredient	cancer	doctor-diagnosed	Germany	hic
237	D. Baris, D. T. Silverman, L. M. Brown, G. M. Swanson, R. B. Hayes, A. G. Schwartz, J. M. Liff, J. B. Schoenberg, L. M. Pottern, R. S. Greenberg and P. A. Stewart	Occupation, pesticide exposure and risk of multiple myeloma	2004	OBJECTIVES: This population-based case-control study examined the relationship between occupation, living or working on a farm, pesticide exposure, and the risk of multiple myeloma. METHODS: The study included 573 persons newly diagnosed with myeloma and 2131 controls. Information was obtained on sociodemographic factors, occupational history, and history of living and working on a farm. Occupational and industrial titles were coded by standardized classification systems. A job-exposure matrix was developed for occupational pesticide exposure. Odds ratios (OR) and 95% confidence intervals (95% CI) were estimated by unconditional logistic regression. RESULTS: Farmers and farm workers had odds ratios of 1.9 (95% CI 0.8-4.6) and 1.4 (95% CI 0.8-2.3), respectively. An odds ratio of 1.7 (95% CI 1.0-2.7) was observed for sheep farm residents or workers, whereas no increased risks were found for cattle, beef, pig, or chicken farm residents or workers. A modestly increased risk was observed for pesticides (OR 1.3, 95% CI 0.9-1.8). Significantly increased risks were found for pharmacists, dieticians and therapists (OR 6.1, 95% CI 1.7-22.5), service occupations (OR 1.3, 95% CI 1.02-1.7), roofers (OR 3.3, 95% CI 1.1-9.8), precision printing occupations (OR 10.1, 95% CI 1.03-99.8), heating equipment operators (OR 4.7, 95% CI 1.4-15.8), and hand molders and casters (OR 3.0, 95% CI 1.0-8.4). CONCLUSIONS: A modest increased risk of multiple myeloma is suggested for occupational pesticide exposure. The increased risk for sheep farm residents or workers indicates that certain animal viruses may be involved in myeloma risk.	Scandinavian Journal of Work, Environment & Health	30	3	215-22	Job exposure matrix			Case-control	Pesticides in general	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
238	D. Baris, S. H. Zahm, K. P. Cantor and A. Blair	Agricultural use of DDT and risk of non-Hodgkin's lymphoma: pooled analysis of three case-control studies in the United States	1998	OBJECTIVES: The objective of this pooled analysis was to examine whether exposure to DDT was associated with the risk of non-Hodgkin's lymphoma among male farmers. METHODS: Data from three case-control studies from four midwestern states in the United States (Nebraska, Iowa, Minnesota, Kansas) were pooled to carry out analyses of 993 cases and 2918 controls. Information on use of agricultural pesticides and other risk factors was based on interviews. Non-farmers (people who had never lived or worked on a farm) were used as a reference category. RESULTS: There were 161 cases and 340 controls who reported use of DDT on animals or crops, or on both, yielding an odds ratio (OR) of 1.2 (95% confidence intervals (95% CI) 1.0 to 1.6). Farmers who had used DDT for > or = 15 years had an OR of 1.5 (95% CI 1.0 to 2.3). Adjustment for respondent status and use of other pesticides resulted in slightly reduced ORs. Analyses by the number of days of use a year was limited to the Nebraska data. The most notable increase was found among farmers who used DDT for > or = 5 days a year (OR 2.6, 95% CI 1.1 to 5.9); however, additional adjustment for use of organophosphates, phenoxyacetic acids, and the individual pesticides lindane, malathion, and atrazine reduced the ORs to 1.0, 0.9, 1.1, 1.6, and 1.9 respectively. CONCLUSIONS: No strong consistent evidence was found for an association between exposure to DDT and risk of non-Hodgkin's lymphoma. It seems that the excess risk initially found may be explained by use of other pesticides.	Occupational & Environmental Medicine	55	8	522-7	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	USA	hic
239	D. Benedetti, E. Nunes, M. Sarmento, C. Porto, C. E. Dos Santos, J. F. Dias and J. da Silva	Genetic damage in soybean workers exposed to pesticides: evaluation with the comet and buccal micronucleus cytome assays	2013	Soybean cultivation is widespread in the State of Rio Grande do Sul (RS, Brazil), especially in the city of Espumoso. Soybean workers in this region are increasingly exposed to a wide combination of chemical agents present in formulations of fungicides, herbicides, and insecticides. In the present study, the comet assay in peripheral leukocytes and the buccal micronucleus (MN) cytome assay (BMCyt) in exfoliated buccal cells were used to assess the effects of exposures to pesticides in soybean farm workers from Espumoso. A total of 127 individuals, 81 exposed and 46 non-exposed controls, were evaluated. Comet assay and BMCyt (micronuclei and nuclear buds) data revealed DNA damage in soybean workers. Cell death was also observed (condensed chromatin, karyorhectic, and karyolitic cells). Inhibition of non-specific choline esterase (BchE) was not observed in the workers. The trace element contents of buccal samples were analyzed by Particle-Induced X-ray Emission (PIXE). Higher concentrations of Mg, Al, Si, P, S, and Cl were observed in cells from workers. No associations with use of personal protective equipment, gender, or mode of application of pesticides were observed. Our findings indicate the advisability of monitoring genetic toxicity in soybean farm workers exposed to pesticides.	Mutation Research	752	1	28-33	Expert case-by-case assessment			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Brazil	umic
240	D. Boers, L. Portengen, H. B. Bueno-de-Mesquita, D. Heederik and R. Vermeulen	Cause-specific mortality of Dutch chlorophenoxy herbicide manufacturing workers	2010	OBJECTIVE: A retrospective cohort study was conducted in two chlorophenoxy herbicide manufacturing factories, producing mainly 2,4,5-trichlorophenoxyacetic acid (factory A) and 4-chloro-2-methylphenoxyacetic acid, 4-chloro-2-methylphenoxy propanoic acid and 2,4-dichlorophenoxyacetic acid (factory B). Previously, we have shown elevated risks for mortality and cancer mortality in this cohort. The purpose of the current, third follow-up, is to provide an updated assessment of cause-specific mortality for both factories. METHODS: The study population was defined as all persons working in one of the two factories during 1955-1985 for factory A, or during 1965-1986 for factory B. Analyses were performed using Cox proportional hazard models, using attained age as the timescale. Exposure to phenoxy herbicides and dioxins was expected to be different for factory A and factory B and the factories were therefore analysed separately. RESULTS: Previously reported increased risks for respiratory cancer, non-Hodgkin's lymphoma and ischaemic heart disease in factory A could not be confirmed in the present analysis. However, increased risks were observed for all cancers in both factory A (hazard ratio (HR) 1.31; 95% CI 0.86 to 2.01) and factory B (HR 1.54; 95% CI 1.00 to 2.37). Increased risks for urinary cancers (HR 4.2; 95% CI 0.99 to 17.89) and genital cancers (HR 2.93; 95% CI 0.61 to 14.15) were observed in factory A, consistent with earlier reported results in this population. More detailed analyses showed that this increased risk for urinary and genital cancers in exposed workers was not due to selection of healthy controls and could not be attributed to specific products or departments. CONCLUSION: The results of this study showed only slight increases in cancer mortality risk. The increased risk for urinary cancers is noteworthy, but could not be linked to a specific exposure and needs to be confirmed in similar cohorts.	Occupational & Environmental Medicine	67	1	24-31	Job title			Cohort (retrospective)	Job title	mortality (all cause)	doctor-diagnosed	Netherlands	hic
241	D. C. Cole, F. Carpio, J. J. Math and N. Leon	Dermatitis in Ecuadorean farm workers	1997	Using a cross-sectional survey of potato farm workers in northern Ecuador, we examined the relationship between pesticide exposure and skin disorders. From a farm population census, all pesticide applicators and 1/2 of exposed field workers were selected. Controls were age-matched from urban occupations. Individual exposure measures included overall years and current hours working with pesticides. Farm-level measures included numbers of applications over the last 6 months and an application practices score (range 0-4). Each participant underwent a clinical skin examination, with patch tests to maneb on a sample of dermatitis cases. Exposure-related increases in conjunctivitis (7% of applicators, 0% in other groups), dermatitis (68% of exposed and 55% of applicators versus 31% of controls, p < 0.001) and pigmentation disorders (25% of exposed and applicators vs 10% controls, p = 0.06) were found. Among dermatitis cases (n = 117), 5% were positive to maneb on patch testing. In logistic regression analysis, significant predictors (p < 0.1) of dermatitis included years using fungicides (OR = 1.12 per year) and poor application practices (OR = 1.42 per score unit). Agricultural fungicide application in high-exposure situations can contribute to dermatitis prevalence among farm populations.	Contact Dermatitis	37	1	43108	Self-reported exposure			Cross-sectional	Pesticides in general	dermatological	doctor-diagnosed	Ecuador	umic
242	D. C. Cole, F. Carpio, J. Julian and N. Leon	Assessment of peripheral nerve function in an Ecuadorian rural population exposed to pesticides	1998	To explore the peripheral nervous system effects of regular agricultural pesticide use, a cross-sectional survey was conducted in highland Ecuador. Participants were 144 occupationally exposed farm members, 30 female farm members with little direct exposure, and 72 unexposed local town residents, frequency matched to the exposed people on age, sex, and education. Organophosphorus and carbamate insecticides and dithiocarbamate fungicides accounted for the majority of pesticide applications, with leaking backpack sprayers, minimal use of personal protective equipment, and frequent dermal contact being the norm. In polytomous logistic regression analyses, applicators had significantly greater odds for more current peripheral nerve symptoms (odds ratio OR = 3.1), signs of poor coordination (OR = 4.3), abnormal deep tendon reflexes (OR = 2.9), and reduced power (OR = 2.1) compared to controls. Mean toe vibration threshold scores, on a logarithmic scale, were significantly higher among applicators (beta = 0.035) and those reporting previous pesticide poisonings (beta = 0.074). Such indicators of peripheral nervous system effects may be due to a variety of factors, including high pesticide exposure conditions.	Journal of Toxicology & Environmental Health Part A	55	2	77-91	Job title			Cross-sectional	Pesticides in general	neurological	medical test result	Ecuador	umic

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243	D. C. Cole, F. Carpio, J. Julian, N. Leon, R. Carbotte and H. De Almeida	Neurobehavioral outcomes among farm and nonfarm rural Ecuadorians	1997	International researchers have urged greater use of simple neurobehavioral batteries in developing country settings where higher levels of exposure and a variety of cultural and demographic factors may both occur. We conducted a cross-sectional survey of 144 farm members and 72 age and education frequency-matched controls from rural Ecuador, using an amplified Neurobehavioral Core Test Battery. Farm members ranged from those with only indirect pesticide contact to applicators regularly applying organophosphate and carbamate insecticides by backpack sprayer. The distributors of scores showed those with less than 4 years of formal education and at the extremes of age (< 16 or > 65 years old) contributed sufficiently to nonnormality that they had to be excluded from subsequent analyses (resultant n = 170). After adjustment for age and education, language-based IQ test scores and farm membership were the most consistent determinants of neurobehavioral outcomes. Visual-spatial tasks were the most sensitive to the effects of farm membership. Gender (women better than men), alcohol problems, and solvent use were also important for some neurobehavioral tests.	Neurotoxicology & Teratology	19	4	277-86	Job title			Cross-sectional	Pesticides in general	NA	self-reported	Ecuador	umic
244	D. C. Cole, S. Sherwood, M. Paredes, L. H. Sanin, C. Crissman, P. Espinosa and F. Munoz	Reducing pesticide exposure and associated neurotoxic burden in an Ecuadorian small farm population	2007	The contribution of community-based interventions, including farmer field schools (FFSs) in integrated pest management (IPM), to reducing pesticide exposures and associated neurotoxic burden among small-farm families in Ecuador was assessed in three Andean farming communities in a co-design of targeted action-research. Baseline questionnaire surveys elicited pesticide-related knowledge, practices, and exposure and neurobehavioral assessments were done using an adapted WHO battery. Pesticide applications on plots farmed by FFS versus non-FFS participants were compared. A year later, repeated surveys of participating households (n = 29) and neurobehavioral testing of individuals (n = 63) permitted comparisons of pre- and post-intervention values. The FFS graduates applied pesticides on their plots less frequently (p = 0.171). FFS households had increased pesticide-related knowledge of labels and exposure risk factors (both p < 0.004), better pesticide-handling practices (p < 0.01), and less skin exposure (p < 0.01). Neurobehavioural status had improved, particularly digit span and visuo-spatial function, resulting in overall z-score increases. Thus, community interventions reduced pesticide use, reported skin exposure, and neurotoxic burden among smallholder farm families.	International Journal of Occupational & Environmental Health	13	3	281-9	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	Ecuador	umic
245	D. C. Glass, A. Reid, H. D. Bailey, E. Milne and L. Fritschi	Risk of childhood acute lymphoblastic leukaemia following parental occupational exposure to pesticides	2012	OBJECTIVE: To ascertain whether there was an association between parental occupational exposure to pesticides and increased risk of acute lymphoblastic leukaemia (ALL) in the offspring. METHOD: A population-based case-control study of childhood ALL was conducted in Australia. Information about the occupational pesticide exposure of mothers and fathers was collected using job-specific modules. Information on the types and extent of pesticide exposure was collected for mothers and fathers before and around the time of conception, and also for mothers during pregnancy for the index case or control and for 1 year after birth. RESULTS: Paternal occupational exposure to pesticides before or around conception was not related to increased risk of childhood ALL. There was a low prevalence of occupational exposure to pesticides among women that reduced after birth. CONCLUSIONS: Paternal occupational exposure to pesticides was not found to be associated with an increased risk of acute lymphoblastic leukaemia in the offspring. The study was underpowered with respect to maternal exposure to pesticides.	Occupational & Environmental Medicine	69	11	846-9	Self-reported exposure	Expert case-by-case assessment		Case-control	Pesticides in general	offspring	doctor-diagnosed	Australia	hic
246	D. C. Shin, H. J. Kim, S. H. Jung, C. Y. Park, S. Y. Lee and C. B. Kim	Pesticide poisoning and its related factors among Korean farmers	1998	This study has been carried out to assess the health damages due to pesticide use and its related risk factors among Korean farmers. Data regarding pesticide handling and poisoning symptoms were collected by means of a questionnaire filled in by 1,032 farmers from two provinces. The results showed that during summer farming 21.9% of the subjects experienced suspected pesticide poisoning. 18.8% mild poisoning, and 2% more serious poisoning. Univariate and logistic regression analyses between "no poisoning", including the "suspected poisoning" and "poisoning" groups, were performed to select significant variables related to pesticide poisoning. Four variables were significantly associated: sex, days of consecutive pesticide use, hours of pesticide use per day, having received safety education (weakly associated), and compliance with safety guidelines for application. Safety education was weakly associated with poisoning, while age, education, wearing protective gear, and compliance with safety guidelines for personal hygiene after pesticide use were not significant risk factors to determine pesticide poisoning.	Medicina del Lavoro	89	NA	S129-35	Self-reported exposure			Cross-sectional	Pesticides in general	pesticide-related illness	self-reported	Korea	hic
247	D. Coggon, G. Ntani, E. C. Harris, N. Jayakody and K. T. Palmer	Soft tissue sarcoma, non-Hodgkin's lymphoma and chronic lymphocytic leukaemia in workers exposed to phenoxy herbicides: extended follow-up of a UK cohort	2015	OBJECTIVES: To provide further information on the possible carcinogenicity of phenoxy herbicides, and in particular their relationship to soft tissue sarcoma (STS), non-Hodgkin's lymphoma (NHL) and chronic lymphocytic leukaemia (CLL). METHODS: We extended follow-up to December 2012 for 8036 men employed at five factories in the UK which had manufactured phenoxy herbicides, or in a contract spraying business. Mortality was compared with that for England and Wales by the person-years method. Nested case-control analyses compared men with incident or fatal STS (n=15) or NHL/CLL (n=74) and matched controls (up to 10 per case). RESULTS: 4093 men had died, including 2303 since the last follow-up. Mortality from all causes and all cancers was close to expectation, but an excess of deaths from NHL was observed among men who had worked for >=1 year in jobs with more than background exposure to phenoxy herbicides (19 deaths, SMR 1.85, 95% CI 1.12 to 2.89). Four deaths from STS occurred among men potentially exposed above background (3.3 expected). In the nested case-control analyses, there were no significantly elevated risks or consistent trends across categories of potential exposure for either STS or NHL/CLL. Among men who had worked for >=1 year in potentially exposed jobs, the highest OR (for STS) was only 1.30 (95% CI 0.30 to 5.62). CONCLUSIONS: Our findings are consistent with the current balance of epidemiological evidence. If phenoxy herbicides pose a hazard of either STS or NHL, then any absolute increase in risk is likely to be small.	Occupational & Environmental Medicine	72	6	435-41	Registers			Cohort (prospective)	Chemical class	cancer	doctor-diagnosed	UK	hic
248	D. Detofano, M. L. Teixeira, L. F. S. de Oliveira and A. M. Fuentefria	Evaluation of toxicity risks in farmers exposed to pesticides in an agricultural community in Concordia, Santa Catarina State, Brazil	2013	There has been an increase during recent years in the use of pesticides in agricultural activities to improve productivity, reduce labor costs and increase profits. On the other hand, the use of pesticides in excess or without adequate biosafety practices could lead to serious harm to human health. Current research evaluated toxicity risks in the case of 50 agricultural workers from the S<U+221A><U+00A3>o Paulo Rural Community in the municipality of Concordia, Santa Catarina State, Brazil, who were exposed to pesticides. The questionnaire with open- and closed-ended questions revealed that there are several situations and procedures that expose most farm workers to toxicity risks since they do not have a clear understanding of biosafety measures or suitable knowledge on the products they use. Since a lack of information on pesticides exists, there is strong evidence for measures to inform and raise consciousness so that agricultural workers may exercise self-care in handling pesticides.	Acta Scientiarum - Health Sciences	35	1	111-118	Job title			Cross-sectional	Job title	pesticide-related illness	self-reported	Brazil	umic

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249	D. E. Fixler and N. Threlkeld	Prenatal exposures and congenital heart defects in Down syndrome infants	1998	The purpose of this study was to determine whether there are important differences in maternal and environmental prenatal risk factors between liveborn Down syndrome infants with congenital heart defects and Down syndrome infants without heart defects. Using a case control study design, we evaluated the risk associated with maternal illness, drug ingestion, substance usage, and chemical exposures in the home or workplace. The period of risk selected was 3 months before and 3 months after the last menstrual period, because cardiac development occurs early, before the mother may become aware of her pregnancy. Because fetal survival in Down syndrome may be more vulnerable to various exposures, controls were selected who also had trisomy 21. Of 171 infants studied, 89 were cases with congenital heart disease, and 82 were controls without heart disease. All interviews were performed by one nurse practitioner using a structured standardized questionnaire. Cases and controls had similar maternal ages, family incomes, parental education levels, and contraceptive practices before pregnancy. No differences were found between case and control mothers for maternal illness, medication use, or consumption of caffeinated beverages, cigarettes, or alcohol. Reporting of recreational drug usage was infrequent, may reflect underreporting, and did not differ between cases and controls. Maternal exposures were commonly reported for pesticides (50%), hair dyes (22%), craft paints (8%), varnishes (7%), and solvents (3.5%). However, in none of the categories was maternal exposure significantly more prevalent among case mothers than among control mothers. The failure of this study to identify risk factors for cardiac malformations may be attributable to the small differences in reported frequencies reducing statistical power or to the possibility that cardiac malformation in Down syndrome is a direct result of chromosomal duplication.	Teratology	58	1	43263	Self-reported exposure			Case-control	Pesticides in general	offspring	doctor-diagnosed	USA	hic
250	D. F. Geffken	Association of occupation and breast cancer mortality in the state of Vermont, 1989-1993	2000	Vermont's breast cancer death rate is among the highest in the U.S. This study analyzed the association between breast cancer mortality and occupation in Vermont women. Given that Vermont is a rural state, one initial hypothesis was that occupational exposure to pesticides might partly explain the high death rate. Death certificate data from 1989-1993 were analyzed to determine relative risk of breast cancer death according to occupation. Case-control analysis demonstrated increased relative risk of breast cancer death for women in two broad occupational groups: 1) Executive, Administrator and Managers and 2) Professionals. Decreased relative risk of breast cancer death was seen for the occupational group of Homemaker. Data indicated that women in the occupational group of Farming, Forestry, and Fishing were not at increased risk of dying from breast cancer. The associations of occupation and breast cancer mortality in Vermont women do not differ significantly from those seen in larger U.S. studies.	McGill Journal of Medicine	5	2	75-79	Job title			Case-control	Job title	mortality (all cause)	doctor-diagnosed	USA	hic
251	D. F. Kaioumova and L. Khabutdinova	Cytogenetic characteristics of herbicide production workers in Ufa	1998	In the present study, we investigated the effect of dioxin-containing products on the cytogenetic characteristics of peripheral blood lymphocytes of herbicide plant workers in Ufa. We found that the mean incidence of cells with chromosomal abberations (CHA) was two fold higher in the herbicide plant workers than the mean incidence level of controls groups consisting of people with no professional contact to herbicides or hospital stuff working in the close vicinity of the herbicide plant in Ufa (for both cases: $p < 0.05$). Moreover, the mean CHA cell incidence in the controls groups was also two times higher than the average level of spontaneous abberations in humans. The chemical herbicides 2,4,5-trichlorphenol (2,4,5-T) and 2,4-dichlorophenoxiacetic acid (2,4-D) appeared to affect various cellular cycle phases. Chromosomal type abberations occurred in the G0 stage of cellular cycle and chromatic type aberrations in the G2 stage. In the S stage, the aberrations of both types were observed. Our results indicate that the herbicides 2,4,5-T and 2,4-D have mutagenic effects in humans.	Chemosphere	37	9	1755-9	Job title			Cross-sectional	Specific active ingredient	genetic (biomarkers)	medical test result	Russia	umic
252	D. Flesch-Janys	Analyses of exposure to polychlorinated dibenzo-p-dioxins, furans, and hexachlorocyclohexane and different health outcomes in a cohort of former herbicide-producing workers in Hamburg, Germany	1997	Several studies have been conducted to assess the exposure of a cohort of former herbicide-producing workers to PCDD/F and other potential carcinogenic substances and to evaluate the morbidity and mortality, especially for cancer, but also for other causes of death. For a quantitative dose-response analyses, a PCDD/F-blood exposure indicator was constructed from available blood levels for n = 190 workers and its relation to the working times in 14 different production departments. These indicators were used in Cox-regression models relating total cancer mortality to estimated TEQ at the end of exposure. A significant trend was observed for total cancer mortality and estimated TEQ levels at the end of exposure. The form of the dose response curve appeared to be slightly sublinear in the observed dose range. For all cardiovascular diseases (CVD), a numerical increase in risk was first observed in the third quintile of the exposure indicator 39.6-98.9 ng/kg; (RR 1.20; 0.82, 1.76), increasing to 1.70 (1.02, 2.85) in the last decile (545.1-4,361.9 ng/kg). For IHD a numerical increase was first observed in the group with TEQ ranging from 278.6 to 545.0 ng/kg (RR 1.26; 0.67, 2.39). In the highest decile, a RR of 2.17 (1.18, 4.00) was observed. The trend tests were significant for both outcomes. Unlike for cancer for CVD and IHD no increase in risk was observed in the lower dose ranges.	Teratogenesis, Carcinogenesis, & Mutagenesis	17	4	257-64	Algorithm/model	Algorithm/model		Cohort (prospective)	Specific active ingredient	mortality (all cause)	doctor-diagnosed	Germany	hic
253	D. G. Robinson, D. G. Trites and E. W. Banister	Physiological effects of work stress and pesticide exposure in tree planting by British Columbia silviculture workers	1993	Tree planters in British Columbia have reported symptoms that are congruent with musculoskeletal stress and organophosphate or carbamate pesticide intoxication. The purpose of this research was to determine the existence of any physiological or biochemical correlate supporting the existence of these potential hazards in tree planting. Worker's health complaints were assessed from regularly distributed questionnaires. Blood samples were obtained from 14 male and three female Canadian subjects before and after tree planting work on 10 occasions throughout a tree planting season. The strenuous physical challenge of tree planting was confirmed by a significant elevation of serum enzyme activity (ESEA) at the beginning of the season, which did not return to a normal level during the remainder of the season. Significant ($p < or = 0.05$) inhibition of erythrocyte acetylcholinesterase activity (AChE) postwork was observed in 15.9% of individuals, and a significant group mean prework-postwork difference of AChE or plasma pseudocholinesterase (PChE) was observed on two days of testing, indicating a potential toxicological hazard from pesticide absorption. No correlation was found between the degree of ESEA or cholinesterase inhibition and the number of health complaints.	Ergonomics	36	8	951-61	Biomonitoring (blood)			Cross-sectional	Chemical class	pesticide-related symptoms	self-reported	Canada	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
254	D. G.-V. Zeljezic, V.	Chromosomal aberration and single cell gel electrophoresis (Comet) assay in the longitudinal risk assessment of occupational exposure to pesticides	2001	In recent years the use of pesticides in agriculture has been increasing steadily. At present there are more than 1000 chemicals classified as pesticides. Therefore, the widespread use of pesticides and their potential genetic hazard suggests that evaluation of their genotoxicity should be extended using the newer assays now available. In the present study chromosomal aberration analysis and the alkaline single cell gel electrophoresis (Comet) assay were used to evaluate the extent of DNA damage and DNA repair in peripheral blood lymphocytes of subjects employed in pesticide production. In order to determine possible primary genotoxic effects in workers blood samples were taken after an 8 month long period of exposure to a complex mixture of pesticides. To detect the possible occurrence of DNA repair in lymphocytes of the same subjects the second blood sample was taken after an 8 month long period of absence from the pesticide exposure zone. Regardless of the period of sampling, in the exposed group statistically significantly increased numbers of aberrant cells, chromatid and chromosome breaks, acentric fragments and dicentric chromosomes compared with the controls were found. After the workers had spent 8 months out of the pesticide exposure zone the number of aberrant cells and all types of chromatid and chromosome aberrations decreased significantly compared with sampling after the high exposure period, but it still remained significantly higher in comparison with the control group. After the period of high exposure to a mixture of pesticides statistically significantly increased levels of DNA damage in the Comet assay in terms of tail length and tail moment were found. After the workers were removed from production for 8 months both Comet assay end-points decreased significantly compared with the first sampling point, but they remained increased compared with the control.	Mutagenesis	16	4	359-63	Job title			Cohort (prospective)	Pesticides in general	genetic (biomarkers)	medical test result	Croatia	hic
255	D. G.-V. Zeljezic, V.	Sister chromatid exchange and proliferative rate index in the longitudinal risk assessment of occupational exposure to pesticides	2002	At present, there are more than 1,000 chemicals classified as pesticides and many reports have shown that some of them have genotoxic properties. In the present longitudinal study, possible genetic damage on a population of workers occupationally exposed to a mixture of pesticides by using sister chromatid exchange (SCE) analysis has been evaluated. As an additional cytogenetic parameter, the proportion of lymphocytes that undergo one, two or three cell divisions as well as proliferative rate index have been determined. This study was performed on the exposed group of workers employed in pesticide production, simultaneously exposed to a complex mixture of pesticides (atrazine, alachlor, cyanazine, 2,4-dichlorophenoxyacetic acid, and malathion). The blood samples of the exposed subjects were collected in three different periods: before the beginning of the new pesticide production period, after 8 months of everyday work in the pesticide production, and 8 months after the removal of subjects out of the production. In all three samplings, the mean value of SCE and number of cells with high sister chromatid exchange frequency (HFC) in the exposed group was significantly higher in the comparison with the control group. There were no differences in the proliferative rate index (PRI) between the control and exposed group, regardless of the sampling period. In both groups examined, the majority of lymphocytes were found in the second cell division, following cultivation. These results suggest that the increase in the number of SCE found in the exposed subjects is not the result of either cytotoxic or epigenetic action of pesticide mixture, but chronic occupational exposure to mixture of pesticides.	Chemosphere	46	2	295-303	Biomonitoring (blood)			Cohort (prospective)	Chemical class	genetic (biomarkers)	medical test result	Croatia	hic
256	D. H. Barrett, R. D. Morris, F. Z. Akhtar and J. E. Michalek	Serum dioxin and cognitive functioning among veterans of Operation Ranch Hand	2001	We used the Halstead-Reitan neuropsychological test battery, the Wechsler adult intelligence scale-revised, the Wechsler memory scale, and the wide range achievement test to assess cognitive functioning among Air Force veterans exposed to Agent Orange and its contaminant, 2,3,7,8-tetrachlorodibenzo-p-dioxin (dioxin), during the Vietnam war The index subjects were veterans of Operation Ranch Hand (N = 937), the unit responsible for aerial herbicide spraying in Vietnam from 1962 to 1971. A comparison group of other Air Force veterans (N= 1,052), who served in Southeast Asia during the same period but were not involved with spraying herbicides served as referents. Cognitive functioning was assessed in 1982, and dioxin levels were measured in 1987 and 1992. We assigned each Ranch Hand veteran to the background, low, or high dioxin exposure category on the basis of a measurement of dioxin body burden. Although we found no global effect of dioxin exposure on cognitive functioning, we did find that several measures of memory functioning were decreased among veterans with the highest dioxin exposure. These results became more distinct when we restricted the analysis to enlisted personnel, the subgroup with the highest dioxin levels. An analysis based on dioxin quintiles in the combined cohort produced consistent results, with veterans in the fifth quintile exhibiting reduced verbal memory function. Although statistically significant, these differences were relatively small and of uncertain clinical significance.	Neurotoxicology	22	4	491-502	Registers			Cohort (prospective)	Chemical class	mental disorders	doctor-diagnosed	USA	hic
257	D. Jung, P. A. Berg, L. Edler, W. Ehrenthal, D. Fenner, D. Flesch-Janys, C. Huber, R. Klein, C. Koitka, G. Lucier, A. Manz, A. Muttray, L. Needham, O. Papke, M. Pietsch, C. Portier, D. Patterson, W. Prellwitz, D. M. Rose, A. Thews and J. Konietzko	Immunologic findings in workers formerly exposed to 2,3,7,8-tetrachlorodibenzo-p-dioxin and its congeners	1998	One hundred ninety-two workers in a German pesticide factory who were exposed to polychlorinated dibenzodioxins and -furans (PCDD/PCDF) were investigated for former and present diseases and laboratory changes of the immune system. Moreover, in a subgroup of 29 highly exposed and 28 control persons, proliferation studies were performed. In addition to assays such as blood count, immunoglobulins, serum electrophoresis, monoclonal bands, surface markers, autoantibodies, and lymphocyte proliferation, two new methods, the rise of tetanus antibody concentration after vaccination and the in vitro resistance of lymphocytes to chromate, were used to diagnose the morphologic and functional state of the immune system. There was no stringent correlation of actual PCDD/PCDF concentrations with the occurrence of infections or with one of the immune parameters. In addition, outcomes of the tetanus vaccination and the chromate resistance test were not correlated with PCDD/PCDF. However, the chromate resistance of lymphocytes stimulated by phytohemagglutinin of highly exposed persons was significantly lower than that for the control group. These findings indicate that the function of lymphocytes can be stressed and possibly impaired by high exposure to PCDD/PCDF.	Environmental Health Perspectives	106	NA	689-95	Biomonitoring (blood)			Cohort (prospective)	Chemical class	immunological	medical test result	Germany	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
258	D. L. R. Greenburg, J.; Koutros, S.; Dosemeci, M.; Patel, R.; Hines, C. J.; Hoppin, J. A.; Alavanja, M. C.	Cancer incidence among pesticide applicators exposed to captan in the Agricultural Health Study	2008	OBJECTIVE: Captan is a widely used antifungal pesticide whose potential to cause cancer in humans is uncertain. METHODS: We evaluated the incidence of cancer among pesticide applicators exposed to captan in the Agricultural Health Study. Detailed information on pesticide exposure and lifestyle factors was obtained from self-administered enrollment questionnaires completed between 1993 and 1997. RESULTS: Of the 48,986 applicators enrolled 4,383 (9%) had applied captan. Median follow-up time was 9.14 years. Poisson regression analysis was used to estimate relative risks (RR) for cancer subtypes by tertiles of captan exposure. We investigated risk for all cancers combined and sites of cancer for which at least 15 cases occurred among captan-exposed applicators. These sites included cancers of the prostate, lung, and colon, blood-related cancers, and colorectal cancers. During follow-up 2,912 incident primary cases of cancer were identified. No association between the highest tertile of captan exposure (>67.375 intensity-weighted days) and development of all cancers (RR = 0.89; 95% CI, 0.71-1.13) or cancer of any specific site was observed. CONCLUSION: Although our study is limited by low numbers of observed cancer cases and follow-up time of 9.14 years, it does not provide evidence of an increased risk for the development of cancer at the investigated sites.	Cancer Causes & Control	19	10	1401-7	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
259	D. M. Ambroise, J. J.; Squinazi, F.; Protois, J. C.; Fontana, J. M.; Wild, P.	Cancer mortality among municipal pest-control workers	2005	OBJECTIVES: This epidemiological study was carried out in order to investigate the hypothesis of a relationship between cancer occurrence and occupational exposure in a population of municipal pest-control workers exposed to a wide range of pesticides and other chemicals. METHODS: The study was designed as a mortality historical cohort study. The cohort comprised all subjects ever employed in a municipal pest-control service between 1979 and 1994. The follow-up period lasted from 1979 to 2000. The mortality rates of pest-control workers were compared with those of a regional population. A job exposure matrix was developed, which took into account four types of chemicals: formaldehyde, ethylene oxide, insecticides and rodenticides. RESULTS: None of the 181 subjects of the cohort, leading to 3,107 person-years, was lost to follow-up. Thirty-nine of them died, and all the causes of deaths were ascertained. The standardized mortality ratios (SMRs) for all causes of deaths and for all cancer causes were significantly greater than unity: 1.61 (1.14-2.20) and 2.24 (1.39-3.43), respectively. Non-significant excesses were observed for most cancer sites, except for lung cancer, which had a low SMR. We obtained significant excesses for cancer in workers with more than 20 years of employment [SMR = 2.42 (1.43-3.82)]. Cancer mortality tended to increase insignificantly with formaldehyde and rodenticides exposures, whereas no clear patterns were observed for ethylene oxide and insecticides. However, significant excesses were observed for the highest exposure levels of formaldehyde, insecticides and rodenticides. CONCLUSIONS: This study showed a statistically significant excess of cancer mortality in a population of municipal pest-control workers exposed to a wide variety of chemicals. These cancer sites might be related to occupational activities, since they tended to be more frequently observed when duration of employment increased.	International Archives of Occupational & Environmental Health	78	5	387-93	Job exposure matrix			Cohort (retrospective)	Specific active ingredient	cancer	doctor-diagnosed	France	hic
260	D. M. Franca, A. Bender Moreira Lacerda, D. Lobato, A. Ribas, K. Ziliotto Dias, T. Leroux and A. Fuente	Adverse effects of pesticides on central auditory functions in tobacco growers.[Erratum appears in Int J Audiol. 2017 Apr;56(4):295; PMID: 28358276]	2017	OBJECTIVE: To investigate the effects of exposure to pesticides on the central auditory functions (CAF) of Brazilian tobacco growers. DESIGN: This was a cross-sectional study carried out between 2010 and 2012. Participants were evaluated with two behavioural procedures to investigate CAF, the random gap detection test (RGDT) and the dichotic digit test in Portuguese (DDT). STUDY SAMPLE: A total of 22 growers exposed to pesticides (study group) and 21 subjects who were not exposed to pesticides (control group) were selected. RESULTS: No significant differences between groups were observed for pure-tone thresholds. A significant association between pesticide exposure and the results for RGDT and DDT was found. Significant differences between pesticide-exposed and nonexposed subjects were found for RGDT frequency average and DDT binaural average, when including age and hearing level as covariates. Age was significantly associated with RGDT frequency average, DDT left ear score, DDT binaural average and DDT right ear advantage. Hearing levels were not significantly associated with any of the test scores. The relative risk of failing the DDT and RGDT for the study group was 1.88 (95% CI:1.10-3.20) and 1.74 (95% CI:1.06-2.86), respectively, as compared with the control group. CONCLUSIONS: The results showed that tobacco growers exposed to pesticides exhibited signs of central auditory dysfunction characterised by decrements in temporal processing and binaural integration processes/abilities.	International Journal of Audiology	56	4	233-241	Job title			Cross-sectional	Job title	other	other	Brazil	umic
261	D. M. Silva, W. F. Carvalho, C. O. A. Melo, F. R. Godoy, R. P. Bastos, A. D. Cruz, F. C. Franco and A. A. Arruda	Evaluating genomic damages and gstm1 and gstt1 polymorphisms in rural workers occupationally exposed to pesticides: A case-control study in an agropastoral Brazilian state	2014	We analyzed 139 individuals, consisting of 71 individuals occupationally exposed to pesticides and 68 of the control group, which had ethnic and socioenvironmental similarities. To evaluate mutagenic and genomic potential of pesticides we collected oral cavity cells and whole blood samples for micronucleus test and comet assay, respectively. Whole blood samples was also evaluated to analyze the GSTT1 and GSTM1 polymorphisms by real time PCR (qPCR), showing the specific melting curves for both loci. We observed a statistically significant difference between the exposed and control ($p<0.001$) groups for comet assay's parameters, frequency of micronuclei and binucleated cells. Thus, our results demonstrated that, both genomic damages and micronuclei frequencies are directly related to occupational exposure to pesticides. The frequency distribution of GSTM1 and GSTT1 null genotypes in the exposed group was observed in 43.66% and 12.21%, respectively. The control group showed deletion of GSTM1 in 39.70% of subjects, and in the GSTT1, 29.41% of patients presented a deletion; however, there was an increased risk of intoxication for the null genotypes. Individuals exposed to pesticides that presented the GSTT1 null genotype had the highest values of the three comet assay parameters, as the highest micronucleus and binucleated frequencies. So, the genetic monitoring should be considered as part of good medical supervision in people in direct contact with pesticides, since it allows evaluating the potential risk of occupational exposure, making possible the implementation of measures for the early identification of genetic risk.	Environmental and Molecular Mutagenesis	55	NA	S39	Job title			Case-control	Job title	genetic (biomarkers)	medical test result	Brazil	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
262	D. M. V. van Bemmel, K.; Beane Freeman, L. E.; Coble, J.; Hoppin, J. A.; Alavanja, M. C.	S-ethyl-N,N-dipropylthiocarbamate exposure and cancer incidence among male pesticide applicators in the agricultural health study: a prospective cohort	2008	BACKGROUND: The Agricultural Health Study (AHS) is a prospective cohort study of licensed pesticide applicators from Iowa and North Carolina enrolled between 1993 and 1997. EPTC (S-ethyl-N,N-dipropylthiocarbamate) is a thiocarbamate herbicide used in every region of the United States. The U.S. Environmental Protection Agency reports that EPTC is most likely not a human carcinogen; however, the previous epidemiologic data on EPTC exposure and cancer risk were limited. OBJECTIVES: The purpose of this study was to examine cancer incidence and EPTC use in 48,378 male pesticide applicators enrolled in the AHS. METHODS: We estimated the rate ratio (RR) and 95% confidence intervals (CIs) for all cancers and selected cancer sites using Poisson regression. We assessed EPTC exposure using two quantitative metrics: lifetime exposure days and intensity-weighted lifetime exposure days, a measure that accounts for application factors that modify personal exposure likelihood. RESULTS: Among the 9,878 applicators exposed to EPTC, 470 incident cancer cases were diagnosed during the follow-up period ending December 2004 compared with the 1,824 cases among individuals reporting no use. Although EPTC was associated with colon cancer in the highest tertile of both lifetime exposure days and intensity-weighted lifetime days (RR = 2.09; 95% CI, 1.26-3.47 and RR = 2.05; 95% CI, 1.34-3.14, respectively) and the trend test was < 0.01 for both, the pattern of RR was not monotonic with increasing use. There was a suggestion of an association with leukemia. No other associations were observed. CONCLUSION: In this analysis, EPTC use appeared to be associated with colon cancer and leukemia. However, given the relatively small number of cases in the highest exposure tertile, results should be interpreted with caution, and further investigations are needed.	Environmental Health Perspectives	116	11	1541-6	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
263	D. McLean, A. Eng, E. Dryson, C. Walls, E. Harding, K. C. Wong, S. Cheng, A. Mannetje, L. Ellison-Loschmann, T. Slater, P. Shoemack and N. Pearce	Morbidity in former sawmill workers exposed to pentachlorophenol (PCP): a cross-sectional study in New Zealand	2009	BACKGROUND: From 1950 to 1990 pentachlorophenol (PCP) was used widely in the New Zealand sawmill industry, and persistent claims of long-term health effects have been made. METHODS: We surveyed surviving members of a cohort enumerated to study mortality in sawmill workers employed from 1970 to 1990. Estimates of historical exposure were based on job titles held, using the results of a PCP biomonitoring survey conducted in the 1980s. The survey involved interviews and clinical examinations, with interviewers and examiners blinded to exposure status. RESULTS: Of the 293 participants 177 had not been exposed, and of the 116 exposed all but 10% had low or short-term PCP exposure. Nevertheless, a number of significant associations between PCP exposure and the prevalence of various symptoms were observed including associations between: (i) exposure levels and self-reported tuberculosis, pleurisy or pneumonia (P < 0.01) and a deficit in cranial nerve function (P = 0.04); (ii) duration of employment and thyroid disorders (P = 0.04), and neuropsychological symptoms including often going back to check things (P = 0.04), low libido (P = 0.02) and heart palpitations (P = 0.02), and a strong dose-response trend for frequent mood changes without cause (P < 0.01); and (iii) cumulative exposure and frequent mood changes without cause (P = 0.02), low libido (P = 0.04), and in the overall number of neuropsychological symptoms reported (P = 0.03). CONCLUSIONS: PCP exposure was associated with a number of physical and neuropsychological health effects that persisted long after exposure had ceased.	American Journal of Industrial Medicine	52	4	271-81	Job title			Cross-sectional	Job title	morbidity	self-reported	New Zealand	hic
264	D. McLean, G. Chen, A. Mannetje, W. D'Souza, M. McConnell, L. Van Den Berg, H. Kromhout, N. Pearce and J. Douwes	Occupational risk factors for motor neurone disease: A New Zealand population-based casecontrol study	2016	Background Apart from increasing age and a few specific genetic polymorphisms, the aetiology of Motor Neurone Disease is largely unknown. Only 5-10% of cases are familial with the vast majority being of the sporadic form. A role for environmental exposures is suggested by the lack of evidence for a genetic component, differences in incidence by geographical region, increases in incidence observed in some countries (including New Zealand) over a relatively short period, associations observed in epidemiological studies, and the higher proportion of males affected. We conducted a New Zealand population-based case-control study to investigate associations between occupational exposures and MND. Methods We recruited both prevalent and incident cases from a voluntary register, supplemented by notifications from neurologists. General population controls were selected from the Electoral Roll. A standardised questionnaire was used to obtain information on personal and demographic details, lifestyle factors and a full occupational history. We estimated odds ratios by occupation and industry, with analyses adjusted for age, gender, ethnicity, SES and smoking using logistic regression. Results We interviewed 265 cases and 532 controls. Two thirds of cases were male, with 70% aged over 60. Significantly elevated risks were observed for Telecommunications Technicians OR = 4.2 (95% CI: 1.2-14.0), Forecourt Attendants OR = 6.2 (1.3-30.2), Agriculture and Fishery Workers OR = 1.5 (1.1-2.2), Market Farmers and Crop Growers OR = 1.9 (1.1-3.3), Fruit Grower/Worker OR = 2.7 (1.2-6.3), Building Trades Workers OR = 1.8 (1.1-3.0), Builders Labourers OR = 4.3 (1.1-16.7) and Agricultural, Earthmoving and Other Materials-Handling Equipment Operators OR = 2.6 (1.1-6.1). There was also a nonsignificant elevation in Electricians (OR = 3.1). Analyses by industry showed significantly elevated risks in agricultural (particularly horticulture and fruit growing), construction, automotive fuel retailing and computer services. Discussion These preliminary results are consistent with those reported in the literature, and suggest that occupational exposures such as pesticides and ELF-MF may play a role in MND in New Zealand.	Occupational and Environmental Medicine	73	NA	A85	Self-reported job history			Case-control	Job title	neurological	doctor-diagnosed	New Zealand	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
265	D. Neupane, E. Jors and L. Brandt	Pesticide use, erythrocyte acetylcholinesterase level and self-reported acute intoxication symptoms among vegetable farmers in Nepal: a cross-sectional study	2014	BACKGROUND: As pesticide use is increasing and proper handling training is lacking, exposure to pesticides and intoxications are an important public health problems among farmers in developing countries. This study describes pesticide use among farmers and compares symptoms of possible acute intoxication and Erythrocyte Acetylcholinesterase(AChE) levels among vegetable farmers with a control group of blood donors in Nepal. METHODS: A cross-sectional study was carried out among 90 pesticide-exposed farmers and a control group of 90 blood donors. Participants were randomly selected and data were gathered through questionnaires, observation and blood test. Chi-square test, logistic regression and Student's t-test were used for data analysis to describe pesticide use and compare symptoms and AChE levels between the two groups. This study was approved by Nepal Health Research Council. RESULTS: The majority of pesticides used were WHO class II, classified as moderately hazardous. The mean numbers of personal protective equipment used by farmers were 2.22 (95% CI: 1.89; 2.54). Out of five hygienic practices asked, farmers followed 3.63 (95% CI: 3.40; 3.86) hygienic practices on the average. Farmers reported more symptoms of possible pesticide intoxication in the past month than did controls, mean 5.47 (95% CI: 4.70; 6.25) versus 2.02 (95% CI: 1.63; 2.40) ($p < 0.05$). The mean haemoglobin-adjusted AChE(Q) was significantly lower among farmers compared to controls, 28.92 (95% CI: 28.28; 29.56) U/g versus 30.05 (95% CI: 29.51; 30.60) U/g, ($p = 0.01$). The risk of a farmer having lower Q level was about 3 times (OR = 2.95; 95% CI: 1.16; 7.51) greater than controls. CONCLUSION: Nepalese farmers exposed to pesticides have significantly more symptoms of possible pesticide intoxication than a control group of healthy individuals. A lower mean haemoglobin- adjusted AChE level was seen among farmers compared to the controls. The use of highly toxic pesticides, inadequate use of personal protective equipment and poor hygienic practices might explain the reason for symptoms of pesticide intoxication and a lower AChE level among farmers. Education and information of farmers should be undertaken to remediate these problems.	Environmental Health: A Global Access Science Source	13	NA	98	Job title			Cross-sectional	Job title	NA	self-reported	Nepal	lic
266	D. O. Hryhorczuk, W. H. Wallace, V. Persky, S. Furner, J. R. Webster, Jr., D. Oleske, B. Haselhorst, R. Ellefson and C. Zugerman	A morbidity study of former pentachlorophenol-production workers	1998	Pentachlorophenol (PCP) is a pesticide that was once widely used for wood preservation. Commercial PCP contained impurities including higher chlorinated dibenzo-p-dioxins (CDDs) and chlorinated dibenzofurans (CDFs). We investigated the effects of occupational exposure to PCP and its CDD and CDF contaminants on the skin, liver, porphyrin metabolism, and central and peripheral nervous systems. In 1986 we conducted a medical survey of 366 workers who had been engaged in the production of PCP at a single plant between 1938 and 1978. The referent group consisted of 303 workers from the same plant who were not exposed to these or related compounds. Exposure was determined from computerized personnel records. The medical survey included an administered questionnaire, medical record review, physical examination by dermatologists, internists, and neurologists, and analysis of 24-hr urine for quantitative porphyrins among other tests. In this paper we present the results of analyses of the general health, chloracne, and porphyrin metabolism end points. The general health status of PCP workers was similar to unexposed workers, but 17.8% of PCP workers had evidence of current or past chloracne. PCP workers with chloracne had significantly higher mean urinary excretion of coproporphyrins (117. 0 vs. 90.6 microg/24 hr) than unexposed workers after controlling for potential confounders. Workers with chloracne who had worked with both PCP and polychlorinated biphenyls had significantly higher mean urinary excretions of hepta-, penta-, and coproporphyrins than unexposed workers. We conclude that occupational exposure to PCP is associated with chloracne and biochemical abnormalities which may persist years after exposure.	Environmental Health Perspectives	106	7	401-8	Job title			Cross-sectional	Specific active ingredient	pesticide-related symptoms	self-reported	USA	hic
267	D. P. Boers, L.; Turner, W.; Bueno-De-Mesquita, B.; Heederik, D.; Vermeulen, R.	Plasma dioxin levels and cause-specific mortality in an occupational cohort of workers exposed to chlorophenoxy herbicides, chlorophenols and contaminants	2011	Objectives We recently reported modestly increased risks for all cancers and urinary cancers in workers exposed to chlorophenoxy herbicides using data from the Dutch Herbicide cohort study. These risks could not be linked to any of the qualitative exposure proxies available. Here, we re-investigate exposureresponse relations using a (semi-)quantitative measure of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) exposure. Methods plasma TCDD levels of 187 workers were used to develop a predictive model for TCDD exposure in the cohort. Cox proportional-hazards model was used to investigate associations between TCDD exposure as a time-varying variable and cause-specific mortality. Additional sensitivity analyses were performed to assess the impact of key assumptions in exposure assessment. Results predicted TCDD levels were associated with mortality from all causes (HR=1.08; 95% CI 1.03 to 1.13), ischemic heart disease (HR=1.19; 95% CI 1.08 to 1.32), and non-Hodgkin's lymphoma (HR=1.30; 95% CI 1.02 to 1.65) but no relations were found between TCDD exposure and mortality from all cancers, respiratory cancers, or urinary cancers. Sensitivity analyses showed that these results were relatively robust to changes in key assumptions in the exposure estimation. Conclusions Modelled TCDD exposure does not explain the previously reported increased risks for cancer mortality in the Dutch herbicide cohort. Although risk estimates for some of the rarer cancer outcomes were still rather imprecise, we do not expect more precise estimates from longer follow-up of this cohort due to the long time-span since last exposure to TCDD.	Occupational and Environmental Medicine	68	NA	A12	Biomonitoring (blood)	Algorithm/model		Cohort (prospective)	Specific active ingredient	mortality (all cause)	doctor-diagnosed	Netherlands	hic
268	D. P. Kang, S. K.; Beane-Freeman, L.; Lynch, C. F.; Knott, C. E.; Sandler, D. P.; Hoppin, J. A.; Dosemeci, M.; Coble, J.; Lubin, J.; Blair, A.; Alavanja, M.	Cancer incidence among pesticide applicators exposed to trifluralin in the Agricultural Health Study	2008	Trifluralin, 2,6-dinitro-N,N-dipropyl-4-trifluoromethylaniline, is a 2,6-dinitro herbicide widely used to control annual grasses and broadleaf weeds in agricultural settings. The association between trifluralin use and common cancer incidence was evaluated among 50,127 private and commercial pesticide applicators in the Agricultural Health Study (AHS), a prospective cohort study of licensed pesticide applicators and their spouses in Iowa and North Carolina. Poisson regression was used to examine internal dose-response relationships, while controlling for important lifestyle factors and other agricultural exposures. Two metrics of exposure (lifetime days and intensity-weighted lifetime days) were used in exposure-response analyses with non-exposed applicators, as well as applicators in the lowest tertile of exposure, as reference groups. Incident cancers were identified through state tumor registries from enrollment in 1993 through 2002. Trifluralin exposure was not associated with cancer incidence overall among 51% of private and commercial applicators (n=25,712) who had used trifluralin. However, there was an excess of colon cancer in the exposure category of higher half of highest tertile (rate ratios (RR) of 1.76 (95% CI=1.05-2.95) using the non-exposed as a referent and 1.93 (95% CI=1.08-3.45) using those with the lowest tertile of exposure as the referent). There was also a non-significantly elevated risk for kidney cancer and bladder cancer in the highest exposure group, although only the kidney cancer finding was consistent across exposure metrics. Although there was a possible link between trifluralin exposure and colon cancer, small numbers and inconsistencies in dose-response and subgroup analyses indicate that this may be a chance finding.	Environmental Research	107	2	271-6	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
269	D. Paoli, F. Giannandrea, M. Gallo, R. Turci, M. S. Cattaruzza, F. Lombardo, A. Lenzi and L. Gandini	Exposure to polychlorinated biphenyls and hexachlorobenzene, semen quality and testicular cancer risk	2015	PURPOSE: We carried out a case-control study to investigate the possible role of occupational and environmental exposure to endocrine disruptors in the onset of testicular cancer (TC).	NA	NA	NA	NA	Job exposure matrix			Case-control	Pesticides in general	cancer	doctor-diagnosed	Italy	hic
270	D. Pelclova, T. Navratil, Z. Fenclova, S. Vlckova, K. Kupka, P. Urban, P. Ridzon, V. Zikan, L. Landova, K. Syslova, M. Kuzma and P. Kacer	Increased oxidative/nitrosative stress markers measured non-invasively in patients with high 2,3,7,8-tetrachloro-dibenzo-p-dioxin plasma level	2011	OBJECTIVES: 2,3,7,8-tetrachloro-dibenzo-p-dioxin (TCDD) is a highly toxic persistent environmental contaminant, classified as a human carcinogen affecting any target organ. The mechanism of carcinogenesis by TCDD is unclear as TCDD shows a lack of direct genotoxicity. Experimental studies also support the role of oxidative stress in TCDD neurotoxicity and vascular dysfunction. The aim was to investigate markers of oxidative/nitrosative stress and inflammation using non-invasive methods in subjects who got ill due to severe occupational exposure to TCDD in the years 1965-1968. METHODS: In 11 TCDD-exposed patients, and 16 controls, the analysis of following oxidative products of lipids, proteins and nucleic acids in plasma, urine and exhaled breath condensate (EBC) was performed: 8-iso-prostaglandin F2alpha (8-isoprostane), 4-hydroxy-trans-2-nonenale (HNE), malondialdehyde (MDA), o-tyrosine (o-Tyr), 8-hydroxyguanosine (8-OHG), 8-hydroxy-2'-deoxy-guanosine (8-OHdG), 5-hydroxymethyluracil (5-OHMeU). In addition, nitric-oxide-tyrosine (NO-Tyr) and leukotriene (LT) B4, C4, D4, and E4 were detected by liquid chromatography-mass spectrometry/mass spectrometry (LC-ESI-MS/MS). TCDD was measured by HRGC/HRMS, body lipid content by densitometry. Single-photon emission spectrometry (SPECT) of the brain was performed and compared with the findings of the patients in 2008. RESULTS: Mean TCDD plasma level in 2010 was 175+/-162pg/g lipids (population level about 2pg/g), total TCDD content in the body 5.16+/-4.62mg. Reduction of cerebral blood flow in SPECT progressed in 8 patients, finding was stable in 2 subjects, and improvement occurred in 1 patient. In the EBC, 10 from 12 markers (all except LT D4 and LT E4), were significantly increased in the patients (p<0.05). In the urine, 7 markers were significantly higher than in the controls (p<0.05): 8-isoprostane, MDA, HNE, LT C4, LT E4, o-Tyr and NO-Tyr. In plasma, only NO-Tyr and 8-OHG were elevated (p<0.05). CONCLUSION: NO-Tyr was increased in all matrices in dioxin-exposed patients. EBC is not limited to lung disorders as the markers of oxidative stress and inflammation were elevated in EBC of patients with normal lung functions. TCDD-induced oxidative stress and inflammation markers can be detected non-invasively in the EBC and urine in the follow-up of the highly-exposed patients. Their prognostic value, however, needs to be elucidated.	Neuroendocrinology Letters	32	NA	26085	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	genetic (biomarkers)	medical test result	Czech Republic	hic
271	D. Pelclova, Z. Fenclova, P. Urban, P. Ridzon, J. Preiss, K. Kupka, J. Malik, Z. Dubska and T. Navratil	Chronic health impairment due to 2,3,7,8-tetrachloro-dibenzo-p-dioxin exposure	2009	OBJECTIVES: The aim of this study, performed in 2008, was to evaluate the consequences of severe occupational intoxication with 2,3,7,8-tetrachloro-dibenzo-p-dioxin (TCDD) that occurred during production of the herbicide trichlorophenoxyacetic acid in the period 1965-1968. DESIGN: Examination of 11 men, mean age 64.4+/-1.5 years, included: internal and neurological examination, eye fundus examination, TCDD in plasma, thyroid-stimulating hormone (TSH), testosterone and serum lipids, ultrasonography of the carotid artery, nerve conduction study (NCS), electroencephalography (EEG), visual evoked potential (VEP), Lanthony test of acquired visual impairment, single photon emission computer tomography (SPECT) of the brain, neuropsychological examination and carbohydrate-deficient transferrin (CDT), a marker of chronic ethanol intake. RESULTS: Mean TCDD level in 2008 was still 274.0+/-181.2 pg/g blood lipids (reference level is 2-3 pg/g). All (100%) patients had residues of chloracne/chloracne consequences, atherosclerotic changes on the eye fundus and plaques in the carotid arteries. Progression of intima-media thickness (IMT) from a mean of 0.84+/-0.14 mm in 2003 to 1.09+/-0.18 mm in 2008 was observed. Ninety-one per cents of patients had impairment in SPECT of the brain; and 55% of patients had hyperfixation of the perfusion indicator as a measure of increased neuronal activity. Additionally, 91 % of patients were treated for hyperlipidaemia, 73 % for hypertension, 55 % for diabetes type 2, 45 % for ischemic heart disease, and 36 % for psychological disorders. The Lanthony test demonstrated acquired dyschromatopsia in 80 % of patients. Mean colour confusion index (CCI) was 1.438, which indicates impairment since 2003, when the index was 1.302. CDT was in the normal range and did not correlate with CCI. Neuropsychological status appeared stabilized in all 8 patients examined, with impairment in one or more parameter (memory, attention, verbal fluency, psychomotor speed, motorics) in comparison to the norm. CONCLUSION: Forty years after intoxication, the blood level of TCDD is still 100 times higher than in the general population. Other PCDD/Fs were not elevated. A high percentage of subjects suffer from neurological and vascular disorders. No association of alcohol consumption with neurological impairment was seen, and the highly significant correlation between CCI and TCDD blood concentration suggests that acquired colour impairment was associated with TCDD but not with alcohol consumption. IMT significantly increased during past 5 years. The patients obviously need complex treatment, including intense hypolipidaemic and antidepressant therapy.	Neuroendocrinology Letters	30	NA	219-24	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	pesticide-related symptoms	medical test result	Czech Republic	hic

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272	D. Pelclova, Z. Fenclova, Z. Dlaskova, P. Urban, E. Lukas, B. Prochazka, C. Rappe, J. Preiss, A. Kocan and J. Vejlupkova	Biochemical, neuropsychological, and neurological abnormalities following 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) exposure	2001	Presented herein are the results of follow-up examinations of 13 workers performed in 1996--30 yr following 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) intoxication in a herbicide production plant. In these workers, the current mean plasma level of 2,3,7,8-TCDD, measured by high-resolution gas chromatography/high-resolution mass spectrometry, was 256 pg/gm lipid (range = 14-760 pg/gm lipid). This mean value corresponded to an estimated concentration of approximately 5,000 pg/gm plasma fat that existed about 30 years ago. Such a mean plasma level indicates that this group was one of the most heavily exposed groups to 2,3,7,8-TCDD described in the literature. Patients with persistent chloracne had significantly higher plasma levels of 2,3,7,8-TCDD than persons without chloracne. A significant, positive correlation was found between plasma levels of 2,3,7,8-TCDD in 1996 and levels of cholesterol and plasma lipids that existed since 1974. During 1996, there was a significant positive correlation between 2,3,7,8-TCDD and levels of beta-lipoproteins, cholesterol, and triglycerides. Also in 1996, significant correlations were found between neuropsychological variables and plasma levels of 2,3,7,8-TCDD. Other significant correlations were observed between neuropsychological variables and (1) the highest levels of triglycerides (i.e., since the year 1989), (2) levels of triglycerides in 1996, (3) levels of cholesterol at the first examination (i.e., 1969-1970), (4) highest level of cholesterol since the year 1969, and (5) cholesterol levels in 1996. Such correlations are biologically plausible, and they provide evidence of impaired cognitive performance (i.e., memory first), with a concurrent increase of plasma lipid levels. Abnormal electromyography, electroencephalography, and visual evoked potentials were observed in 23%, 54%, and 31 %, respectively, of former workers. Abnormal electroencephalography findings occurred more frequently in workers who had 2,3,7,8-TCDD blood levels that exceeded 200 pg/gm plasma fat than in workers with 2,3,7,8-TCDD values lower than 200 pg/gm plasma fat ($p < .025$). Frequency of polyneuropathic EMG abnormalities decreased from 38% in the 1970s to 23% in 1996. Improvement of conduction velocity in the tibial nerve was statistically significant ($p < .05$).	Archives of Environmental Health	56	6	493-500	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	biochemical	medical test result	Czech Republic	hic
273	D. Provost, A. Cantagrel, P. Lebailly, A. Jaffre, V. Loyant, H. Loiseau, A. Vital, P. Brochard and I. Baldi	Brain tumours and exposure to pesticides: a case-control study in southwestern France	2007	BACKGROUND: Brain tumours are often disabling and rapidly lethal; their aetiology is largely unknown. Among potential risk factors, pesticides are suspected. OBJECTIVE: To examine the relationship between exposure to pesticides and brain tumours in adults in a population-based case-control study in southwestern France. METHODS: Between May 1999 and April 2001, 221 incident cases of brain tumours and 442 individually matched controls selected from the general population were enrolled. Histories of occupational and environmental exposures, medical and lifestyle information were collected. A cumulative index of occupational exposure to pesticides was created, based on expert review of lifelong jobs and tasks. Separate analyses were performed for gliomas and meningiomas. RESULTS: A non-statistically significant increase in risk was found for brain tumours when all types of occupational exposure to pesticides were considered (OR = 1.29, 95% CI 0.87 to 1.91) and slightly higher but still non-statistically significant when gliomas were considered separately (OR = 1.47, 95% CI 0.81 to 2.66). In the highest quartile of the cumulative index, a significant association was found for brain tumours (OR = 2.16, 95% CI 1.10 to 4.23) and for gliomas (OR = 3.21, 95% CI 1.13 to 9.11), but not for meningiomas. A significant increase in risk was also seen for the treatment of home plants (OR = 2.24, 95% CI 1.16 to 4.30) owing to environmental exposure to pesticides. CONCLUSIONS: These data suggest that a high level of occupational exposure to pesticides might be associated with an excess risk of brain tumours, and especially of gliomas.	Occup Environ Med	64	8	509-14	Self-reported job history	Expert case-by-case assessment		Case-control	Job title	cancer	doctor-diagnosed	France	hic
274	D. S. Flesch-Janys, K.; Gurn, P.; Becher, H.	Estimation of the cumulated exposure to polychlorinated dibenzo-p-dioxins/furans and standardized mortality ratio analysis of cancer mortality by dose in an occupationally exposed cohort	1998	For a cohort of 1189 male German former herbicide and insecticide workers with exposure to polychlorinated dibenzo-p-dioxins and -furans (PCDD/F), we report an extended standardized mortality ratio (SMR) analysis based on a new quantitative exposure index. This index characterizes the cumulative lifetime exposure by integrating the estimated concentration of PCDD/F at every point in time (area under the curve). Production department-specific dose rates were derived from blood levels and working histories of 275 workers by applying a first-order kinetic model. These dose rates were used to estimate exposure levels for all cohort members. Total mortality was elevated in the cohort; 413 deaths yielded an SMR of 1.15 (95% confidence interval [CI] 1.05, 1.27) compared to the mortality of the population of Germany. Overall cancer mortality (n = 124) was significantly increased (SMR = 1.41, 95% CI 1.17, 1.68). Various cancer sites showed significantly increased SMRs. The exposure index was used for an SMR analysis of total cancer mortality by dose. For 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) a significant trend ($p = 0.01$) for the SMRs with increasing cumulative PCDD/F exposure was observed. The SMR in the first exposure quartile (0-125.2 ng/kg x years) was 1.24 (95% CI 0.82, 1.79), increasing to 1.73 (95% CI 1.21, 2.40) in the last quartile (> or = 2503.0 ng/kg x years). For all congeners combined as toxic equivalencies (TEQ) using international toxic equivalency factors, a significant increase in cancer mortality was observed in the second quartile (360.9-1614.4 ng/kg x years, SMR 1.64; 95% CI 1.13, 2.29) and the fourth quartile (> or = 5217.7 ng/kg x years TEQ, SMR 1.64, 95% CI 1.13, 2.29). The trend test was not significant. The results justify the use of this cohort for a quantitative risk assessment for TCDD and to a lesser extent for TEQ.	Environmental Health Perspectives	106	NA	655-62	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	Germany	hic

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275	D. S. I. Rohlman, A. A.; Rasoul, G. A.; Bonner, M. R.; Hendy, O.; Mara, K.; Wang, K.; Olson, J. R.	A 10-month prospective study of organophosphorus pesticide exposure and neurobehavioral performance among adolescents in Egypt	2016	Chlorpyrifos is an organophosphorus (OP) pesticide widely used around the world for agricultural operations. Although studies have examined exposure in children, there is limited information on adolescents who are occupationally exposed. Furthermore, there is limited research addressing the change in exposure patterns and outcomes across the application season. The goal of the current study was to examine the impact of chlorpyrifos exposure on neurobehavioral performance in adolescents before, during and after the application season. The longitudinal study was conducted in Egypt from April 2010 to January 2011, quantifying exposure and neurobehavioral performance with repeated measures prior to, during, and following the application period. At each test session, participants completed a neurobehavioral test battery and urine was collected for analysis of the chlorpyrifos metabolite 3,5,6-trichloro-2 pyridinol (TCPy) (biomarker of exposure). Cumulative urinary TCPy over the study period was used to classify participants into low (<median) and high (>= median) exposure groups. The urinary TCPy concentrations increased for both groups during the application season and decreased following the end of application. TCPy levels were significantly elevated in the high exposure group compared to the low exposure groups at all time intervals except baseline. Deficits in cumulative neurobehavioral performance were found among the high exposure group compared with the low exposure group. Additionally, changes in neurobehavioral performance across the application season indicate a pattern of impaired performance in the high exposure group compared to the low exposure group. Deficits increased during the application season and remained even months after application ceased. This study is the first to examine the impact of changes in pesticide exposure and neurobehavioral performance not only before and after the application season, but also within the application season. Furthermore, this study examines the impact of pesticide exposure on an adolescent population who may be at greater risk than adult populations.	Cortex	74	NA	383-95	Biomonitoring (urine)			Cohort (prospective)	Specific active ingredient	neurological	medical test result	Egypt	lmic
276	D. S. Rohlman, A. A. Ismail, G. Abdel-Rasoul, M. Lasarev, O. Hendy and J. R. Olson	Characterizing exposures and neurobehavioral performance in Egyptian adolescent pesticide applicators	2014	Children and adolescents may have occupational exposure to pesticides. Although previous studies examining prenatal pesticide exposure have identified neurobehavioral deficits in children, there are limited studies examining the impact of occupational exposure in children. The objectives of this study are to estimate exposures to the organophosphorus pesticide, chlorpyrifos (CPF), by measuring urinary levels of 3,5,6-trichloro-2-pyridinol (TCPy), a specific CPF metabolite, and blood cholinesterase (ChE) activities and to characterize neurobehavioral performance in adolescents working as seasonal pesticide applicators and non-applicator controls. A neurobehavioral test battery, consisting of 14 tests, was used to assess a broad range of functions. Applicators performed worse than controls on the majority of tests. Principal component analysis was used to reduce the number of outcome variables and two components, focused on reasoning-short-term memory and attention-executive functioning, showed significant deficits in applicators compared to non-applicators. Elevated metabolite levels were found in the applicators compared to the non-applicators, confirming CPF exposure in the applicators. Although this study is limited by a small sample size, it provides preliminary evidence of moderate CPF exposures, decreased blood ChE in some applicators and decreased neurobehavioral performance in an adolescent working population.	Metabolic Brain Disease	29	3	845-55	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	neurological	medical test result	Egypt	lmic
277	D. S. Rohlman, S. R. Bailey, W. K. Anger and L. McCauley	Assessment of neurobehavioral function with computerized tests in a population of hispanic adolescents working in agriculture	2001	In recent years there has been heightened concern over the potential of occupational or environmental exposures to affect neurological function in children and adolescents. The current study was designed to develop computerized tests to effectively assess neurobehavioral function in Hispanic adolescents working in agriculture and to evaluate those tests in Hispanic youths working in agriculture and in a non-agricultural group. After exclusions, 96 adolescents currently working in agriculture (AG) and 51 adolescents currently non-migratory and not working in agriculture (Non-AG) were tested. Neurobehavioral tests were selected from the computerized Behavioral Assessment and Research System. AG test performance was significantly below Non-AG performance on the cognitive tests. However, educational and cultural differences between the AG and Non-AG groups may explain this difference. Repeat testing of the AG group revealed substantially improved performance, further supporting educational or cultural differences as an explanation for the group differences. Together, these results expose the limitations in case-control or cross-sectional designs for testing migrant worker populations in the United States. Longitudinal or cross-sectional designs with repeat testing offer more promise and may be essential for drawing accurate conclusions in migrant worker groups where there are no truly equivalent comparison or control groups.	Environmental Research	85	1	14-24	Job title			Cross-sectional	Job title	neurological	medical test result	USA	hic
278	D. Sack, D. Linz, R. Shukla, C. Rice, A. Bhattacharya and R. Suskind	Health status of pesticide applicators: postural stability assessments	1993	Postural sway testing was performed on 37 pesticide-exposed workers and 35 nonexposed subjects. All subjects were asymptomatic. When ratios of sway measurements in different test conditions were investigated, total length of sway was significantly different between groups (P = .0001). Weight/height (P = .0006), exposure to pesticides (P = .0215), recent organophosphate exposure (P = .0391), and plasma cholinesterase level (P = .1537) were associated with increased body sway. The pattern of sway performance suggested a proprioceptive impairment, well compensated by visual cues, potentially attributable to pesticide exposure. This finding is of unclear clinical significance because results of neurologic examinations and nerve conduction studies that were reported separately did not show evidence of neuropathy. Postural sway testing is a simple, sensitive, noninvasive, and reproducible technique to evaluate subtle neurologic dysfunction. These findings are preliminary. Further studies are required to validate the findings and, if confirmed, to explore their functional or clinical significance.	Journal of Occupational Medicine	35	12	1196-202	Biomonitoring (blood)			Cross-sectional	Chemical class	neurological	medical test result	USA	hic

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279	D. v. A. Boers, L.; Colosio, C.; Corsini, E.; Fustinoni, S.; Campo, L.; Bosetti, C.; La Vecchia, C.; Vergieva, T.; Tarkowski, M.; Liesivuori, J.; Steerenberg, P.; van Loveren, H.	Asthmatic symptoms after exposure to ethylenebisdithiocarbamates and other pesticides in the Europit field studies	2008	We conducted a multicenter prospective study to assess the effects of occupational exposure to ethylenebisdithiocarbamate fungicides and/or other pesticides on self-reported asthma and asthmatic symptoms. This multicenter study was conducted among 248 workers exposed to pesticides and 231 non-exposed workers from five field studies. The five field studies were carried out in The Netherlands, Italy, Finland, and two studies in Bulgaria. Subjects constituting this cohort completed a self-administered questionnaire at baseline (before the start of exposure). Ethylenethiourea in urine was determined to assess exposure to ethylenebisdithiocarbamates. In multivariate analyses adjusted for all potential confounders (age, education, residence, smoking, gender, and field study), we found inverse associations, all not statistically significant, between occupational exposure to pesticides and asthma diagnosis (OR 0.41; 95% CI 0.15-1.11), complains of chest tightness (OR 0.60; 95% CI 0.36-1.02), wheeze (OR 0.56; 95% CI 0.32-0.98), asthma attack (OR 0.52; 95% CI 0.12-2.25), and asthma medication (OR 0.79; 95% CI 0.25-2.53). Furthermore, we reported null associations for multivariate analysis using ethylenethiourea as determinant for exposure. Although exposure to pesticides remains a potential health risk, our results do not suggest an association between exposure to ethylenebisdithiocarbamates and/or other pesticides used in our study on asthma and asthmatic symptoms.	Human & Experimental Toxicology	27	9	721-7	Biomonitoring (urine)			Cohort (prospective)	Chemical class	respiratory	self-reported	SHIC	SHIC
280	D. V. Vizcaya, Lavoue, Pintos, Richardson and Siemiatycki	Lung cancer and cleaning-related exposures: Results from two case-control studies	2013	Objectives To evaluate the association between lung cancer and cleaning-related exposures. Methods Two case-control studies conducted in Montreal to explore occupational associations with cancer included 2016 lung cancer cases and 2001 population controls. Occupational exposure to several agents was assessed using a combination of subject-reported job history and expert assessment. Participants also provided information on personal characteristics such as smoking and medical history. Using multivariate logistic regression analyses, we evaluated the associations between lung cancer and employment in 12 cleaning-related occupations, and exposure to eight chemicals related to cleaning products. For the most recent study, we analysed the effect of cleaning agents on lung cancer risk separately for asthmatics and non-asthmatics. Results The general pattern of results was similar in both studies. Pooling the studies, we found no increased risk of lung cancer for cleaning-related occupations (odds ratio and 95% confidence interval (OR) for <U+201A><U+00C4><U+00FA>ever employed in any cleaning-related occupation<U+201A><U+00C4><U+00F9>: 1.0; 0.8-1.1) as compared to never cleaners. Among chemical exposures, we found a negative association of lung cancer with any occupational exposure to cleaning agents (OR: 0.9; 0.7-1.0), and biocides (0.8; 0.7-1.0). In a secondary analysis, restricting to subjects with a history of asthma, the OR between lung cancer and long duration employment in a cleaning-related occupation was 2.1 (0.9 to 5.0). The OR of lung cancer and cleaning agents was also higher, yet non-significant, among asthmatics (1.5; 0.8-2.8) than among non-asthmatics (0.9; 0.7-1.1). Conclusions People employed in cleaning-related occupations or who had worked with cleaning agents had no increased risk of lung cancer. There was a suggestion that this overall result masked a possible increased risk of lung cancer among asthmatics with cleaning-related exposures and/or occupations.	Occupational and Environmental Medicine	70	NA	NA	Expert case-by-case assessment	Self-reported exposure		Case-control	Type of pesticide	cancer	doctor-diagnosed	Canada	hic
281	D. W. Kaufman, T. E. Anderson and S. Issaragrisil	Risk factors for leukemia in Thailand	2009	A case-control study of adult-onset leukemia was conducted in Bangkok, Thailand to explore the contribution of cellular telephone use and other factors to the etiology of the disease; 180 cases (87 acute myeloblastic leukemia, 40 acute lymphoblastic leukemia, 44 chronic myelogenous leukemia, eight chronic lymphocytic leukemia, one unclassified acute leukemia) were compared with 756 age- and sex-matched hospital controls. Data were obtained by interview; odds ratios (ORs) were estimated by unconditional logistic regression. There was no clear association with cellular telephone phone use, but durations were relatively short (median 24-26 months), and there was a suggestion that risk may be increased for those with certain usage practices (ORs, 1.8-3.0 with lower confidence intervals >1.0) and those who used GSM service (OR, 2.1; 95% confidence interval, 1.1-4.0). Myeloid leukemia (acute and chronic combined) was associated with benzene (OR, 3.9; 95% confidence interval, 1.3-11), a nonspecific group of other solvents (2.3; 1.1-4.9), occupational pesticides that were mostly unspecified (3.8; 2.1-7.1), and working with or near powerlines (4.3; 1.3-15). No associations were found for diagnostic X-rays, cigarette smoking, or other occupational exposures.	Annals of Hematology	88	11	1079-88	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Thailand	umic
282	D. Z. Boers, M. P.; Swaen, G. M.; Kant, I.; van den Brandt, P. A.	The influence of occupational exposure to pesticides, polycyclic aromatic hydrocarbons, diesel exhaust, metal dust, metal fumes, and mineral oil on prostate cancer: a prospective cohort study	2005	AIMS: To investigate the relation between exposure to pesticides, polycyclic aromatic hydrocarbons (PAHs), diesel exhaust, metal dust, metal fumes, and mineral oil in relation to prostate cancer incidence in a large prospective study. METHODS: This cohort study was conducted among 58,279 men in the Netherlands. In September 1986, cohort members (55-69 years) completed a self-administered questionnaire on potential cancer risk factors, including job history. Follow up for prostate cancer incidence was established by linkage to cancer registries until December 1995 (9.3 years of follow up). The analyses included 1386 cases of prostate cancer and 2335 subcohort members. A blinded case-by-case expert exposure assessment was carried out to assign cases and subcohort members a cumulative probability of exposure for each potential carcinogenic exposure. RESULTS: In multivariate analyses there was a significant negative association for pesticides (RR 0.60; 95% CI 0.37 to 0.95) when comparing the highest tertile of exposure to pesticides with no exposure. No association was found for occupational exposure to PAHs (RR 0.75; 95% CI 0.42 to 1.31), diesel exhaust (RR 0.81; 95% CI 0.62 to 1.06), metal dust (RR 1.01; 95% CI 0.72 to 1.40), metal fumes (RR 1.11; 95% CI 0.80 to 1.54), or mineral oil (RR 0.99; 95% CI 0.66 to 1.48) when comparing the highest tertile of exposure with no exposure. In subgroup analysis, with respect to tumour invasiveness and morphology, null results were found for occupational exposure to pesticides, PAH, diesel exhaust, metal dust, metal fumes, and mineral oil. CONCLUSIONS: These results suggest a negative association between occupational exposure to pesticides and prostate cancer. For other carcinogenic exposures results suggest no association between occupational exposure to PAHs, diesel exhaust, metal dust, metal fumes, or mineral oil and prostate cancer.	Occupational & Environmental Medicine	62	8	531-7	Expert case-by-case assessment			Cohort (prospective)	Pesticides in general	cancer	doctor-diagnosed	Netherlands	hic

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283	D. Zeljezic, A. L. Vrdoljak, B. Radic, N. Fuchs, S. Berend, V. Orescanin and N. Kopjar	Comparative evaluation of acetylcholinesterase status and genome damage in blood cells of industrial workers exposed to carbofuran	2007	Literature data on carbofuran genotoxicity in vitro and in vivo are very scarce. There are few papers indicating that occupational exposure to this AChE inhibiting insecticide might be connected to increased risk of developing non-Hodgkin's lymphoma and lung cancer. Other authors showed its genotoxicity in vitro. We used comet and CBMN micronucleus assay combined with centromere probes to evaluate genome damage in lymphocytes of workers employed in carbofuran production. Also, the level of AChE activity in blood and plasma was measured. Only few workers exhibited AChE activity below 85%. Comet assay parameters were slightly but significantly elevated compared to control subjects, especially the long-tailed nuclei ratio. We found poor correlation between AChE activity and comet assay parameters, but significant effect of smoking and alcohol intake on the latest. In binucleated lymphocytes of workers significantly increased number of micronuclei, nuclear buds, and nucleoplasmic bridges was detected. Proportion of micronuclei with centromere, DAPI signal positive micronuclei was also elevated. Micronucleus assay parameters also appeared to be significantly influenced by duration of exposure to carbofuran. Together with published data on carbofuran's effect on health our results might indicate the need for further evaluations of its genotoxicity using a range of different cytogenetic techniques.	Food & Chemical Toxicology	45	12	2488-98	Biomonitoring (blood)	Self-reported exposure		Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	Croatia	hic
284	D. Zeljezic, A. L. Vrdoljak, J. N. Lucas, R. Lasan, A. Fucic, N. Kopjar, J. Katic, M. Mladinic and B. Radic	Effect of occupational exposure to multiple pesticides on translocation yield and chromosomal aberrations in lymphocytes of plant workers	2009	Employees handling pesticides are simultaneously exposed to different active substances. Occurring multiple chemical exposures may pose a higher risk than it could be deduced from studies evaluating the effect of a single substance. This study comprised 32 pesticide plantworkers exposed to carbofuran, chlorpyrifos, metalaxyl, and dodine and an equal number of control subjects. Groups were matched by age (43.8 +/- 10.16 vs 41.8 +/- 7.42, respectively), sex (14 females; 18 males), and smoking (11 smokers; 21 nonsmokers). Chromosome aberration and translocation frequencies were determined using a standard aberration assay and fluorescent in situ hybridization (FISH) by applying painting probes for chromosomes 1, 2, and 4. Although significant, an observed increase in chromatid breaks (5.2 +/- 2.49) compared to controls (2.1 +/- 0.87), p(PostHoc) = 0.000001 is biologically irrelevant. Genomic frequency of translocations was also significantly elevated (exposed 0.0165 +/- 0.0070; control 0.0051 +/- 0.0023, P(PostHoc) = 0.000004). The distribution of translocations among chromosomes 1, 2, and 4 did not differ from control subjects. It corresponded to the distribution of DNA content among selected chromosomes indicating randomness of DNA damage. A good translocation yield correlation within years spent in pesticide production indicates that multiple pesticide exposure may pose a risk to genome integrity. However, for more accurate health risk assessments, the use of probes for some other groups of chromosomes should be considered.	Environmental Science & Technology	43	16	1632817	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Croatia	hic
285	D. Zeljezic, M. Bjelis and M. Mladinic	Evaluation of the mechanism of nucleoplasmic bridge formation due to premature telomere shortening in agricultural workers exposed to mixed pesticides: indication for further studies	2015	Agricultural workers are often exposed to high levels of pesticides over prolonged periods of time. We attempted to determine whether exposure to multiple pesticides shortens relative telomere length (RTL) and causes nucleoplasmic bridge (NPB) formation via the mechanism of telomere-end fusion in the lymphocytes of agricultural workers. For measuring RTL, we used quantitative fluorescent in situ hybridization, while NPB frequency was measured as part of the cytome assay. Multivariate analysis of variances taking into account confounding factors (age, gender, years of exposure, smoking, and alcohol intake) did not show a decrease, but rather an increase of RTL in agricultural workers compared to control individuals. In the exposed population, NPB frequency was significantly higher compared to controls (6 times, $p<0.05$). Multiple regression between NPB, RTL, and confounding factors was not significant. Using Spearman correlation, we did not find proof for our initial hypothesis. Our hypothesis that telomere shortening is a mechanism of NPB origin was not proven, indicating that telomere-end fusion is not a mechanism of NPB formation under our experimental conditions for agricultural workers.	Chemosphere	120	NA	45-51	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Croatia	hic
286	E. A. Holly, C. Lele and P. Bracci	Non-Hodgkin's lymphoma in homosexual men in the San Francisco Bay Area: occupational, chemical, and environmental exposures	1997	Chemical, occupational, and other exposures as risk factors for non-Hodgkin's lymphoma (NHL) among homosexual men are reported from a population-based case-control study of 1593 eligible subjects with NHL and 2515 control subjects conducted in the San Francisco Bay Area between 1988 and 1995. Results are presented for 312 homosexual men with NHL and 420 homosexual control subjects. HIV-positive patients were less likely than control subjects to have worked in technical, sales, and administrative occupations; service occupations; and precision production, craft, or repair-related occupations. They were likely to have had less exposure to petroleum products, aldehydes, cleaning solvents, adhesives, insecticides, welding fumes, and tar, pitch, soot, or ash. The HIV-negative patients were less likely than the control subjects to have worked in managerial or professional specialty occupations and in technical, sales, or administrative occupations. HIV-negative patients were somewhat more likely than control subjects to have been exposed to herbicides (OR = 2.0, CI = 0.89 to 4.7), to radioactivity (OR = 4.7, CI = 1.7 to 13), and to tar, soot, pitch, or ash (250+ hours: OR = 2.3, CI = 0.96 to 5.6). HIV-negative NHL patients also were somewhat more likely to have lived on a farm as children than the control subjects (OR = 2.4, CI = 1.0 to 5.6). Pooled over HIV status, patients were somewhat more likely to have worked as motor vehicle or rail operators for more than 1 year (OR = 2.1, CI = 0.98 to 4.4). Most occupational exposures were of brief duration and many chemical exposures were reported as minimal. No clear and strong associations were found, although the risk for NHL related to exposure to several chemicals generally was reduced among HIV-positive men and elevated among HIV-negative men.	Journal of Acquired Immune Deficiency Syndromes & Human Retrovirology	15	3	223-31	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	USA	hic
287	E. A. Holly, D. A. Aston, D. K. Ahn and A. H. Smith	Intraocular melanoma linked to occupations and chemical exposures	1996	We conducted a case-control study in the western United States to determine the relation between occupations or chemical exposures and increased risk of uveal melanoma. Among men (221 patients, 447 controls), we found increased risks for occupational groups who had intense exposure to ultraviolet light [odds ratio (OR) = 3.0; 95% confidence interval (CI) = 1.2-7.8], welding exposure (OR = 2.2; 95% CI = 1.3-3.5), and asbestos exposure (OR = 2.4; 95% CI = 1.5-3.9 for most likely exposed). The highest odds ratio was for the small number of men (nine cases, three controls) who were chemists, chemical engineers, and chemical technicians (OR = 5.9; 95% CI = 1.6-22.7). Odds ratios also were elevated for exposures to antifreeze, formaldehyde, pesticides, and carbon tetrachloride, but these findings, based on recall of specific chemical exposures, are more subject to recall bias than the findings based on occupational groups.	Epidemiology	7	1	55-61	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
288	E. A. Salem, M. M. Hegazy and E. A. El Khouley	Pesticide exposure as a risk factor for lymphoproliferative disorders in adults	2014	In view of the widespread use of pesticides in Egypt and the increasing incidence of leukaemia and lymphoma we aimed to assess pesticide exposure and other selected variables as risk factors for lymphoproliferative disorders (leukaemia and non-Hodgkin lymphoma). In a hospital-based, retrospective, case-control study in 2011-2012, adult cases of lymphoproliferative disorders (n = 130) were recruited from outpatient clinics in Menoufia, Egypt, while controls (n = 130) were age- and sex-matched fracture patients. Family history of cancer, exposure to X-rays, smoking and use of hair dyes were not risk factors for lymphoproliferative disorders in univariate analysis. History of exposure to pesticides and HCV infection were significant risk factors for lymphoproliferative disorders in multivariate analysis (OR = 2.24; 95% CI: 1.22-4.11 and OR = 2.67; 95% CI: 1.50-4.80 respectively). The risk was significant for cases of non-Hodgkin lymphoma but not chronic lymphocytic leukaemia.	Eastern Mediterranean Health Journal	20	6	363-71	Self-reported exposure			Case-control	Pesticides in general	immunological	doctor-diagnosed	Egypt	lmic
289	E. B. MacFarlane, G.; Del Monaco, A.; Sim, M. R.	Causes of death and incidence of cancer in a cohort of Australian pesticide-exposed workers	2010	PURPOSE: To determine the rates of mortality and of cancer incidence in a cohort of pesticide-exposed Australian workers. METHODS: The study cohort was assembled using records of former government occupational health surveillance programs. The cohort was then linked to the Australian national registries of cancer and mortality and analyzed in comparison with the general Australian population. RESULTS: Consistent with a healthy worker effect, we found no overall excesses in mortality or incident cancer. Non-injury-related causes of death were less than expected; however, non-intentional poisoning and suicide mortality were significantly elevated. All types of suicide were elevated, and firearm suicide deaths were significantly in excess. The suicides by poisoning were predominantly associated with pesticides, although other published research suggests this pattern is more often associated with developing countries. CONCLUSIONS: This study did not find evidence of a relationship between occupational pesticide exposure and cancer or non-injury-related mortality. However, accidental poisoning and intentional self-harm warrant further investigation.	Annals of Epidemiology	20	4	273-80	Registers			Cohort (prospective)	Job title	cancer	doctor-diagnosed	Australia	hic
290	E. Beane Freeman, Koutros; , Alavanja; , Zahm; , Sandler; , Hines; , Thomas; , Hoppin; , Blair	2,4-D use and cancer incidence in pesticide applicators in the agricultural health study	2013	Objectives 2,4-dichlorophenoxyacetic acid (2,4-D) is one of the most widely used herbicides in the world. It has been associated with increased risk of non-Hodgkin lymphoma (NHL) in multiple epidemiologic studies, with some evidence for association with cancer at other sites. Findings from experimental studies, however, have been largely negative with respect to NHL. Within the Agricultural Health Study (AHS), a prospective cohort of licensed pesticide applicators in the United States, we evaluated use of this herbicide and multiple cancer sites. Methods We used Poisson regression to estimate relative risks (RR) and 95% confidence intervals for cancers that occurred from enrollment in the AHS (1993-97) through 2008. Total lifetime days of use of 2,4-D were calculated based on information provided at enrollment and at a follow-up interview conducted 5 years later. In addition, an intensity-weighting algorithm was applied to account for factors that modify exposure. Results Overall, 78% of the 52,324 applicators who provided information on 2,4-D use and who were cancer free at enrollment reported using 2,4-D. Among this group, there were 5,168 incident cancers. Compared to non-users, there was no association with cancer risk overall (p-trend = 0.68), NHL overall (p-trend = 0.84), or any sub-type of NHL with intensity-weighted lifetime days. Conversely, in the highest quartiles, there was an elevated risk of gastric cancer (RR = 2.3, 95% CI:1.1-5.2, p-trend = 0.03) and a suggestion of elevated risk of brain cancer (RR = 2.3, 95% CI: 0.9-5.7, p-trend = 0.31). Conclusions The results from this prospective study showed no association between use of 2,4-D and NHL, the cancer most often linked to this herbicide. The increased risk of gastric cancer is noteworthy but supporting data are limited. Some previous studies of brain cancer have suggested a role for pesticides, particularly herbicides; to our knowledge there is no other study specifically suggesting an association with 2,4-D.	Occupational and Environmental Medicine	70	NA	NA	Algorithm/model	Self-reported exposure		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
291	E. C. Persson, B. I. Graubard, A. A. Evans, W. T. London, J. P. Weber, A. LeBlanc, G. Chen, W. Lin and K. A. McGlynn	Dichlorodiphenyltrichloroethane and risk of hepatocellular carcinoma	2012	Dichlorodiphenyltrichloroethane (p,p'-DDT), an organochlorine pesticide known to have deleterious health effects in humans, has been linked to hepatocellular carcinoma (HCC) in rodents. A recent study has reported that p,p'-DDT and its most persistent metabolite, dichlorodiphenyldichloroethylene (p,p'-DDE), may also be associated with HCC in humans. To examine whether there is an association between p,p'-DDT and/or p,p'-DDE in a population at high-risk of developing HCC, a nested case-control study was conducted within the 83,794 person Haimen City Cohort in China. Sera and questionnaire data were collected from all participants between 1992 and 1993. This study included 473 persons who developed HCC and 492 who did not, frequency matched on sex, age and area of residence. p,p'-DDT and p,p'-DDE levels were determined by mass spectrometry. Hepatitis B viral infection status (based on hepatitis B virus surface antigen; HBsAg) was also determined. p,p'-DDT and/or p,p'-DDE serum levels were significantly associated with sex, area of residence, occupation, alcohol consumption and cigarette smoking. Adjusting for age, sex, area of residence, HBsAg, family history of HCC, history of acute hepatitis, smoking, alcohol, occupation (farmer vs. other) and levels of p,p'-DDT or p,p'-DDE, odds ratios (OR) and 95% confidence intervals (CI) were calculated via unconditional logistic regression. Overall, the highest quintile of p,p'-DDT was associated with an increased risk of HCC, OR = 2.96 95% CI; 1.19-7.40. There were no statistically significant associations with p,p'-DDE. Overall, these results suggest that recent exposure to p,p'-DDT may increase risk of HCC.	International Journal of Cancer	131	9	2078-84	Biomonitoring (blood)	Self-reported job history		Case-control	Specific active ingredient	cancer	doctor-diagnosed	China	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
292	E. Corsini, I. Codeca, S. Mangiaratti, S. Birindelli, C. Minoia, R. Turci, B. Viviani, A. Facchi, N. Vitelli, L. Lucchi, C. L. Galli, M. Marinovich and C. Colosio	Immunomodulatory effects of the herbicide propanil on cytokine production in humans: In vivo and in vitro exposure	2007	Propanil, 3,4-dichloropropionanilide, a commonly used herbicide, has been shown to induce effects on the mouse immune system. The aim of this study was to assess the immunotoxicity of propanil in occupationally exposed agricultural workers and to characterize its molecular mechanism of action. Seven agricultural workers intermittently exposed to propanil and 7 healthy matched controls entered the study. Data were collected through physical examination, and laboratory investigations addressed at the main serum, cellular, and functional immune parameters. The levels of exposure were assessed by determining the urine concentration of the major propanil metabolite, 3,4-dichloroaniline. The investigation of serum, cellular, and functional immune parameters suggested that propanil exposure results in a modest immunomodulatory effect, characterized by an increase in the plasma level of IgG(1) and in LPS-induced IL-6 release and, by a reduction in PHA-induced IL-10 and IFN release, associated with a reduced IFN/IL-4 ratio. As observed, following in vivo exposure, in vitro treatment of human peripheral blood leukocytes with propanil resulted in a dose-dependent reduction in PHA-induced IFN-gamma and IL-10 production, while LPS-induced TNF-alpha production was not affected indicating a direct effect of propanil on selected immune parameters. We demonstrated that propanil interfering with PHA-induced intracellular calcium increase modulated IL-10 and IFN-gamma transcription and translation, which indicates that propanil acts on early events triggered by PHA. Overall, our results suggest that human exposure to propanil has slight immunomodulatory effects, and point out that the inhibition of the PHA-induced intracellular calcium rise is an important target of propanil. These findings improve our understanding of the mechanism underlying propanil-induced immunotoxicity.	Toxicology & Applied Pharmacology	222	2	202-10	Biomonitoring (urine)			Cross-sectional	Specific active ingredient	immunological	medical test result	Italy	hic
293	E. Corsini, S. Birindelli, S. Fustinoni, G. De Paschale, T. Mammone, S. Visentin, C. L. Galli, M. Marinovich and C. Colosio	Immunomodulatory effects of the fungicide Mancozeb in agricultural workers	2005	Available data suggest that ethylenebisdithiocarbamates (EBDCs) may have immunomodulatory effects. This study aimed to investigate the immunological profile of farmers exposed to Mancozeb, an EBDC fungicide, through the determination of several serum, cellular, and functional immune parameters. Twenty-six healthy subjects entered the study, 13 vineyards exposed to Mancozeb and 13 unexposed controls. Exposure was assessed through the determination of ethylentiourea (ETU) in urine. Complete and differential blood count, serum immunoglobulins, complement fractions, autoantibodies, lymphocyte subpopulations, proliferative response to mitogens, natural killer (NK) activity, and cytokine production were measured. Post-exposure samples showed ETU urine concentration significantly higher than pre-exposure and control groups. A significant increase in CD19+ cells, both percentage and absolute number, and a significant decrease in the percentage of CD25+ cells were found in post-exposure samples compared to controls. A statistically significant increase in the proliferative response to phorbol myristate acetate plus ionomycin (PMA + ionomycin) was observed in the post-exposure group compared to controls and baseline, while a significant reduction in LPS-induced TNF-alpha release in post-exposure samples was observed. Overall, our results suggest that low-level exposure to Mancozeb has slight immunomodulatory effects, and point out a method adequate to reveal immune-modifications in workers occupationally exposed to potential immunotoxic compounds, based on a whole blood assay.	Toxicology & Applied Pharmacology	208	2	178-85	Biomonitoring (urine)			Cohort (prospective)	Specific active ingredient	immunological	medical test result	NA	NA
294	E. D. Louis, P. Factor-Litvak, M. Parides, L. Andrews, R. M. Santella and M. S. Wolff	Organochlorine pesticide exposure in essential tremor: a case-control study using biological and occupational exposure assessments	2006	Essential tremor (ET) is a common neurological disorder. Its etiology and pathogenesis are not well understood and several environmental factors (i.e., toxicants) have been studied. Organochlorine pesticides (OCPs) are potent tremor-producing chemicals. These pervasive environmental contaminants have been linked with other tremor disorders (e.g., Parkinson's disease) but they have not been assessed in ET cases. Our objective was to test the hypothesis that ET is associated with OCP exposure. Serum OCP concentrations and lifetime occupational histories were assessed in ET cases and control subjects. Six serum OCP concentrations (p,p'-DDE, p,p'-DDT, beta-hexachlorocyclo-hexane, oxychlordane, trans-nonachlor, and dieldrin) were assessed. Data from a lifetime occupational history were reviewed by a blinded industrial hygienist. The six serum OCP concentrations were similar in 136 ET cases and 144 control subjects. There was no association in ET cases between the six serum OCP concentrations and total tremor score. Three (2.2%) ET cases versus 9 (6.3%) controls had past occupational exposure to OCPs (OR=0.34, 95% CI=0.09-1.28, p=0.10). Although OCPs have been associated with other tremor disorders, we were not able to find an association between the six most tremorogenic OCPs and ET. Our data suggest that these tremor-producing chemicals are not of major etiological importance in our patients with ET.	Neurotoxicology	27	4	579-86	Biomonitoring (blood)	Self-reported job history		Case-control	Specific active ingredient	neurological	doctor-diagnosed	USA	hic
295	E. De Stefani, M. Kogevinas, P. Boffetta, A. Ronco and M. Mendilaharsu	Occupation and the risk of lung cancer in Uruguay	1996	OBJECTIVES: The purpose of this study was to provide more information regarding the risk of lung cancer associated with asbestos, and other exposures in the Uruguayan work force. METHODS: This multisite case-referent study was part of a large project designed for evaluating the role of occupational exposures in cancer risk in Uruguay. According to the design employed, cases were a subset of the data base corresponding to a particular site (in this instance lung cancer), and they were compared with all other sites combined (referents). RESULTS: Significant increases in risk associated with workers in the construction industry were mainly observed for squamous-cell carcinoma. Asbestos, silica dust, and DDT (dichlorodiphenyltrichloroethane) exposure were also associated with increases in the risk of lung cancer. Pipefitters, bakers, and textile workers were also at increased risk of developing lung cancer. CONCLUSIONS: Workers employed in the construction industry, as well as those exposed to DDT may have an excess risk of lung cancer. These findings are particularly important in showing that developing countries like Uruguay display risk patterns of similar magnitude as those observed in developed communities.	Scandinavian Journal of Work, Environment & Health	22	5	346-52	Expert case-by-case assessment	Self-reported job history		NA	Specific active ingredient	cancer	doctor-diagnosed	Uruguay	hic
296	E. De Stefani, P. Boffetta, F. Oreggia, A. Ronco, M. Kogevinas and M. Mendilaharsu	Occupation and the risk of laryngeal cancer in Uruguay	1998	In a case-control analysis involving 112 patients afflicted by laryngeal cancer and 509 controls diagnosed with cancers not related to tobacco and alcohol exposures, we studied the effects of type of employment and of substances present in the workplace on laryngeal cancer risk. Effects were measured relative to those never employed or never exposed to the substances. All analyses were controlled for age, tobacco smoking, and alcohol drinking through unconditional logistic regression and stratified analysis. Among job titles, butchers, vintners, bakers, and car assemblers presented elevated risks of laryngeal cancer (OR for butchers 2.8, 95% CL 1.1-7.2). Similarly, asbestos, mists from strong inorganic acids and pesticide exposures were associated with increased risks of laryngeal cancer (OR for strong acids 1.8, 95% 1.1-2.9).	American Journal of Industrial Medicine	33	6	537-42	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Uruguay	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
297	E. Dryver, L. Brandt, T. Kauppinen and H. Olsson	Occupational exposures and non-Hodgkin's lymphoma in Southern Sweden	2004	In a case-control study based on 859 consecutive non-Hodgkin's lymphoma (NHL) cases identified through a tumor registry between 1990 and 1998, the authors collected demographic, occupational, exposure, and education information. Exposures were identified through self-report, reported occupational history, and the use of a job-exposure matrix. Conditional logistic regression analyses of the 859 cases and 1,310 controls showed increased risks in workers exposed to gasoline (odds ratio [OR] 1.46; 95% confidence interval [CI] 1.04, 2.05), aliphatic or alicyclic hydrocarbons (OR 1.75; CI 1.03, 2.99), aromatic hydrocarbons (OR 1.45; (CI 1.13, 1.86), and solvents for mole than five years (OR 1.59: CI 1.11, 2.28), as well as automobile mechanics (OR 1.82; CI 1.18, 2.81) and painters (OR 1.77; CI 1.13, 2.76). Exposures to pesticides and farming were not associated with increased risk. Prior radiotherapy was associated with increased risk (OR 2.84; (CI 1.85, 4.37). Concordance between analyses based on self-reported exposures, occupations, and the job-exposure matrix supported the links between organic solvents and prior radiotherapy and NHL but did not support associations between farming or pesticides and NHL.	International Journal of Occupational & Environmental Health	10	1	13-21	Self-reported exposure	Job exposure matrix		Case-control	Pesticides in general	cancer	doctor-diagnosed	NA	NA
298	E. E. Clarke, L. S. Levy, A. Spurgeon and I. A. Calvert	The problems associated with pesticide use by irrigation workers in Ghana	1997	The use of pesticides in Ghanaian agriculture, though beneficial in reducing crop loss both before and after harvest, has been associated with threats to human health often due to the misapplication of the chemicals. This study was an initial attempt to explore the knowledge, attitudes and practices of 123 farm workers on three irrigation project areas in the Accra Plains, Ghana, regarding the safe handling and use of pesticides, to assess the prevalence of symptoms associated with organophosphorus pesticides (OPs) and carbamates and to determine the prevalence of pesticide-related symptoms, and blood cholinesterase. The study design was cross-sectional in type. Methods used were interviews and observation, and biological monitoring. The results revealed moderate levels of knowledge of the routes of absorption of pesticides and of potential symptoms following exposure. Knowledge of personal protective measures was poor to moderate. High risk practices included frequent handling of the chemicals, home storage of pesticides and short re-entry intervals. Despite knowledge of some health risks associated with pesticides, the use of personal protective equipment (PPE) was minimal due primarily to financial constraints. The prevalence of symptoms was higher and cholinesterase levels lower than in a control group of teachers. It is suggested that there is a need for more epidemiologic studies to investigate the problems associated with pesticide induced ill health as well as research into appropriate and affordable PPE. PPE needs to be subsidized. Training of agriculture and health workers in safety precautions, recognition, and management of pesticide-related ill health is a matter of urgency.	Occupational Medicine (Oxford)	47	5	301-8	Biomonitoring (blood)			Cross-sectional	Chemical class	NA	self-reported	Ghana	lmic
299	E. F. Heineman, Y. T. Gao, M. Dosemeci and J. K. McLaughlin	Occupational risk factors for brain tumors among women in Shanghai, China	1995	The etiology of brain cancer is not well understood and few studies have evaluated occupational risk factors among women. We evaluated occupation and industry at time of diagnosis for 276 incident primary brain tumor cases among women in Shanghai, China, for the period 1980-1984, identified through the Shanghai Cancer Registry. Standardized incidence ratios (SIRs) and their 95% confidence intervals (CIs) were calculated for all occupations and industries with at least three female cases. SIRs compared observed to expected numbers of cases, based on incidence rates for Shanghai and the number of women in each occupation and industry according to the 1982 census. Statistically significant excesses of brain tumors were seen among grain farmers (SIR = 6.5, 95% CI = 1.3-19.1), rubber workers (SIR = 5.0, 95% CI = 1.6-11.6), and workers in transportation equipment manufacture and repair (SIR = 2.3, 95% CI = 1.1-4.3). Risks among textile spinners and winders were of borderline significance (SIR = 1.7, 95% CI = 1.0-2.8). Elevated but nonsignificant risks of 2.0 or greater were seen among nurses, plastic products workers, sanitation workers, painters, and workers in manufacture of equipment for electrical generation, transmission, and distribution. Results for farmers, rubber workers, and painters are consistent with previously reported excesses among these occupations in men. The increase among nurses is a new finding, although elevated risks have been observed among male medical professionals. Risks were elevated with likely exposure to pesticides, particularly among those thought to have a high probability and a high level of exposure (SIR = 3.6, 95% CI = 1.2-8.5).	Journal of Occupational & Environmental Medicine	37	3	288-93	Registers			Cohort (prospective)	Job title	cancer	doctor-diagnosed	China	umic
300	E. G. Ortega Freyre, M. A. Carrera Gracia, D. Delgadillo Guzm<U+221A>< U+00B0>n, M. P. Intriago Ortega, E. F. Lares Bayona and M. A. Quintanar Escorza	Association of occupational exposure to pesticides organophosphate oxidative damage and activity acetylcholinesterase	2016	Organophosphate pesticides (OPs) are considered as negative risk factors for the health POF farm workers. The anticholinesterase action these compounds have been used as an indicator POF chronic OP poisoning. Some authors have suggested that agricultural workers in the Ops can act as pro-oxidants, affecting the activity POF antioxidant enzymes and generating chronic damage likely. Objective. This study was conducted to determine the influence POF occupational exposure to OPs in oxidative damage and acetylcholinesterase activity in farmworkers Plant Health Committee POF Durango A.C (CESAVEDAC). Methodology. An observational, analytical, retrospective comparative study was conducted on 45 workers. The activity POF acetylcholinesterase as a biomarker POF toxicity assessed, indicator POF oxidative damage to lipid peroxidation antioxidant capability. Results. Was found that there is an association between oxidative damage and exposure to OPs (p = 0.003) being 3.21 times greater risk POF developing oxidative damage when it is exposed to OPs, moreover, there is an association between inhibition POF acetylcholinesterase and exposure to OPs (p = 0.01), 2.92 times higher risk POF show inhibition activity acetylcholinesterase when it is exposed to OPs Conclusions. There is a negative influence POF occupational exposure to OPs on oxidative damage and acetylcholinesterase activity in farmworkers.	Revista de Toxicologia	33	1	39-43	Biomonitoring (blood)			Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	NA	NA

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
301	E. Haraux, K. Braun, P. Buisson, E. Stephan-Blanchard, C. Devauchelle, J. Ricard, B. Boudailliez, P. Tourneux, R. Gouron and K. Chardon	Maternal Exposure to Domestic Hair Cosmetics and Occupational Endocrine Disruptors Is Associated with a Higher Risk of Hypospadias in the Offspring	2016	Pregnant women are exposed to various chemical products at home and at work. Some of these products contain endocrine-disrupting chemicals (EDCs) such as cosmetics, pesticides, industrial chemicals, heavy metals, plastics or medications that could alter sexual differentiation and increase the risk of hypospadias. We evaluated maternal occupational and household exposures that could constitute risk factors for hypospadias. From 2011 to 2014, we enrolled 57 full-term newborns with hypospadias and three randomly selected controls per case (162 control newborns), matched for gestational age, from 11 maternity units in Picardy, France. Neonatal and parental data were collected at birth (personal characteristics, maternal lifestyle, and medical history). Maternal occupational exposure was assessed by a job-exposure matrix for EDCs from a job history questionnaire completed by mothers. Odds ratios (OR) and 95% confidence intervals (CI) were calculated with univariate and multivariable logistic regression, and adjusted for relevant covariates. Multivariate analysis showed a strong association between hypospadias and potential maternal occupational exposure to EDCs and maternal household use of hair cosmetics (OR 6.1, 95% CI: 1.1-34.9; OR: 9.6, 95% CI: 1.4-66.1, respectively). Our results suggest that maternal occupational exposure to EDCs is a risk factor for hypospadias and suggests a possible influence of household use of hair cosmetics during early pregnancy on the incidence of hypospadias in the offspring. A larger study with more accurate exposure assessment should evaluate the impact of EDCs in hair cosmetics on the incidence of hypospadias.	International Journal of Environmental Research & Public Health [Electronic Resource]	14	1	29	Self-reported job history	Job exposure matrix		Case-control	Job title	offspring	doctor-diagnosed	France	hic
302	E. J. Duell, R. C. Millikan, D. A. Savitz, B. Newman, J. C. Smith, M. J. Schell and D. P. Sandler	A population-based case-control study of farming and breast cancer in North Carolina	2000	We examined the role of farming and pesticide exposure among 862 cases and 790 controls in a population-based, case-control study of breast cancer conducted in North Carolina between 1993 and 1996. We obtained exposure information through personal interview. Increasing duration of farming was inversely associated with breast cancer risk; odds ratios (95% confidence intervals) were 1.2 (0.8-1.7), 0.8 (0.5-1.2), 0.7 (0.5-1.1), and 0.6 (0.4-0.9) for 1-10, 11-17, 18-23, and >23 years of farming, respectively, relative to nonfarmers. Inverse associations persisted when farming was restricted to calendar time periods of 2,2-bis(p-chlorophenyl)- 1,1,1-trichloroethane (DDT) use or to farming at ages 9-16. Among women who farmed, odds ratios (ORs) were elevated for those who reported being present in fields during or shortly after pesticide application (OR = 1.8, 95% CI = 1.1-2.8) and for those who reported not using protective clothing while applying pesticides (OR = 2.0; 95% CI = 1.0-4.3), but not among those who reported using protective clothing (OR = 0.8; 95% CI = 0.4-1.8). We conclude that residence or work on farms may be associated with a reduced risk of breast cancer. Nevertheless, our results suggest a possible increased risk of breast cancer among a subgroup of farming women who were most likely to be exposed to pesticides.	Epidemiology	11	5	523-31	Self-reported exposure			Case-control	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
303	E. J. Hallberg, S. J. Achenbach, K. G. Rabe, T. G. Call, C. Allmer, T. D. Shanafelt, M. Liebow, N. E. Kay, J. R. Cerhan and S. L. Slager	Occupational exposure to agricultural pesticides and CLL risk	2014	Background Previous literature regarding the association between occupational exposure to agricultural pesticides and non-Hodgkin lymphoma (NHL) risk has been inconsistent, particularly when looking at specific lymphoma subtypes. Most recently, a large European case-control study showed an elevated risk of chronic lymphocytic leukemia (CLL) among those ever exposed to inorganic and organic pesticides with the strongest association among those exposed to organophosphates. However, when restricting the analysis to subjects with high confidence of exposure, these associations were attenuated (Cocco P., 2013). We used case-control data from the Mayo Clinic to evaluate whether there is an increased risk of CLL among individuals with known occupational exposure to agricultural pesticides Methods We evaluated pesticide exposure and CLL risk in a clinic-based study of newly diagnosed CLL cases and frequency-matched controls enrolled at the Mayo Clinic from 2002-2012. 200 CLL cases and 474 controls returned a detailed farming and pesticide exposure questionnaire that was modeled after the Agricultural Health Study, where exposure was based on pesticide-specific application. Unconditional logistic regression, adjusted for age and sex, was used to estimate odds ratios (ORs) and 95% confidence intervals (CI). We evaluated the effect of each pesticide individually, by chemical class of pesticides, and by an aggregate of multiple pesticide exposure on CLL risk Results Among those participants with detailed farming data, the mean age of CLL diagnosis was 66 years and 76% were male; for controls, the mean age at enrollment was 65 years and 66% were male. Risk of CLL was mildly elevated, but not significant, amongst those with application of any pesticide (OR 1.39; 95% CI. 0.92-2.10). When broken down by chemical class, risk of CLL was also mildly elevated, but not significant, for application of organophosphates and carbamates (OR 1.21; 95% CI 0.84-1.73; OR 1.21; 95% 0.85-1.73, respectively). Organochlorines, phenoxy compounds, pyrethriods and triazines showed no evidence of an elevated risk, nor did we see evidence of a trend that CLL risk increases with number of pesticides applied Discussion Our preliminary results provide inconclusive support for the role of pesticide exposure as a possible risk factor for CLL. However our sample size was small. Additional data will be incorporated, including confidence of exposure measures, as well as other modifying factors, to further evaluate these results.	Cancer Research	74	19	NA	Self-reported exposure			Case-control	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
304	E. J. Kasner, J. M. Keralis, L. Mehler, J. Beckman, J. Bonnar-Prado, S. J. Lee, B. Diebolt-Brown, P. Mulay, M. Lackovic, J. Waltz, A. Schwartz, Y. Mitchell, S. Moraga-McHaley, R. Roisman, R. Gergely and G. M. Calvert	Gender differences in acute pesticide-related illnesses and injuries among farmworkers in the United States, 1998-2007	2012	BACKGROUND: Farmworkers have a high risk for acute pesticide-related illness and injury, and the rate among female farmworkers is approximately twice as high as that among males. Surveillance data were used to identify reasons for this gender difference. METHODS: We identified acute pesticide-related illness and injury cases among farmworkers from the Sentinel Event Notification System for Occupational Risks (SENSOR)-Pesticides Program and the California Department of Pesticide Regulation. Gender-specific associations with acute pesticide-related illness and injury were assessed using chi-square tests. National Agricultural Workers Survey data were also examined. RESULTS: The over-representation of females among farmworker illness and injury cases was confined to females who did not handle pesticides (non-handlers). Female non-handler farmworkers who were affected were more likely to be working on fruit and nut crops, to be exposed to off-target pesticide drift, and to be exposed to fungicides and fumigants compared to males. CONCLUSIONS: Although there is an increased risk for acute pesticide-related illness and injury among female farmworkers, the absolute number of farmworkers with acute pesticide-related illness and injury is far higher among males than females. Furthermore, farmworkers have little or no control over many of the identified contributing factors that led to illness and injury. Stringent enforcement of existing regulations and enhanced regulatory efforts to protect against off-target drift exposures may have the highest impact in reducing acute pesticide-related illness and injury among farmworkers.	American Journal of Industrial Medicine	55	7	571-83	Registers			Cohort (prospective)	Pesticides in general	pesticide-related illness	doctor-diagnosed	USA	hic

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305	E. Jors, R. C. Morant, G. C. Aguilar, O. Huici, F. Lander, J. Baelum and F. Konradsen	Occupational pesticide intoxications among farmers in Bolivia: a cross-sectional study	2006	BACKGROUND: Pesticide use and its consequences are of concern in Bolivia due to an intensive and increasing use. METHODS: To assess the magnitude and reasons for occupational pesticide intoxication, a cross-sectional study with interviews and blood-tests was performed among 201 volunteer farmers from 48 villages in the temperate and subtropical valleys in the eastern part of the Andes Mountains in Bolivia. Of these 171 male farmers using pesticides in their agricultural production were used in the statistical analysis, including linear- and logistic regression analysis. RESULTS: This study documented a frequent use of the most toxic pesticides among farmers who have had almost no instructions in how to use pesticides and protect themselves against the dangers of intoxication, reflected in the hazardous practices used when handling pesticides. Symptoms of intoxications were common in connection with spraying operations. The risk of experiencing symptoms and the serum cholinesterase activity were influenced by whether or not organophosphates were used and the number of times sprayed. The experience of symptoms was moreover influenced by the hygienic and personal protective measures taken during spraying operations while this had no influence on the serum cholinesterase level. CONCLUSION: The study showed that occupational pesticide intoxications were common among farmers and did depend on multiple factors. Pesticide use is probably one of the largest toxicological problems in Bolivia, and a coordinated action by authorities, society and international bodies is needed to limit the number of intoxications and the environmental pollution.	Environmental Health: A Global Access Science Source	5	NA	10	Biomonitoring (blood)			Cross-sectional	Pesticides in general	pesticide-related illness	doctor-diagnosed	Bolivia	lmic
306	E. Lynge	Cancer in phenoxy herbicide manufacturing workers in Denmark, 1947-87--an update	1993	This report is an update of a cohort study from the two Danish phenoxy herbicide manufacturing plants. The study originally covered the period 1947-82. Data now have been added for the period 1983-87. In 1943-87, the 940 phenoxy herbicide manufacturing and packaging workers experienced the same overall cancer incidence as the Danish population (observed [Obs] = 66; expected [Exp] = 64.27; standardized incidence ratio [SIR] = 1.0; 95 percent confidence interval [CI] = 0.8-1.3). The same was true for the 1,179 workers employed in manual service functions. The data for 1947-82 included five cases of soft tissue sarcoma (STS). One of these patients had his diagnosis changed when he died in 1985. One new STS case was diagnosed during the period 1983-87. This updated study thus includes a total of five STS cases. Four of the STS cases were observed among persons potentially exposed to phenoxy herbicide (Exp = 1.76; SIR = 2.3; CI = 0.6-5.8). Three of the cases occurred among men employed for at least one year in one factory. In this subgroup, an SIR of 6.4 (CI = 1.3-18.7) was observed when a 10-year latency period was taken into account. Based on small numbers, this Danish study thus continues to add to the evidence for a possible association between phenoxy herbicide exposure and risk of STS. Persons potentially exposed to phenoxy herbicide had an incidence of non-Hodgkin's lymphoma close to that of the Danish population (Obs = 4; Exp = 3.08; SIR = 1.3; CI = 0.4-3.3). [References: 64]	Cancer Causes & Control	4	3	261-72	Registers	Expert case-by-case assessment		Cohort (prospective)	Chemical class	cancer	doctor-diagnosed	Denmark	hic
307	E. Lynge	Cancer incidence in Danish phenoxy herbicide workers, 1947-1993	1998	A cohort study was undertaken of 2119 workers from Denmark who were potentially exposed to phenoxy herbicides. The workers were from two factories that produced phenoxy herbicides since 1947 and 1951, respectively. They had been employed either in the manufacture of phenoxy herbicide or in the manual service functions. The main product was 4-chloro-2-methylphenoxyacetic acid (MCPA). From 1947 to 1993 the 2119 workers had a slightly lower overall cancer incidence than the Danish population (observed = 204; expected [Exp] = 234.23; standardized incidence ratio [SIR] = 0.87; 95% confidence interval [CI] 0.8-1.0). Four soft-tissue sarcoma cases were observed (Exp = 2.47; SIR = 1.62; 95% CI = 0.4-4.1). All four cases occurred among men from Kemisk Vaerk Koge (Exp = 1.68; SIR = 2.38; 95% CI = 0.7-6.1). There were six cases of non-Hodgkin's lymphoma (Exp = 5.07; SIR = 1.10; 95% CI = 0.4-2.6) and no significantly elevated risk of other cancers. Based on small numbers, the study suggests an association between the exposure to MCPA and related phenoxy herbicides and the risk of soft-tissue sarcoma. The study does not indicate a risk of non-Hodgkin's lymphoma after exposure to these phenoxy herbicides or a risk of other cancer diseases.	Environmental Health Perspectives	106	NA	683-8	Registers			Cohort (prospective)	Chemical class	cancer	doctor-diagnosed	Denmark	hic
308	E. M. Smith, M. Hammonds-Ehlers, M. K. Clark, H. L. Kirchner and L. Fuortes	Occupational exposures and risk of female infertility	1997	This study examined the association between occupational chemical and radiation exposures and risk of medically diagnosed infertility in 281 women compared with 216 fertile women. After adjustment for age and exposures that occurred before case/referent ascertainment, there was an increased risk of infertility among those women exposed to volatile organic solvents (odds ratio [OR], 1.74; 95% confidence interval [CI], 1.11 to 2.71), chemical dusts (OR, 2.66; CI, 1.17 to 6.05), pesticides (OR, 3.02; CI, 1.10 to 8.29), and video display terminals (OR, 2.21, CI, 1.22, to 4.01). Among the medically diagnosed causes of infertility, the adjusted risk associated with having an ovulatory factor increased among those women exposed to solvents (OR, 1.75; CI, 1.03 to 2.98), dusts (OR, 3.00; CI, 1.19 to 7.52), or pesticides (OR, 3.82; 1.28 to 11.42). Solvents and dusts also were associated with a higher risk of tubal-factor infertility (solvents; OR, 1.95; CI, 1.08 to 3.52; dusts: OR, 2.87; CI, 1.05 to 7.88) and endometriosis (solvents: OR, 2.13; CI, 0.96 to 4.72; dusts: OR, 3.63; CI, 0.99 to 13.28). Video display terminal exposure was more likely to be found among those women diagnosed with endometriosis (OR, 3.69; CI, 1.50 to 9.13) and cervical-factor infertility (OR, 2.65; CI, 0.99 to 7.12). Results suggest that among women with a medically confirmed diagnosis, fertility may be adversely affected by a variety of occupational chemical exposures.	Journal of Occupational & Environmental Medicine	39	2	138-47	Self-reported exposure			Case-control	Pesticides in general	reproductive	medical test result	USA	hic
309	E. MacFarlane, P. Simpson, G. Benke and M. R. Sim	Suicide in Australian pesticide-exposed workers	2011	BACKGROUND: Epidemiological research has observed that workers with exposure to anticholinesterase pesticides, and particularly those with a history of acute overexposure, may be at increased risk of depression. However, there is little published research about the risk of suicide in relation to pesticide exposure. AIMS: To investigate risk of suicide in relation to metrics of pesticide exposure and type of work. METHODS: A nested case-control study was performed within a retrospective cohort study of pesticide-exposed workers from various industries. Ninety male suicide deaths and 270 male controls were matched by age bands, state of residence and live status. Cholinesterase inhibition was determined using subject-specific biomonitoring records collected at the time of exposure. RESULTS: Suicide risk was not significantly elevated in relation to exposure to any particular pesticide classes nor in relation to pesticide overexposure, confirmed by blood test. While the risk of suicide associated with a history of cholinesterase inhibition was raised, this was not significant (odds ratio = 1.90, 95% confidence interval = 0.73-4.93). CONCLUSIONS: This study did not find an elevated suicide risk associated with use of any major class of pesticide and there was little evidence that overexposure was associated with increased risk of suicide. A non-significant association between overexposure to anticholinesterase pesticides may be consistent with previous research showing increased depression in workers with a history of cholinesterase inhibition and warrants further investigation.	Occupational Medicine (Oxford)	61	4	259-64	Biomonitoring (blood)			Case-control	Chemical class	other	doctor-diagnosed	Australia	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
310	E. Medda, F. Santini, S. De Angelis, F. Franzellin, C. Fiumalbi, A. Perico, E. Gilardi, M. T. Mechi, A. Marsili, A. Citroni, A. Leandri, A. Mantovani, P. Vitti and A. Olivieri	Iodine nutritional status and thyroid effects of exposure to ethylenebisdithiocarbamates	2017	INTRODUCTION: Italy is still characterized by a mild iodine deficiency and is among the most intensive users of chemical products for agriculture in Europe. The aim of this study was i) to evaluate thyroid effects of exposure to mancozeb, a fungicide widely used in agriculture, in a sample of Italian grapevine workers, and ii) to verify whether the iodine intake may modulate the risk of thyroid disruption due to the mancozeb metabolite ethylenthiourea (ETU). METHODS: One hundred seventy-seven occupationally exposed male workers (29 from Chianti, a mild iodine deficient area, and 148 from Bolzano an iodine sufficient province) and 74 non-occupationally exposed male controls (34 from Chianti and 40 from Bolzano) were enrolled in the study. Serum biomarkers of thyroid function, as well as urinary iodine and ETU concentrations were assessed. Moreover all the recruited subjects underwent clinical examination and thyroid ultrasound. RESULTS: Multivariate comparisons showed lower mean serum levels of FT4 in Chianti-workers as compared to Bolzano-workers. Moreover, an increased urinary iodine excretion (>250micro g/L) was more frequently found among more exposed workers (ETU>20micro g/L) than among less exposed ones and this effect was more pronounced in Chianti- than in Bolzano-workers. Chianti-workers also showed a significantly higher frequency of very low thyroid volume (<=6.0ml) as compared to controls. CONCLUSIONS: These findings showed a mild thyroid disrupting effect due to occupational exposure to mancozeb, more pronounced in workers residing in an area characterized by a mild to moderate iodine deficiency as compared to workers residing in an area covered by a long-lasting iodine prophylaxis program.	Environmental Research	154	NA	152-159	Biomonitoring (urine)			Cross-sectional	Specific active ingredient	endocrine/nutritional/metabolical	medical test result	Italy	hic
311	E. Rapiti, F. Fantini, V. Dell'Orco, V. Fano, F. Blasetti, C. Bracci, F. Forastiere and P. Comba	Cancer mortality among chemical workers in an Italian plant	1997	Objective of this study was to assess the mortality experience of a cohort of chemical workers at a plant located in central Italy. Subjects employed for any time between 1954 and 1970 at the chemical plant were included in the cohort and followed up to June 1991. The workers were classified as having ever/never worked in one of the following work processes: organic chemicals, acid mixtures, cleansing agents and insecticides. Mortality experience of the cohort was compared with that of the regional population by computing SMRs (standardized mortality ratios) and 90% CI (confidence intervals). Vital status was ascertained for 96% of the 505 cohort members. All causes of mortality for the entire cohort were lower than expected (Obs: 176; SMR: 0.90; 90% CI: 0.79-1.03). Analysis by work process revealed an increased mortality for lymphatic and hematopoietic tissue neoplasm in the cleansing agents department (Obs: 3; SMR: 5.00; 90% CI: 1.36-12.9); peritoneum and retropertioneum neoplasm in the organic compounds production (Obs: 2; SMR: 13.33; 90% CI: 2.37-42.0), and bladder cancer in the insecticides process (Obs: 3; SMR: 3.53; 90% CI: 0.96-9.12). Although the study had a low statistical power, the increased cancer risks detected are consistent with previous observations and may be of etiologic interest.	European Journal of Epidemiology	13	3	281-5	Registers			Cohort (prospective)	Type of pesticide	mortality (all cause)	doctor-diagnosed	Italy	hic
312	E. Regidor, E. Ronda, A. M. Garcia and V. Dominguez	Paternal exposure to agricultural pesticides and cause specific fetal death	2004	AIMS: To study the association between fetal death and paternal agricultural occupation in areas and time periods with different levels of use of agricultural pesticides. METHODS: A total of 1 473 146 stillbirths and births occurring in Spain between 1995 and 1999 were analysed. RESULTS: The offspring of agricultural workers had the highest risk of fetal death from congenital anomalies in the southern and eastern area (where pesticide use is greatest) and the lowest risk in the rest of Spain. In both areas the offspring of agricultural workers had a similar excess risk of fetal death from the remaining causes of death. The relative risk of fetal death from congenital anomalies in infants conceived between April and September (the months of greater use of pesticides) in the southern and eastern area was 0.90 in manual workers and 1.62 in agricultural workers, compared to non-manual workers; in individuals who were conceived during the rest of the year, the relative risk was 0.87 and 0.85, respectively. In both periods the offspring of agricultural workers had an excess risk of fetal death from the remaining causes of death. CONCLUSIONS: Paternal agricultural work in the areas where pesticides are massively used increases the risk of fetal death from congenital anomalies. The risk is also increased for fetuses conceived during the time periods of maximum use of pesticides The higher risk of fetal death from the remaining causes of death in the offspring of agricultural workers seems unrelated to pesticide exposure.	Occupational & Environmental Medicine	61	4	334-9	Registers			Cohort (prospective)	Pesticides in general	reproductive	doctor-diagnosed	Spain	hic
313	E. Riu, E. Monso, A. Marin, R. Magarolas, K. Radon, J. Morera, F. Andreo and D. Nowak	Occupational risk factors for rhinitis in greenhouse flower and ornamental plant growers	2008	BACKGROUND: The purpose of this study was to assess the relationships between rhinitis, exposure to workplace air contaminants, and occupational characteristics in greenhouse flower and ornamental plant (OP) growers. METHODS: A random sample of growers cultivating such crops and participating in the European Farmers' Study was selected for a cross-sectional assessment of (1) rhinitis in the last year, (2) sensitization to workplace allergens, and (3) occupation characteristics. Associations between variables were assessed through univariate and multivariate analyses. RESULTS: Thirty-nine greenhouse flower and OP growers participated in the study (mean, 48.6; SD, 10.2 years; 35 men). Rhinitis was reported by 12 (31%) of them and was significantly related to sensitization to workplace allergens (odds ratio [OR], 13.20; 95% confidence interval [CI], 2.59-67.23) and pesticide application by hand pump (OR, 12.50; 95% CI, 2.00-78.05). After adjustment for these variables rhinitis emerged as significantly related to number of hours worked inside the greenhouse per day (OR, 1.85; 95% CI, 1.05-3.23). CONCLUSION: Rhinitis is often reported by greenhouse flower and OP growers and is related to sensitization to workplace allergens and pesticide application by hand pump. The disease shows a dose-response relationship with the number of hours spent inside the greenhouse per day, a finding supporting a causal link with greenhouse exposure.	American Journal of Rhinology	22	4	361-4	Self-reported exposure			Cross-sectional	Pesticides in general	respiratory	self-reported	SHIC	SHIC
314	E. Ronda, E. Regidor, A. M. Garcia and V. Dominguez	Association between congenital anomalies and paternal exposure to agricultural pesticides depending on mother's employment status	2005	OBJECTIVE: We analyzed the association between fetal death from congenital anomalies and paternal agricultural occupation in mothers who were employed and in housewives. MATERIALS AND METHODS: The data consist of individual records from the Spanish Birth Register (1995-1999). RESULTS: The adjusted relative risk of fetal death in agricultural workers compared with nonagricultural was 1.24 (95% confidence interval = 0.38- 4.02) in mothers who were employed and 1.68 (95% confidence interval = 1.03-2.73) in housewives. CONCLUSION: The risk of fetal death in the offspring of agricultural workers exposed to pesticides around the time of conception was higher than in the offspring of nonagricultural workers in mothers who were housewives but not in mothers who worked outside the home.	Journal of Occupational & Environmental Medicine	47	8	826-8	Registers			Cohort (prospective)	Job title	offspring	doctor-diagnosed	Spain	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
315	E. S. Cha, Y. K. Lee, E. K. Moon, Y. B. Kim, Y. J. Lee, W. C. Jeong, E. Y. Cho, I. J. Lee, J. Hur, M. Ha and W. J. Lee	Paraquat application and respiratory health effects among South Korean farmers	2012	OBJECTIVES: Paraquat is commonly used worldwide as major herbicide. The objective of this study was to investigate the association among farmers between occupational paraquat exposure and respiratory health effects. METHODS: A cross-sectional survey of health effects related to an oil spill was conducted in South Korea from 2008 to 2009. For this analysis, a total of 2882 full-time farmers were selected from the overall sample. Data collection included an interviewer-administered questionnaire and spirometry testing. Logistic regression analysis and linear regression analysis were performed to evaluate the relationship between paraquat exposure and respiratory health outcomes after adjustment for potential confounders. RESULTS: The risks of self-reported physician-diagnosed asthma, chronic obstructive pulmonary disease and allergic rhinitis were non-significantly increased among paraquat-applying farmers compared with non-paraquat-applying farmers. Although the results of a pulmonary function test fell within normal limits, a decline in forced vital capacity and forced expiratory volume in one second was apparent among paraquat-applying farmers compared with non-paraquat-applying farmers. Forced vital capacity (beta = -5.20, p<0.001) and forced expiratory volume in one second (beta = -1.89, p = 0.010) significantly decreased with each unit increase in years of paraquat application. Paraquat-applying farmers showed a significant exposure-response relationship between restrictive ventilatory defects and paraquat application years (p trend = 0.015) or lifetime days of application (p trend = 0.007). CONCLUSIONS: Our findings suggest a possible association between paraquat application and adverse respiratory health effects among farmers.	Occupational & Environmental Medicine	69	6	398-403	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	Korea	hic
316	E. S. El Okda, M. A. Abdel-Hamid and A. M. Hamdy	Immunological and genotoxic effects of occupational exposure to alpha-cypermethrin pesticide	2017	OBJECTIVES: The aim of this work has been to find out the occupational oxidative stress, immunological and genotoxic health hazards among alpha-cypermethrin (CYP) pesticide-exposed workers. MATERIAL AND METHODS: A cross-sectional study was performed including 200 workers divided into 3 groups according to the level of exposure: highly exposed group (50 workers), moderately exposed group (50 workers) and unexposed group (100 workers). All workers were subjected to detailed laboratory investigation for gene P53 mutations, immunological parameters as a cluster of differentiation into 3 percentage (CD3%), CD4% and CD8% in addition to peripheral blood total leukocytic and platelet counts that were measured. Spectrophotometer technique was used for detection of superoxide dismutase (SOD), catalase (CAT), glutathione (GSH) and glutathione peroxidase (GPx). Air samples were collected with a High Volume Small Surface Sampler for measurement of alpha-cypermethrin level. RESULTS: A highly exposed group to the alpha-cypermethrin had lower CD4/CD8 as compared to an unexposed group with statistically significant difference. As regards gene mutation, exons 5a and 6 were more frequent among the highly exposed group as compared to no mutation among moderately exposed and unexposed groups with significant difference. As regards antioxidants; SOD, CAT, GSH and GPx were higher among the unexposed group as compared to the highly and moderately exposed group with statistically significant difference. Significant negative correlation was found between working years and antioxidant parameters. CONCLUSIONS: Repeated exposure to alpha-CYP may lead to gene mutations, immunological disturbances and oxidative stress. Strict safety precautions are required not only for workers but also for public users. Int J Occup Med Environ Health 2017;30(4):603-615.	International Journal of Occupational Medicine & Environmental Health	30	4	603-615	Self-reported job history	Environmental air monitoring		Cross-sectional	Pesticides in general	immunological	medical test result	Egypt	lmic
317	E. S. Hansen, F. Lander and J. M. Lauritsen	Time trends in cancer risk and pesticide exposure, a long-term follow-up of Danish gardeners	2007	OBJECTIVES: Occupational exposure to petrochemical pesticides was high during the first 10-15 years after their introduction in the late 1940s, and, during these years, many cases of intoxication occurred. In the 1960s, the use and marketing of pesticides was regulated to reduce exposure to these substances, and, since 1970, substantial exposure has been rare in Denmark. The present study aimed at investigating the extent to which these alterations have influenced the cancer risk of gardeners. METHODS: A historical cohort of 3156 male gardeners was followed from May 1975 until 2002 with regard to cancer incidence. RESULTS: The cancer incidence was significantly below the national average [standardized incidence ratio (SIR) 0.86, 95% confidence interval (95% CI) 0.79-0.94], but an analysis by birth cohort indicated marked differences with a downward tendency for younger birth cohorts. Among the gardeners born prior to 1915, significant increases were found for leukemia (12 cases, SIR 2.33, 95% CI 1.32-4.10) and soft tissue sarcoma (3 cases, SIR 5.87, 95% CI 1.89-18.20). CONCLUSIONS: Gardeners constitute a healthy worker group, but an increased risk of soft tissue sarcoma and leukemia is indicated for people born prior to 1915, a finding that may reflect substantial pesticide exposure during the late 1940s and the 1950s. Among the gardeners born in 1915 or later, no excess cancer risk was found. The latter finding suggests a cancer-preventive effect for safety recommendations and improved technical devices with respect to pesticide application, along with legislative control measures to reduce pesticide exposure.	Scandinavian Journal of Work, Environment & Health	33	6	465-9	Job title			Cohort (prospective)	Job title	cancer	doctor-diagnosed	Denmark	hic
318	E. Straube, W. Straube, E. Kr<U+221A><U+00BA>ger and H. J. Rose	The influence of pesticides on sexual hormones with occupational exposure in agriculture and pest control	2002	Contact with pesticides - during production or their application - has been mentioned as a reason for unintentional childlessness. In previous studies we found evidence that pesticides are capable of disrupting the levels of sexual hormones in men [33]. These studies have now been extended to check our previous findings and to take into account the body mass index (BMI). We investigated serum hormone concentrations before, during and after the annual pesticide season in 56 men who worked in agriculture or pest control. Testosterone and estradiol were detected with the Immulite<U+00AC><U+00C6> Analyzer, luteinising hormone (LH), follicle-stimulating hormone (FSH), and prolactin with the LIA-mat<U+00AC><U+00C6> System 300. 56 control persons, pair-matched with regard to sex, age and BMI, were studied once a year. Pesticide exposure was estimated on the basis of exposure time, concentration of pesticides in the air and on the body surface. The pesticide sprayers were exposed for about 400 hours per year. The normal levels of inhalation and dermal exposure were never exceeded. The most important finding was reduced levels of estradiol ($p < 0.001$) during and after the spraying season (compared to controls and to the cases before the season) to concentrations below the normal range. The other hormone concentrations changed within the normal ranges. During the season testosterone was generally reduced in the agricultural workers, while the findings in the pest control workers were contradictory. The LH levels increased ($p < 0.05$). The levels of prolactin were found to be increased after the exposure season ($p < 0.001$), during which time FSH levels dropped ($p < 0.05$). We concluded that the usual occupational exposure to pesticides can be followed by temporary sterility in men. We suspect the cause to be inhibition of the aromatase system by organophosphates and carbamates.	Arbeitsmedizin Sozialmedizin Umweltmedizin	37	1	35-40	Biomonitoring (blood)			Case-control	Specific active ingredient	reproductive	medical test result	Germany	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
319	E. Tielemans, A. Burdorf, E. R. te Velde, R. F. Weber, R. J. van Kooij, H. Veulemans and D. J. Heederik	Occupationally related exposures and reduced semen quality: a case-control study	1999	OBJECTIVE: To determine whether there is an association between abnormal semen parameters and occupational exposures to organic solvents, metals, and pesticides. DESIGN: Case-control study using three case groups based on different cutoff values for semen parameters and one standard reference group. SETTING: University Hospital Utrecht and University Hospital Rotterdam, the Netherlands. PATIENT(S): Male partners of couples having their first consultation at the two infertility clinics (n = 899). INTERVENTION(S): Men provided at least one semen sample. Occupational exposure was assessed with use of job-specific questionnaires, a job exposure matrix, and measurements of metals and metabolites of solvents in urine. MAIN OUTCOME MEASURE(S): Standard clinical semen analyses were used to define case groups and controls. RESULT(S): An association between aromatic solvents and reduced semen quality was demonstrated, irrespective of the exposure assessment method used. The associations were stronger if the case definition was based on stricter cutoff values for semen parameters. Risk estimates were higher if the analysis was restricted to primary infertile men. Exposure to other pollutants at the workplace was not associated with impaired semen quality. CONCLUSION(S): The findings indicated an association between aromatic solvent exposure and impaired semen parameters.	Fertility & Sterility	71	4	690-6	Job exposure matrix	Biomonitoring (urine)	Self-reported job history	Case-control	Type of pesticide	reproductive	medical test result	Netherlands	hic
320	E. Tielemans, R. van Kooij, E. R. te Velde, A. Burdorf and D. Heederik	Pesticide exposure and decreased fertilisation rates in vitro	1999	The effect of paternal occupational exposures on fertilising ability was investigated in 836 couples who sought in-vitro fertilisation treatment. Fertilisation rates were significantly decreased for couples with paternal pesticide exposure.	Lancet	354	9177	484-5	Self-reported exposure			Cross-sectional	Pesticides in general	reproductive	medical test result	Netherlands	hic
321	E. V. Carbonell, A.; Xamena, N.; Creus, A.; Marcos, R.	Temporary variations in chromosomal aberrations in a group of agricultural workers exposed to pesticides	1995	The induction of chromosomal aberrations (CA) was studied in the peripheral lymphocytes of 29 male agricultural workers occupationally exposed to several pesticides. To investigate possible exposure-related changes in the frequency of CA, a longitudinal study has been conducted. Two blood samples were taken from each individual: one in a period of high exposure (spring-summer) and the other in a period of lower exposure (autumn-winter). Simultaneously, two matched control groups constituted by 29 and 24 healthy men, without indication of exposure to pesticides, were analysed. During the period of major exposure, the group of agricultural workers showed a significant increase in the frequency of CA, mainly of chromatid-type, when compared to the unexposed control group; nevertheless, this increase in the expression of CA was not found in the period of minor exposure. This finding could indicate that the frequency of CA is related to the intensity of the pesticide exposure, and that CA have a relatively short-life, recovering the control value a few months later. In addition to the cytogenetic analysis, biochemical and haemotological blood parameters were also analysed and no significant variations were detected.	Mutation Research	344	3	127-34	Biomonitoring (blood)			Cohort (prospective)	Chemical class	genetic (biomarkers)	medical test result	Spain	hic
322	E. v. K. Tielemans, R.; Looman, C.; Burdorf, A.; te Velde, E.; Heederik, D.	Paternal occupational exposures and embryo implantation rates after IVF	2000	OBJECTIVE: To investigate any influence of paternal occupational exposures on implantation rates after IVF. DESIGN: Cohort study of couples who sought IVF treatment. SETTING: University Hospital Utrecht, The Netherlands. PATIENT(S): The study population was composed of 726 couples pursuing IVF treatment. INTERVENTION(S): Only the earliest IVF treatment cycle with ET was selected for the analysis. All couples filled in a generic questionnaire on lifestyle factors and details about their occupation. In addition, more detailed exposure information was obtained for pesticides with use of job-specific questionnaires and a subsequent telephone interview. MAIN OUTCOME MEASURE(S): The implantation rate was defined as the number of gestational sacs seen with ultrasound at 6-7 weeks of pregnancy, divided by the number of embryos replaced. RESULT(S): A significantly reduced implantation rate was seen among couples with male partners working in occupations with presumably high levels of organic solvent exposure. Conversely, paternal pesticide exposure was significantly associated with an increased implantation rate. Paternal exposures to metal dust or fumes and welding fumes were not related to the probability of implantation. CONCLUSION(S): The findings suggested that paternal organic solvent exposure decreased the implantation rate among couples undergoing IVF-ET treatment.	Fertility & Sterility	74	4	690-5	Self-reported exposure	Self-reported exposure		Cohort (prospective)	Job title	reproductive	medical test result	Netherlands	hic
323	E. van Balen, R. Font, N. Cavalle, L. Font, M. Garcia-Villanueva, Y. Benavente, P. Brennan and S. de Sanjose	Exposure to non-arsenic pesticides is associated with lymphoma among farmers in Spain	2006	OBJECTIVES: To estimate the risk of lymphoma among farmers in Spain. METHODS: This is a multicentre case control study conducted in Spain. Cases were subjects diagnosed with lymphoma according to the World Health Organization (WHO) classification in four hospitals between 1998-2002. Hospital controls were frequency matched to the cases by sex, age, and centre. All subjects were interviewed about jobs ever held in lifetime for at least one year and the exposures in those jobs were recorded. The risk of lymphomas among subjects ever having had a job as a farmer was compared with all other occupations. Farmers were analysed according to the type of farming job performed: crop farming, animal farming, and general farming. Occupational exposure was summarised into 15 main categories: organic dust, radiation, contact with animals, PAH, non-arsenic pesticides (carbamates, organophosphates, chlorinated hydrocarbons, triazines and triazoles, phenoxy herbicides, chlorophenols, dibenzodioxin, and dibenzofuran), arsenic pesticides, contact with meat, contact with children, solvents, asbestos, soldering fumes, organic colourants, polychlorinated biphenyls, ethylene oxide, and hair dyes. RESULTS: Although farmers were not at an increased risk of lymphoma as compared with all other occupations, farmers exposed to non-arsenic pesticides were found to be at increased risk of lymphoma (OR = 1.8, 95% CI 1.1 to 2). This increased risk was observed among farmers working exclusively either as crop farmers or as animal farmers (OR = 2.8, 95% CI 1.3 to 5.8). Risk was highest for exposure to non-arsenic pesticides for over nine years (OR = 2.4, 95% CI 1.2 to 2.8). CONCLUSIONS: Long term exposure to non-arsenic pesticides may induce lymphomagenesis among farmers.	Occupational & Environmental Medicine	63	10	663-8	Self-reported exposure			Case-control	Chemical class	cancer	doctor-diagnosed	Spain	hic
324	E. van Wijngaarden	An exploratory investigation of suicide and occupational exposure	2003	This exploratory study evaluated the association between suicide and occupational exposure to electromagnetic fields, pesticides, and hydrocarbon solvents. The study population comprised 11,707 suicide deaths and 132,771 eligible controls identified from United States death certificate files for the years 1991 and 1992. Exposure assignment was based on job title reported on the death certificates. Exposure to electromagnetic fields and pesticides was weakly associated with suicide risk, while little evidence for an increased risk was seen for hydrocarbon solvents. The association for electromagnetic field exposure was highest for suicide between the ages 20 and 35 (odds ratio; OR = 1.5), while the highest risk of suicide for pesticide exposure was seen between the ages of 35 and 49 years (OR = 1.5). Further investigation to replicate these findings seems warranted, using higher quality occupational data.	Journal of Occupational & Environmental Medicine	45	1	96-101	Job title			Cohort (prospective)	Job title	other	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
325	E. van Wijngaarden	Mortality of mental disorders in relation to potential pesticide exposure	2003	Some studies have suggested a role of pesticide exposure in the development of neurobehavioral disorders. This case-control study examined the association between mortality from mental disorders and occupational exposure to pesticides. The study population consisted of 7756 deaths and 330,452 eligible controls identified from US death certificate files for the years 1988 through 1992. Exposure assignment was based on job title reported on the death certificates. Employment in jobs potentially involving pesticide exposure was weakly associated with the risk of death from mental disorders (odds ratio [OR] = 1.46; 95% confidence interval (95% CI) = 1.33-1.60). This association was stronger among women (OR = 2.65; 95% CI = 1.89-3.71), in particular for deaths from neurotic disorders (OR = 4.32; 95% CI = 2.44-7.64). These results must be interpreted with caution, however, because the impact of social and work-related factors other than pesticide exposure is not known.	Journal of Occupational & Environmental Medicine	45	5	564-8	Job title			Case-control	Job title	mortality (all cause)	doctor-diagnosed	USA	hic
326	E. van Wijngaarden, P. A. Stewart, A. F. Olshan, D. A. Savitz and G. R. Bunin	Parental occupational exposure to pesticides and childhood brain cancer	2003	The authors examined the risk of childhood brain cancer in relation to parental exposure to classes of pesticides among 154 children diagnosed with astrocytoma and 158 children diagnosed with primitive neuroectodermal tumors (PNET) in the United States and Canada between 1986 and 1989. Controls were selected by random digit dialing and were individually matched to cases by race, age, and geographic area. Each job in the fathers' work history and the usual occupation of mothers were assigned a probability, intensity, and frequency of exposure to insecticides, herbicides, and agricultural and nonagricultural fungicides. Elevated risks of astrocytoma were found for paternal exposure (ever vs. never) to all four classes of pesticides (odds ratio (OR) = 1.4-1.6). An increased risk of PNET was observed for only herbicides (OR = 1.5). For mothers, odds ratios for astrocytoma were elevated for insecticides, herbicides, and nonagricultural fungicides (OR = 1.3-1.6) but not agricultural fungicides (OR = 1.0). No indication was found of an increased risk for PNET. There was little indication for an association with cumulative and average parental exposure. Most risk estimates were around unity, and exposure-response patterns were absent. Overall, it seems unlikely that parental exposure to pesticides plays an important role in the etiology of childhood brain cancer.	American Journal of Epidemiology	157	11	989-97	Expert case-by-case assessment			Case-control	Type of pesticide	offspring	doctor-diagnosed	USA/Canada	AHIC
327	E. Van Wijngaarden, S. Mlynarek, K. Thevenet-Morrison and G. R. Bunin	Parental occupational exposure to pesticides and childhood brain tumor risk	2011	Epidemiologic studies have shown suggestive associations of childhood brain tumors in relation to parental farm residence, pesticide use, and contact with farm animals. We examined the risk of childhood brain cancer in relation to parental exposure to classes of pesticides among 318 children diagnosed with medulloblastoma/primitive neuroectodermal tumors (MB/ PNET) before 6 years of age in the United States and Canada between 1991 and 1997. Controls were selected by random digit dialing and were individually matched to cases by race, age, and geographic area. 2,048 jobs in the fathers' work history and 463 jobs held by mothers during pregnancy were assigned a probability and intensity of exposure to insecticides, herbicides, and fungicides by two expert raters. In addition, jobs were assigned exposure (any vs. none) to animal manure, farm animals, pigs and hogs, poultry, pets, and raw meat. Finally, 16 specific job tasks (e.g., welding and painting) were identified based on participants' responses in job-specific modules. None of the specific pesticide classes were associated with elevated MB/PNET risk, with odds ratios (OR) around the null. ORs differed little between expert raters. Similarly, there were no excess risks in relation to exposures to animals or animal products. Finally, ORs were elevated for three job tasks (working with plastics and sandblasting among fathers, and working with X-rays for mothers) but they were based on very small numbers and not statistically significant. Overall, our data do not support a role of parental exposure to pesticides, animals or animal products, or specific job tasks in the etiology of childhood MB/PNET.	American Journal of Epidemiology	173	NA	S69	Expert case-by-case assessment	Self-reported job history		Case-control	Type of pesticide	offspring	doctor-diagnosed	USA	hic
328	E. Varol, S. Ogut and F. Gultekin	Effect of pesticide exposure on platelet indices in farm workers	2014	We aimed to assess the effect of exposure to pesticide on platelet indices including mean platelet volume (MPV) and platelet distribution width (PDW) in farm workers. The study group consisted of 40 farm workers (4 females, 36 males; mean age 42.6 +/- 9.8 years). An age-, gender- and body mass index-matched control group was composed of 38 healthy volunteers (8 females, 30 males; mean age 46.1+/-8.9 years). Platelet indices were assessed in farm workers exposed to pesticides. MPV values were significantly lower in farm workers than in those of controls (6.3 +/- 1.1 vs. 7.6 +/- 0.7 fL, respectively; p < 0.001). Platelet count was significantly lower in farm workers than those of controls (155.7 +/- 35.7 vs. 271.3 +/- 96.2 x 10(9)/L, respectively; p < 0.001). PDW was significantly lower in farm workers than in those of controls (8.9% +/- 2.0% vs. 15.8% +/- 0.8%, respectively; p < 0.001). We have found that MPV and other platelet indices were significantly lower in farm workers exposed to pesticides than those of controls. Our findings suggest that MPV may be a sensitive indicator of a pesticide-exposure effect.	Toxicology & Industrial Health	30	7	630-4	Self-reported exposure			Cross-sectional	Pesticides in general	hematological	medical test result	Turkey	umic
329	E. Zuskin, E. N. Schachter and J. Mustajbegovic	Respiratory function in greenhouse workers	1993	Respiratory findings were studied in a group of 135 female and 32 male workers employed in greenhouses. In addition 51 women and 30 men were studied as a control group. Exposed women had significantly higher prevalences of chronic cough, dyspnea, chest tightness, and rhinitis (P < 0.01) than the controls. Among the men, only rhinitis was more prevalent in greenhouse workers (P < 0.01) than in controls. Smokers had higher prevalences of all chronic respiratory symptoms than nonsmokers, but the differences were statistically significant only for chronic cough and rhinitis in women and for chronic phlegm in men. There was a high prevalence of acute symptoms during work. A large number of greenhouse workers complained of skin reactions to plants and pesticides (women: 37.8%; men: 34.4%). Workers had significantly lower mean ventilatory capacity measurements (except in the case of forced vital capacity) when compared to standard predicted values. Smokers and nonsmokers had similar values of lung function expressed as percentages of the predicted values. Greenhouse workers exposed for more than 10 years had a significantly lower FEF25, measured as a percentage of the predicted value, than workers exposed for less than 10 years. Our data indicate that occupational exposure to greenhouses may be associated with the development of acute and chronic respiratory symptoms and impairment of ventilatory capacity.	International Archives of Occupational & Environmental Health	64	7	521-6	Job title			Case-control	Job title	respiratory	medical test result	Croatia	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
330	E. Zuskin, J. Mustajbegovic, E. N. Schachter, J. Kern and D. Pavicic	Respiratory function in vineyard and orchard workers	1997	A group of 174 male vineyard and orchard workers was studied for the prevalence of acute and chronic respiratory symptoms and lung function changes. In addition, 115 male control workers were studied for the prevalence of chronic respiratory symptoms. There was a significantly higher prevalence of dyspnea and chest tightness in exposed compared to control workers. In particular, exposed nonsmokers had significantly higher prevalences of dyspnea and chest tightness than controls this was found for exposed nonsmokers with both short (< or = 10 years) and long (> 10 years) exposure. Smokers exposed for more than 10 years had significantly higher prevalences of chronic cough, chronic phlegm, chronic bronchitis, and chest tightness than smokers with shorter exposures ($p < 0.01$ or $p < 0.05$). Workers employed for more than 10 years had higher prevalences of most of the acute (shipt-related) symptoms than those workers with shorter employment; however, the differences were significant only for cough in smokers ($p < 0.05$). Significantly lower than predicted FVC values were measured in smokers and nonsmokers after both short and long duration of employment. Differences between measured and predicted FEV1, FEF50, and FEF25 were significant for workers employed for more than 10 years. A separate analysis of individual data as a percent of predicted values demonstrated that many workers had FVC (5.2%), FEV1 (6.3%), FEF50 (27.6%), and FEF25 (40.2%) lower than 70% of predicted values. These data suggest that vineyard and orchard workers may develop acute and chronic respiratory symptoms and lung function changes which are, in part, related to environmental factors and to cigarette consumption.	American Journal of Industrial Medicine	31	2	250-5	Job title			Cross-sectional	Job title	respiratory	self-reported	Croatia	hic
331	E. Zuskin, J. Mustajbegovic, E. N. Schachter, J. Kern, V. Deckovic-Vukres, I. Trosic and A. Chiarelli	Respiratory function in pesticide workers	2008	OBJECTIVE: Pesticide aerosols are frequently toxic irritants associated with respiratory symptoms and lung function impairment. METHODS: A cross-sectional study examined the prevalence of acute and chronic respiratory symptoms and lung function abnormalities in 82 workers employed in processing pesticides and in 60 control workers not exposed to irritants and employed in a soft drink bottling plant. RESULTS: The prevalence of almost all chronic respiratory symptoms was greater among pesticide workers than among controls. A logistic regression analysis shows differences between men and women. There was a high prevalence of acute symptoms during the work shift in pesticide workers. The data on ventilatory capacity indicates significant reductions in all tests compared to predicted. Multivariate analysis of lung function showed differences in smoking and work exposure effects in men and women. CONCLUSION: Our data indicate that duration of work exposure in the pesticide processing industry may be associated with the development of acute and chronic respiratory symptoms and lung function changes. These effects appear to be aggravated by smoking.	Journal of Occupational & Environmental Medicine	50	11	1299-305	Job title			Cross-sectional	Job title	respiratory	self-reported	Croatia	hic
332	F. A. Sham'a, M. Skogstad, K. Nijem, E. Bjertness and P. Kristensen	Cross-Shift Changes in Lung Function Among Palestinian Farmers During High- and Low-Exposure Periods to Pesticides: A Longitudinal Study	2015	The purpose of this study was to study cross-shift changes of lung function in relation to pesticide use. One hundred and ninety-five male farmers, from a total of 250 farmers, performed lung function tests both pre- and post-shift during high- and low-pesticide-exposure periods. There were no associations between lung function differences across shifts and estimated quantity of pesticides used. However, the cross-shift reduction in forced expiratory volume in 1 second (FEV1; DELTAFEV1) was more pronounced during the period when pesticides were used on a larger scale, September 2006, compared with the exposure period with a lower level of pesticide use, April 2007, +50 mL (95% confidence interval [CI]: +24, +76) and +17 mL (95% CI: -13, +48), respectively. This contrast was statistically significant only among the subset of never-smoking participants below 50 years of age. This finding suggests a possible obstructive effect of pesticide exposure on lung function among this rural male population in Palestine. A follow-up of farmers' lung function in this part of the world along with high-quality measurements of exposure is needed.	Archives of Environmental & Occupational Health	70	4	218-24	Self-reported exposure			Cohort (prospective)	Pesticides in general	respiratory	medical test result	Palestine	lmic
333	F. A. Wollheim	Are occupational risk factors associated with markers of disease severity in patients with systemic scleroderma?	2006	It has been established that the causes of systemic scleroderma (SSc) are both endogenous and exogenous. Occupational risk factors that have been associated with the disease include exposure to silica dust, welding fumes and various solvents. The exact association between these risk factors and the severity of SSc, however, is not known. It has been established that the causes of systemic scleroderma (SSc) are both endogenous and exogenous. Occupational risk factors that have been associated with the disease include exposure to silica dust, welding fumes and various solvents. The exact association between these risk factors and the severity of SSc, however, is not known. In this blinded, prospective study patients with SSc, who were predominantly female, were interviewed using a structured questionnaire to establish occupational exposure to silica dust, welding fumes, silicon, vinyl chloride, solvents, epoxy resins and pesticides. The interviews were subsequently assessed by a panel of experts. Patients with SSc with a history or signs of respiratory infection and patients with pulmonary hypertension at the time of study were excluded. Once patients had been separated into two groups according to exposure or nonexposure to occupational toxic agents, disease severity was then assessed. Disease severity markers investigated were the extent of cutaneous disease, pulmonary involvement, results of pulmonary function tests including high resolution CT (HRCT), and the existence of anti-topo-I lgG or anticentromere autoantibodies (ACA). All data were analyzed using a multiple correspondence analysis, the Description of Modalities procedure, and were confirmed by Fisher's exact test. Severe SSc was defined by the combined presence of markers including diffuse cutaneous extent, pulmonary involvement and anti-topo-I lgG. Mild SSc was defined by limited cutaneous extent and presence of positive ACA. A total of 105 patients participated in this study, of whom 39 (37%) were deemed to have had exposure to occupational toxic agents and 66 (63%) were deemed unexposed. Patients who had been exposed to occupational risk factors were associated with diffuse SSc ($P = 0.06$), pulmonary involvement ($P = 0.10$) and negative testing for ACA ($P = 0.03$). Statistical association was found between patients with diffuse cutaneous SSc and exposure to epoxy resins ($P = 0.06$), white spirit ($P = 0.07$), aromatic solvents ($P = 0.07$) and silica and welding fumes ($P = 0.10$). All results were confirmed by Fisher's exact test, which showed a statistically significant association of each disease severity marker ($P < 0.0002$). Positive testing for anti-topo-I lgG autoantibody was not found to be associated with occupational exposure to toxic agents. The authors conclude that occupational risk factors, including exposure to epoxy resins, white spirit and aromatic solvent, influence the degree of disease	Nature Clinical Practice Rheumatology	2	1	43447	Expert case-by-case assessment	Self-reported exposure		Cohort (prospective)	Pesticides in general	immunological	medical test result	NA	NA

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
334	F. Abu Sham'a, M. Skogstad, K. Nijem, E. Bjertness and P. Kristensen	Lung function and respiratory symptoms in male Palestinian farmers	2010	In a cross-sectional study of 250 farmers aged 22 to 77 years, of whom 36.4% are smokers, the authors aimed at describing lung function and respiratory symptoms and to estimate associations with exposures to pesticides and dust. Lung function was measured using a spirometer. Respiratory symptoms and exposure levels were self-reported based on a modified standardized questionnaire. Mean forced vital capacity (FVC) was 4.20 L (SD = 0.93 L), 95.51% of predicted as compared to European standards. Mean forced expiratory volume in one second (FEV(1)) was 3.28 L (SD = 0.80 L), 91.05% of predicted. The authors found high symptom prevalences: 14.0% for chronic cough; 26.4% for wheeze; and 55.2% for breathlessness. There was no clear association between exposure to pesticides or dust and lung function or between such exposures and respiratory symptoms. However, a significant association was found between smoking and respiratory symptoms such as chronic cough, cough with phlegm, and wheezes. The lack of farm exposure associations could be due to improvement in farmers' awareness to pesticides hazards as well as regulations of pesticide import, or because of inherent problems with the experimental design. Farmers who kept animals and poultry seem to have less respiratory symptoms and better lung function.	Archives of Environmental & Occupational Health	65	4	191-200	Self-reported exposure			Cross-sectional	Pesticides in general	respiratory	medical test result	Palestine	lmic
335	F. B. Mayhoub, T.; Bach, V.; Tack, K.; Deguines, C.; Floch-Barneaud, A.; Desmots, S.; Stephan-Blanchard, E.; Chardon, K.	Self-reported parental exposure to pesticide during pregnancy and birth outcomes: the MecoExpo cohort study	2014	The MecoExpo study was performed in the Picardy region of northern France, in order to investigate the putative relationship between parental exposures to pesticides (as reported by the mother) on one hand and neonatal parameters on the other. The cohort comprised 993 mother-newborn pairs. Each mother completed a questionnaire that probed occupational, domestic, environmental and dietary sources of parental exposure to pesticides during her pregnancy. Multivariate regression analyses were then used to test for associations between the characteristics of parental pesticide exposure during pregnancy and the corresponding birth outcomes. Maternal occupational exposure was associated with an elevated risk of low birth weight (odds ratio (OR) [95% confidence interval]: 4.2 [1.2, 15.4]). Paternal occupational exposure to pesticides was associated with a lower than average gestational age at birth (-0.7 weeks; p = 0.0002) and an elevated risk of prematurity (OR: 3.7 [1.4, 9.7]). Levels of domestic exposure to veterinary antiparasitics and to pesticides for indoor plants were both associated with a low birth weight (-70 g; p = 0.02 and -160 g; p = 0.005, respectively). Babies born to women living in urban areas had a lower birth length and a higher risk of low birth length (-0.4 cm, p = 0.006 and OR: 2.9 [1.5, 5.5], respectively). The present study results mainly demonstrate a negative correlation between fetal development on one hand and parental occupational and domestic exposure to pesticides on the other. Our study highlights the need to perform a global and detailed screening of all potential physiological effects when assessing in utero exposure to pesticides.	PLoS ONE [Electronic Resource]	9	6	e99090	Self-reported job history			Cohort (prospective)	Pesticides in general	offspring	self-reported	France	hic
336	F. Bonvicini, N. Marcello, J. Mandrioli, V. Pietrini and M. Vinceti	Exposure to pesticides and risk of amyotrophic lateral sclerosis: a population-based case-control study	2010	A few epidemiologic studies have suggested an association of agricultural work and pesticides exposure with a severe degenerative disease of the motor neurons, amyotrophic lateral sclerosis (ALS), though conflicting results have also been provided. We investigated through a population-based case-control study the possible relation between overall occupational exposure to pesticides and ALS risk in the northern Italy municipality of Reggio Emilia. By administering a questionnaire, we investigated occupational history and leisure-time habits of the 41 ALS patients diagnosed in the 1995-2006 period, and of 82 age- and sex-matched randomly sampled population controls. More cases than controls were found to have been exposed to pesticides for at least six months (31.7% vs 13.4%, respectively), in all cases within the occupational environment. In a conditional logistic regression model, we found an excess ALS risk associated with exposure to pesticides, with a relative risk of 3.6 (95% confidence interval 1.2-10.5). Such association persisted after inclusion in the statistical analysis of potential confounders. Despite the limited statistical stability of the risk estimates, these results appear to indicate that occupational exposure to pesticides is a risk factor for ALS, suggesting the need to further investigate this issue.	Annali Dell'Istituto Superiore di Sanita	46	3	284-7	Self-reported job history			Case-control	Pesticides in general	neurological	doctor-diagnosed	Italy	hic
337	F. C. Franco, A. A. Alves, F. R. Godoy, J. B. Avelar, D. D. Rodrigues, T. M. Pedroso, A. D. da Cruz, F. Nomura and E. S. D. de Melo	Evaluating genotoxic risks in Brazilian public health agents occupationally exposed to pesticides: a multi-biomarker approach	2016	This is the first study demonstrating genotoxic effects and whole transcriptome analysis on community health agents (CHAs) occupationally exposed to pesticides in Central Brazil. For the transcriptome analysis, we found some genes related to Alzheimer's disease (LRP1), an insulin-like growth factor receptor (IGF2R), immunity genes (IGL family and IG]), two genes related to inflammatory reaction (CXCL5 and CCL3), one gene related to maintenance of cellular morphology (NHS), one gene considered to be a strong apoptosis inductor (LGALS14), and several transcripts of the neuroblastoma breakpoint family (NBPF). Related to comet assay, we demonstrated a significant increase in DNA damage, measured by the olive tail moment (OTM), in the exposed group compared to the control group. Moreover, we also observed a statistically significant difference in OTM values depending on GSTM1 genotypes. Therefore, Brazilian epidemiological surveillance, an organization responsible for the assessment and management of health risks associated to pesticide exposure to CHA, needs to be more proactive and considers the implications of pesticide exposure for CHA procedures and processes.	Environmental Science & Pollution Research	23	19	19723-34	Self-reported exposure			NA	Pesticides in general	genetic (biomarkers)	medical test result	Brazil	umic
338	F. C. Franco, F. R. Godoy, M. Alencar, A. A. Marques, M. P. Batista, C. O. Melo, C. C. Da Silva, A. D. Cruz and D. M. Silva	Analysis of polymorphisms of gstm1 and gstt1 genes and transcriptome in public health agents occupationally exposed to pesticides	2014	Pesticides belong to a chemical category developed to eliminate pests, although the advantages, some of these are associated with risk of the health. Occupational exposure to pesticides is particularly worrying to public health agents in eradication campaigns, whereas, the combat vector is still the solution to prevent dengue epidemics. The aim of this study (case-control) was the evaluation of occupational exposure to pesticides used to eradicate dengue vectors by public health agents in Aparecida de Goiania. We applied a questionnaire for lifestyle and professional knowledge after signing a consent form. We used commercial kits to extract nucleic acids; the polymorphisms of GSTM1 and GSTT1 were analyzed by qPCR and the transcriptome by microarray. Both groups are composed of 125 people, approximately half male and half female, in which 14% of exposed and 10% of controls are smokers. Regarding the use of PPE 83% confirm the use of gloves and mask at least sometimes and 90% use boot. Analysis of polymorphisms on GSTM1 and GSTT1 showed no significance difference (p=0.498) by chi-squared test between case and control groups. Indicating no affect in the integrity of these detoxification genes. For the microarray analysis were selected 8 members divided into low (<12 months) and longer exposure (>108 months), 53,617 genes expression analyzed showed no significant difference between the groups, according to the FDR test. There is no real quantification of the contact with the pesticide despite of the exposure time, so the next steps will be to compare exposed groups to controls.	Environmental and Molecular Mutagenesis	55	NA	S43	Self-reported job history			Case-control	Job title	genetic (biomarkers)	medical test result	NA	NA

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
339	F. C. Su, S. A. Goutman, S. Chernyak, B. Mukherjee, B. C. Callaghan, S. Batterman and E. L. Feldman	Association of Environmental Toxins With Amyotrophic Lateral Sclerosis	2016	IMPORTANCE: Persistent environmental pollutants may represent a modifiable risk factor involved in the gene-time-environment hypothesis in amyotrophic lateral sclerosis (ALS). OBJECTIVE: To evaluate the association of occupational exposures and environmental toxins on the odds of developing ALS in Michigan. DESIGN, SETTING, AND PARTICIPANTS: Case-control study conducted between 2011 and 2014 at a tertiary referral center for ALS. Cases were patients diagnosed as having definitive, probable, probable with laboratory support, or possible ALS by revised El Escorial criteria; controls were excluded if they were diagnosed as having ALS or another neurodegenerative condition or if they had a family history of ALS in a first- or second-degree blood relative. Participants completed a survey assessing occupational and residential exposures. Blood concentrations of 122 persistent environmental pollutants, including organochlorine pesticides (OCPs), polychlorinated biphenyls (PCBs), and brominated flame retardants (BFRs), were measured using gas chromatography-mass spectrometry. Multivariable models with self-reported occupational exposures in various exposure time windows and environmental toxin blood concentrations were separately fit by logistic regression models. Concordance between the survey data and pollutant measurements was assessed using the nonparametric Kendall tau correlation coefficient. MAIN OUTCOMES AND MEASURES: Occupational and residential exposures to environmental toxins, and blood concentrations of 122 persistent environmental pollutants, including OCPs, PCBs, and BFRs. RESULTS: Participants included 156 cases (mean [SD] age, 60.5 [11.1] years; 61.5% male) and 128 controls (mean [SD] age, 60.4 [9.4] years; 57.8% male); among them, 101 cases and 110 controls had complete demographic and pollutant data. Survey data revealed that reported pesticide exposure in the cumulative exposure windows was significantly associated with ALS (odds ratio [OR]=5.09; 95% CI, 1.85-13.99; P=.002). Military service was also associated with ALS in 2 time windows (exposure ever happened in entire occupational history: OR=2.31; 95% CI, 1.02-5.25; P=.046; exposure ever happened 10-30 years ago: OR=2.18; 95% CI, 1.01-4.73; P=.049). A multivariable model of measured persistent environmental pollutants in the blood, representing cumulative occupational and residential exposure, showed increased odds of ALS for 2 OCPs (pentachlorobenzene: OR=2.21; 95% CI, 1.06-4.60; P=.04; and cis-chlordane: OR=5.74; 95% CI, 1.80-18.20; P=.005), 2 PCBs (PCB 175: OR=1.81; 95% CI, 1.20-2.72; P=.005; and PCB 202: OR=2.11; 95% CI, 1.36-3.27; P=.001), and 1 BFR (polybrominated diphenyl ether 47: OR=2.69; 95% CI, 1.49-4.85; P=.001). There was modest concordance between survey data and the measurements of persistent environmental	JAMA Neurology	73	7	803-11	Self-reported exposure	Biomonitoring (blood)		Case-control	Chemical class	neurological	doctor-diagnosed	USA	hic
340	F. D. Dick, G. De Palma, A. Ahmadi, N. W. Scott, G. J. Prescott, J. Bennett, S. Semple, S. Dick, C. Counsell, P. Mozzoni, N. Haites, S. B. Wettinger, A. Mutti, M. Otelea, A. Seaton, P. Soderkvist, A. Felice and g. Geoparkinson study	Environmental risk factors for Parkinson's disease and parkinsonism: the Geoparkinson study	2007	OBJECTIVE: To investigate the associations between Parkinson's disease and other degenerative parkinsonian syndromes and environmental factors in five European countries. METHODS: A case-control study of 959 prevalent cases of parkinsonism (767 with Parkinson's disease) and 1989 controls in Scotland, Italy, Sweden, Romania and Malta was carried out. Cases were defined using the United Kingdom Parkinson's Disease Society Brain Bank criteria, and those with drug-induced or vascular parkinsonism or dementia were excluded. Subjects completed an interviewer-administered questionnaire about lifetime occupational and hobby exposure to solvents, pesticides, iron, copper and manganese. Lifetime and average annual exposures were estimated blind to disease status using a job-exposure matrix modified by subjective exposure modelling. Results were analysed using multiple logistic regression, adjusting for age, sex, country, tobacco use, ever knocked unconscious and family history of Parkinson's disease. RESULTS: Adjusted logistic regression analyses showed significantly increased odds ratios for Parkinson's disease/parkinsonism with an exposure-response relationship for pesticides (low vs no exposure, odds ratio (OR) = 1.13, 95% CI 0.82 to 1.57, high vs no exposure, OR = 1.41, 95% CI 1.06 to 1.88) and ever knocked unconscious (once vs never, OR = 1.35, 95% CI 1.09 to 1.68, more than once vs never, OR = 2.53, 95% CI 1.78 to 3.59). Hypnotic, anxiolytic or antidepressant drug use for more than 1 year and a family history of Parkinson's disease showed significantly increased odds ratios. Tobacco use was protective (OR = 0.50, 95% CI 0.42 to 0.60). Analyses confined to subjects with Parkinson's disease gave similar results. CONCLUSIONS: The association of pesticide exposure with Parkinson's disease suggests a causative role. Repeated traumatic loss of consciousness is associated with increased risk.	Occupational & Environmental Medicine	64	10	666-72	Self-reported job history	Job exposure matrix		Case-control	Job title	neurological	doctor-diagnosed	SHIC	SHIC
341	F. D. O. Giordano, V.; Giannandrea, F.; Lauria, L.; Valente, P.; Figa-Talamanca, I.	Mortality in a cohort of pesticide applicators in an urban setting: sixty years of follow-up	2006	The study is a further follow-up of a cohort of 168 urban pesticide applicators of the municipality of Rome who were first employed in 1946. An earlier analysis of the mortality of this group concerned the deaths observed up to 1987, and showed a significant excess in mortality from liver cancer. In this report we present an updated follow up of the mortality of the cohort, which comprises the total of 85 deaths for the entire period of observation, corresponding to 5227 person/years. The living status of each member of the cohort was ascertained through the official records up to 2005. For the 85 deceased individuals, the primary cause of death was coded according to the 9th Revision of the ICD. Standardized mortality ratios (SMR) were calculated on the basis of the age, sex, and cause specific mortality rates prevailing during the same calendar years in the province of Rome. The SMR from all causes for the whole cohort was 103.8 (90 %CI 86 124). The SMR for all cancers was 106.0 (90 % CI 75-146). An increased risk was observed for the exposed for cancer of the gallbladder (SMR 723.8 90% CI 129-2279), of the liver (SMR 596.3, 90 % CI 204-1365) and for cancer of the nervous system (SMR 529.2, 90 % CI 144-1368). All increases were statistically significant, but no association was found between the increased risk of these cancers and the longer duration of exposure. The increase in risk of the three cancers mentioned above (liver, nervous system and gallbladder), was further increased, when the analysis was restricted to the workers exposed prior to the 1978 ban of DDT and products containing arsenic.	International Journal of Immunopathology & Pharmacology	19	4	22402	Job title			Cohort (prospective)	Job title	mortality (all cause)	doctor-diagnosed	Italy	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
342	F. Dutheil, P. Beaune, C. Tzourio, M. A. Loriot and A. Elbaz	Interaction between ABCB1 and professional exposure to organochlorine insecticides in Parkinson disease	2010	OBJECTIVE: To study the association between Parkinson disease (PD) and 2 polymorphisms in ABCB1 among subjects enrolled in the French health system for agricultural workers (Mutualite Sociale Agricole), as well as the interaction between ABCB1 and organochlorine insecticides. DESIGN: Case-control study. SETTING: Mutualite Sociale Agricole. PARTICIPANTS: Patients with PD were examined by a neurologist and were matched to a maximum of 3 controls. Participants were classified as never users, users for gardening, and professional users of pesticides. Detailed information on pesticides lifelong use was obtained for professional users by occupational health physicians. MAIN OUTCOME MEASURES: DNA was obtained and 2 ABCB1 polymorphisms (exon 21: G2677[A,T]; exon 26: C3435T) associated with altered P-glycoprotein function were genotyped. RESULTS: Among 207 cases and 482 matched controls, ABCB1 polymorphisms were not associated with PD (C3435T, P = .43; G2677[A,T], P = .97). Among 101 male cases and 234 matched controls, the odds ratio for organochlorines was 3.5 (95% confidence interval, 0.9-14.5) times higher among homozygous carriers of variant G2677(A,T) alleles than noncarriers. Among cases only, we found an association between carrying 2 variant G2677(A,T) alleles and organochlorines (odds ratio, 5.4, 95% confidence interval, 1.1-27.5) as well as with the number of cumulative lifetime number of hours of exposure (P = .005; analyses restricted to subjects exposed to organochlorines, P = .03). CONCLUSIONS: Our findings suggest that the ABCB1 gene and exposure to organochlorine insecticides interact to increase PD risk: in subjects professionally exposed to organochlorines, polymorphisms associated with a decreased ability of ABCB1 to clear xenobiotics from the brain increased the risk of PD. These findings support the hypothesis of gene x pesticides interactions in PD.	Archives of Neurology	67	6	739-45	Expert case-by-case assessment			Case-control	Chemical class	neurological	doctor-diagnosed	France	hic
343	F. Fagioli, G. M. Rigolin, A. Cuneo, G. Scapoli, R. Spanedda, P. Cavazzini and G. Castoldi	Primary gastric lymphoma: distribution and clinical relevance of different epidemiological factors	1994	BACKGROUND: Over the last 10 years the incidence of primary gastric lymphomas (PGL), and in particular those of MALT origin, has significantly increased. Recent works correlated this epidemiological observation to Helicobacter pylori (HP) infection. On the other hand, new evidence demonstrating that occupational exposure to pesticides and solvents has played an important role in the pathogenesis of non-Hodgkin lymphomas (NHL) has emerged from studies involving large series of patients. METHODS: Thirty PGL patients, observed between 1986-1992, were subdivided according to HP infection, history of previous gastric disturbances (G) and exposure to pesticides and solvents (T). RESULTS: On the basis of these parameters we divided the patients into three groups: T+HP+ (8), T+HP- (7), T-HP+ (9). T+ patients had a positive history of gastric problems or a positive histological biopsy in 13.3% of cases, versus 66.7% in T- patients. The incidence of HP infection in the T+ group was 53%, which proved to be comparable to the statistics for northeastern Italy, while in the T- group the incidence of infection was 100%. CONCLUSIONS: On the whole these data suggest that HP infection could be considered a pathogenetic factor in 34% of patients, while occupational exposure to pesticides and solvents could have played a more important role in 66% of these cases.	Haematologica	79	3	213-7	Self-reported exposure			Cross-sectional	Pesticides in general	cancer	doctor-diagnosed	Italy	hic
344	F. Forastiere, A. Quercia, M. Miceli, L. Settimi, B. Terenzoni, E. Rapiti, A. Faustini, P. Borgia, F. Cavariani and C. A. Perucci	Cancer among farmers in central Italy	1993	This case-referent study evaluated cancer risks among farmers in central Italy. Cancer cases (N = 1674, 17 sites) were selected from all deceased men aged 35-80 years; a random sample of 480 decedents formed the reference series. Farmers had a decreased risk of lung and bladder cancer and melanoma and nonsignificant excess risks for stomach, rectal, kidney, and nonmelanoma skin cancer. Stomach and kidney cancer were significantly increased among the farmers with > 10 years' experience, and stomach, rectal, and pancreatic cancer were increased among licensed pesticide users with > 10 years' experience. Possible relationships emerged between specific crops and cancer: fruit and colon and bladder cancer, wheat and prostate cancer, olives and kidney cancer, and potato and kidney cancer. The results regarding stomach, pancreatic, lung, bladder, and prostate cancer and melanoma congrue with earlier results. The kidney cancer excess, the association of colon and bladder cancer with orchard farming, and the excess of rectal cancer among licensed farmers are new and unexpected findings.	Scandinavian Journal of Work, Environment & Health	19	6	382-9	Job title			Case-control	Job title	cancer	doctor-diagnosed	Italy	hic
345	F. Giordano, A. Abballe, E. De Felip, A. di Domenico, F. Ferro, P. Grammatico, A. M. Ingelido, V. Marra, G. Marrocco, S. Vallasciani and I. Figa-Talamanca	Maternal exposures to endocrine disrupting chemicals and hypospadias in offspring	2010	BACKGROUND: Prenatal exposures to endocrine-disrupting chemicals (EDCs) are suspected risk factors in the etiology of hypospadias. The aim of this case-control study was to test the hypothesis of an association between maternal environmental exposures to EDCs and hypospadias in the offspring. METHODS: Detailed questionnaire data on occupational and dietary exposures to EDCs in the perinatal period were collected from 80 mothers with hypospadiac infants and from 80 mothers with healthy controls within 24 months of childbirth. Maternal exposure to selected EDCs was also ascertained by measuring the concentration of dichlorodiphenyldichloroethylene, hexachlorobenzene, and several polychlorinated biphenyl congeners in the serum of primiparous mothers of 37 cases and 21 controls. RESULTS: The risk to bear an hypospadiac infant was associated with perinatal maternal occupational exposures to EDCs evaluated by a job-exposure matrix: jobs with exposure to one class of EDCs (odds ratios [OR](crude), 2.83; 95% confidence intervals [CI], 1.32-6.07; OR(adjusted), 2.44; 95% CI, 1.06-5.61) and jobs with exposure to more than one group of EDCs (OR(crude), 4.27; 95% CI, 1.43-12.78; OR(adjusted), 4.11; 95%CI, 1.34-12.59). Increase in risk was also found among mothers consuming a diet rich in fish or shellfish (OR(crude), 3.41; 95% CI, 1.42-8.23; OR(adjusted), 2.73; 95%CI, 1.09-6.82). Serum hexachlorobenzene concentration above the median of all subjects was significantly associated with the risk of hypospadias (OR(adjusted), 5.50; 95% CI, 1.24-24.31). CONCLUSIONS: This study, although based on a limited number of cases, for the first time provides evidence of an association between maternal exposure to EDCs, in particular elevated plasma hexachlorobenzene concentration, and the development of hypospadias in the offspring.	Birth Defects Research	88	4	241-50	Job exposure matrix	Self-reported job history		Case-control	Pesticides in general	offspring	doctor-diagnosed	Italy	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
346	F. H. Pierik, A. Burdorf, J. A. Deddens, R. E. Juttmann and R. F. Weber	Maternal and paternal risk factors for cryptorchidism and hypospadias: a case-control study in newborn boys	2004	Little is known on environmental risk factors for cryptorchidism and hypospadias, which are among the most frequent congenital abnormalities. The aim of our study was to identify risk factors for cryptorchidism and hypospadias, with a focus on potential endocrine disruptors in parental diet and occupation. In a case-control study nested within a cohort of 8,698 male births, we compared 78 cryptorchidism cases and 56 hypospadias cases with 313 controls. The participation rate was 85% for cases and 68% for controls. Through interviews, information was collected on pregnancy aspects and personal characteristics, lifestyle, occupation, and dietary phytoestrogen intake of both parents. Occupational exposure to potential endocrine disruptors was classified based on self-reported exposure and ratings of occupational hygienists based on job descriptions. Our findings indicate that paternal pesticide exposure was associated with cryptorchidism [odds ratio (OR) = 3.8; 95% confidence interval (95% CI), 1.1-13.4]. Smoking of the father was associated with hypospadias (OR = 3.8; 95% CI, 1.8-8.2). Maternal occupational, dietary, and lifestyle exposures were not associated with either abnormality. Both abnormalities were associated with suboptimal maternal health, a lower maternal education, and a Turkish origin of the parents. Being small for gestational age was a risk factor for hypospadias, and preterm birth was a risk factor for cryptorchidism. Because paternal pesticide exposure was significantly associated with cryptorchidism and paternal smoking was associated with hypospadias in male offspring, paternal exposure should be included in further studies on cryptorchidism and hypospadias risk factors.	Environmental Health Perspectives	112	15	1570-6	Self-reported exposure	Expert case-by-case assessment		Case-control	Pesticides in general	offspring	doctor-diagnosed	Netherlands	hic
347	F. Herin, E. Boutet-Robinet, A. Levant, S. Dulaurent, M. Manika, F. Galatry-Bouju, P. Caron and J. M. Soulat	Thyroid function tests in persons with occupational exposure to fipronil.[Erratum appears in Thyroid. 2011 Aug;21(8):939]	2011	BACKGROUND: Fipronil represents a chemical class of insecticides acting at the gamma-aminobutyric acid receptor in pests. [corrected] Fipronil has been associated with a significant increase in the incidence of thyroid gland tumors concomitant with prolonged exposure to thyroid-stimulating hormone (TSH) in rats. An association between human TSH concentration and thyroid cancer has been also reported. The primary objective of this study was to test the hypothesis that chronic occupational fipronil exposure may be associated with abnormal thyroid function tests. METHODS: In 2008, 159 workers of a factory manufacturing fipronil-containing veterinary drugs were assessed. Serum concentrations of TSH, total thyroxine, free thyroxine, fipronil, and fipronil sulfone were measured. RESULTS: A positive and significant correlation was observed between serum fipronil or fipronil sulfone levels and duration of fipronil exposure. Serum fipronil sulfone concentration was negatively correlated with TSH concentration in fipronil-exposed workers, but with no significant increase in thyroid function test abnormalities. CONCLUSION: This study did not show that chronic fipronil exposure was associated with an increase of thyroid function test abnormalities. But, despite the fact that fipronil exposure in rats has been associated with increased serum TSH, fipronil sulfone concentrations were negatively correlated with serum TSH concentrations in fipronil-exposed workers, raising the possibility that fipronil has a central inhibitory effect on TSH secretion in humans. Close occupational medical surveillance, therefore, appears to be required in factory workers manufacturing fipronil-containing veterinary drugs. Larger epidemiological studies as well as investigations on possible thyroid-disrupting mechanisms of fipronil are also required.	Thyroid	21	7	701-6	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	endocrine/nutritional/metabolical	medical test result	France	hic
348	F. Hossain, O. Ali, U. J. D'Souza and D. K. Naing	Effects of pesticide use on semen quality among farmers in rural areas of Sabah, Malaysia	2010	OBJECTIVES: To determine the relationship between semen quality and exposure to pesticide residues. METHODS: A cross-sectional study was conducted among male farmers from 3 different communities in Sabah, Malaysia. A total of 152 farmers participated in this study of whom 62 farmers had been exposed to either paraquat or malathion or both to varying extents. Questionnaires were designed to record a history of pesticides exposure and other potential risk factors among farmers. All semen samples were collected, processed and analyzed by qualified personnel based on WHO guidelines. Volume, pH, sperm concentration, motility, morphology and WBC count were examined and recorded. The association between pesticide exposure and semen parameters was highly significant. RESULTS: The mean values of volume, pH, sperm concentration, motility, and WBC count were significantly less in the exposed group than in compared with the non-exposed group, with p<0.005. Those who were exposed to pesticides had greater risk of having abnormal semen parameters than those in with the non exposed group, with p values of less than 0.05. The comparison between semen qualities such as lower sperm count, motility and higher percentage of sperm abnormality of those exposed to different types of pesticides (paraquat and malathion) showed no significant differences. CONCLUSION: The results showed a significant decline in semen quality with a decline in sperm count, motility and higher percent of teratospermia among subjects with pesticide exposure, and those who were exposed to pesticides had significantly 3 to 9 times greater risk of having abnormal semen parameters.	Journal of Occupational Health	52	6	353-60	Self-reported exposure			Cross-sectional	Pesticides in general	reproductive	medical test result	Malaysia	umic
349	F. J. Jimenez-Jimenez, M. de Toledo-Heras, H. Alonso-Navarro, L. Ayuso-Peralta, J. Arevalo-Serrano, A. Ballesteros-Barranco, I. Puertas, T. Jabbour-Wadih and B. Barcenilla	Environmental risk factors for essential tremor	2007	We conducted a case-control study searching for a possible role of environment in the risk of essential tremor (ET). We interviewed 142 ET patients and 284 age- and sex-matched controls about a family history of ET, exposure to environmental products containing lead, mercury, manganese, solvents and beta-carbolines, and exposure to agricultural work, well water, pesticides, and cigarette smoking and alcohol drinking habits. In a univariate study, reported family history of ET and exposure to agricultural work, pesticides, smelting, frosted glass, paintings, wheat, corn, and barley were more frequent in the ET patient group. With a multivariate study, only reported family history of ET and exposure to agricultural work and frosted glass remained significant. Time of exposure to agricultural work, wheat and barley was significantly higher in ET patients. Age at onset of ET was significantly lower in patients with a family history of tremor and higher in patients exposed to iron-manganese alloys and alcohol. Time of exposure, but not total consumption of alcohol and cigarettes, was correlated with age at onset of ET. In conclusion, our study shows that the association between ET and reported family history of ET was robust, and that there were also associations between ET and exposure to some environmental factors (agricultural work and frosted glass).	European Neurology	58	2	106-13	Self-reported exposure			Case-control	Pesticides in general	neurological	self-reported	Spain	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
350	F. J. Tuchsen, A. A.	Agricultural work and the risk of Parkinson's disease in Denmark, 1981-1993	2000	OBJECTIVES: This study examined the possible association between agricultural and horticultural work and the subsequent morbidity of Parkinson's disease. METHODS: Fixed cohorts of 2,273,872 men and women aged 20-59 years on 1 January 1981 and identified in the Central Population Register of Denmark were followed, and all first-time hospitalizations with Parkinson's disease as the principal diagnosis during the 13 years until 31 December 1993 were recorded. Standardized hospitalization ratios (SHR) were calculated using all gainfully employed persons as the standard and by multiplying the ratio by 100. Ninety-five percent confidence intervals (95% CI) were calculated on the assumption of a Poisson distribution. RESULTS: A high risk of Parkinson's disease was found for the men and women in agriculture and horticulture (134 cases, SHR 132, 95% CI 111-156). Statistically significantly high risks were found for farmers (79 cases, SHR 130, 95% CI 103-163) and for all men in agriculture and horticulture (109 cases, SHR 134, 95% CI 109-162). CONCLUSIONS: A consistent pattern of high Parkinson's disease morbidity was found among occupational groups employed in agriculture and horticulture.	Scandinavian Journal of Work, Environment & Health	26	4	359-62	Job title			Cohort (prospective)	Job title	neurological	doctor-diagnosed	Denmark	hic
351	F. Jamal, Q. S. Haque and S. Singh	Interrelation of glycemic status and neuropsychiatric disturbances in farmers with organophosphorus pesticide toxicity	2016	Background: Diverse group of agro-chemicals are indiscriminately sprayed by the farmers for pest control to enhance crop yield. About 25 million agricultural workers in the developing world suffer from at least one episode of poisoning each year, mainly by anticholinesteraselike organophosphates (OPs). Objective: The present study was aimed to establish the OP toxicity in 187 occupationally exposed pesticide sprayers of mango plantation in rural Malihabad, Lucknow, in terms of neuro-cognitive impairment, mental health status, clinical symptoms, diabetes, and hematological factors. Method: The exposed group was compared to 187 pesticides-unexposed normal healthy persons engaged in normal usual agricultural work (age, sex and education corresponding to age group of selected subject group) from Rural Malihabad, Lucknow (India). Neurocognitive impairment was measured using the Subjective Neurocognition Inventory and mental health status using the General Health questionnaire-28. The subjects were also tested for biochemical and enzymatic parameters. Results: The exposed farmers showed alterations in enzymatic and clinical parameters. While the rates of anxiety / insomnia and severe depression were also significantly higher in the pesticide sprayers, disorders affecting psychomotor speed, selective attention, divided attention, verbal memory, nonverbal memory, prospective memory, spatial functioning, and initiative/energy were all lower in the sprayers. Pesticide sprayers showed a number of clinical symptoms like eczema, saliva secretion, fatigue, headache, sweating, abdominal pain, nausea, superior distal muscle weakness, inferior distal muscle weakness, hand tingling and etc. which all significantly correlated with the number of working years. Conclusion: These findings suggested that farmers who work with OPs are prone to neuro-psychological disorders and diabetes.	Open Biochemistry Journal	10	NA	27-34	Biomonitoring (blood)			Cross-sectional	Chemical class	neurological	medical test result	India	lmic
352	F. Kamel, L. S. Engel, B. C. Gladen, J. A. Hoppin, M. C. Alavanja and D. P. Sandler	Neurologic symptoms in licensed private pesticide applicators in the agricultural health study	2005	Exposure to high levels of many pesticides has both acute and long-term neurologic consequences, but little is known about the neurotoxicity of chronic exposure to moderate levels of pesticides. We analyzed cross-sectional data from 18,782 white male licensed private pesticide applicators enrolled in the Agricultural Health Study in 1993-1997. Applicators provided information on lifetime pesticide use and 23 neurologic symptoms typically associated with pesticide intoxication. An indicator of more symptoms (> or = 10 vs. < 10) during the year before enrollment was associated with cumulative lifetime days of insecticide use: odds ratios (95% confidence intervals) were 1.64 (1.36-1.97) for 1-50 days, 1.89 (1.58-2.25) for 51-500 days, and 2.50 (2.00-3.13) for > 500 days, compared with never users. A modest association for fumigants [> 50 days, 1.50 (1.24-1.81)] and weaker relationships for herbicides [> 500 days, 1.32 (0.99-1.75)] and fungicides [> 50 days, 1.23 (1.00-1.50)] were observed. Pesticide use within the year before enrollment was not associated with symptom count. Only associations with insecticides and fumigants persisted when all four pesticide groups were examined simultaneously. Among chemical classes of insecticides, associations were strongest for organophosphates and organochlorines. Associations with cumulative exposure persisted after excluding individuals who had a history of pesticide poisoning or had experienced an event involving high personal pesticide exposure. These results suggest that self-reported neurologic symptoms are associated with cumulative exposure to moderate levels of fumigants and organophosphate and organochlorine insecticides, regardless of recent exposure or history of poisoning.	Environmental Health Perspectives	113	7	877-82	Self-reported exposure			Cross-sectional	Specific active ingredient	neurological	self-reported	USA	hic
353	F. Kamel, W. K. Boyes, B. C. Gladen, A. S. Rowland, M. C. Alavanja, A. Blair and D. P. Sandler	Retinal degeneration in licensed pesticide applicators	2000	BACKGROUND: Retinal degeneration is the leading cause of visual impairment in older adults, but little is known about its relationship to neurotoxic exposures. METHODS: The Agricultural Health Study is a cohort study of licensed pesticide applicators from Iowa and North Carolina. We used cross-sectional data from self-administered questionnaires given at enrollment in 1994-1996 to compare pesticide use in 154 applicators who reported retinal degeneration and 17,804 controls. RESULTS: Retinal degeneration was associated with fungicide use (odds ratio = 1.8, 95% confidence interval = 1.3-2.6). This relationship was seen in subgroups defined by state, demographic characteristics, or medical history, as well as in the entire group. Risk increased with cumulative days of fungicide use (P for trend = 0.011) and was greater when application methods involving greater personal exposure were used. Retinal degeneration was also related to use of organochlorine or carbamate insecticides, but these associations were less consistent. Since nearly all applicators used organophosphate insecticides and herbicides, these exposures could not be effectively evaluated. CONCLUSIONS: These results suggest that exposure to some fungicides and insecticides may increase risk of retinal degeneration.	American Journal of Industrial Medicine	37	6	618-28	Self-reported exposure			Cross-sectional	Chemical class	other	other	USA	hic
354	F. Lander and M. Ronne	Frequency of sister chromatid exchange and hematological effects in pesticide-exposed greenhouse sprayers	1995	OBJECTIVES: A cross-sectional study was conducted to investigate whether exposure to pesticides in greenhouses causes hemato- or genotoxic damage in sprayers. METHODS: The frequency of sister chromatid exchange (SCE) in cultured lymphocytes and the number of blood erythrocytes, leucocytes, and thrombocytes were studied among 134 greenhouse sprayers exposed to a complex mixture of almost 50 insecticides, fungicides, and growth regulators and among 157 referents. RESULTS: The hematological profiles did not differ between the exposed and unexposed groups. The SCE frequency was elevated in nonsmoking, but not in currently smoking sprayers when compared with the referents. There was a slight tendency towards an increased SCE frequency with decreasing degree of protection during pesticide applications. The frequency of pesticide applications, lifetime pesticide exposure, and in-season plasma-cholinesterase inhibition (as an estimate of current exposure to organophosphates and carbamates) did not influence the SCE frequency or any of the hematological parameters. CONCLUSIONS: The present results suggest a genotoxic effect from combined subtoxic occupational pesticide exposure, whereas no hematogenic effects could be observed at the current exposure level.	Scandinavian Journal of Work, Environment & Health	21	4	283-8	Biomonitoring (blood)	Job title		Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	NA	NA

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
355	F. Merletti, L. Richiardi, F. Bertoni, W. Ahrens, A. Buemi, C. Costa-Santos, M. Eriksson, P. Guenel, L. Kaerlev, K. H. Jockel, A. Llopis-Gonzalez, E. Merler, A. Miranda, M. M. Morales-Suarez-Varela, H. Olsson, T. Fletcher and J. Olsen	Occupational factors and risk of adult bone sarcomas: a multicentric case-control study in Europe	2006	We investigated the association between occupational factors and risk of bone sarcoma, a rare tumor with a largely unknown aetiology. A multicentric case-control study was conducted in 7 European countries in 1995-97. Ninety-six cases aged 35-69 years with a centrally reviewed diagnosis of bone sarcoma (68 chondrosarcomas and 28 osteosarcomas) were compared to 2,632 population (68%) or colon cancer (32%) controls. Subjects were interviewed to obtain information on occupational, medical and reproductive history, smoking and alcohol consumption and selected exposures including use of pesticides. Response proportions were 90% among cases and 66% among controls. Odds ratios (OR) and 95% confidence intervals (CI) were estimated for selected categories of job titles and branches of industry and for use of pesticides. We found an increased OR for bone sarcoma among blacksmiths, toolmakers, machine-tool operators (OR = 2.14, 95% CI 1.08-4.26), woodworkers (OR = 2.68, 95% CI 1.36-5.29) and construction workers (OR = 1.62, 95% CI 0.92-2.87). Ever users of pesticide had an OR of 2.33 (95% CI 1.31-4.13), with similar risks for exposure to insecticides and exposure to herbicides. Neither duration of employment in any of the analyzed occupational categories nor duration of use of pesticides showed an increasing trend in the risk of bone sarcoma. ORs of bone sarcoma were 1.03 (95% CI 0.23-4.57), 3.13 (95% CI 1.26-7.76) and 1.44 (95% CI 0.43-4.85) for the first, second and third tertile of days of use of pesticides. Our study suggests that novel and previously reported (woodworking) occupational factors play a role in the aetiology of bone sarcomas.	International Journal of Cancer	118	3	721-7	Self-reported exposure			Case-control	Type of pesticide	cancer	doctor-diagnosed	AHIC	AHIC
356	F. Moisan, J. Spinosi, J. L. Dupupet, L. Delabre, J. L. Mazurie, M. Goldberg, E. Imbernon, C. Tzourio and A. Elbaz	The relation between type of farming and prevalence of Parkinson's disease among agricultural workers in five French districts	2011	Retrospective assessment of pesticide exposure is complex; however, patterns of pesticide use strongly depend on farming type, which is easier to assess than pesticide exposure. Our aim was to estimate Parkinson's disease (PD) prevalence in five French districts in 2007 among affiliates of Mutualite Sociale Agricole (MSA) and to investigate the relation between PD prevalence and farming type. We identified PD cases from administrative files as persons who used levodopa and/or benefited from free health care for PD. Densities of 16 farming types were defined at the canton of residence level (1988 French agricultural census). We used logistic regression to study the relation between PD prevalence and density of farming types and a semi-Bayes approach to deal with correlated exposures. We identified 1,659 PD cases, yielding an age- and sex-standardized PD prevalence of 3.01/1,000. Prevalence increased with age and was higher in men than women. We found a higher PD prevalence among affiliates living in cantons characterized by a higher density of farms specialized in fruits and permanent crops (multivariable semi-Bayes model: OR(4+5 vs 1+2+3 quintiles) = 1.21, 95% CI = 1.08-1.36; test for trend, P = 0.035). In France, farms specialized in fruits and permanent crops rank first in terms of insecticide use per hectare. Our findings are consistent with studies reporting an association between PD and insecticide use and show that workers in farms specialized in fruits or permanent crops may be an occupational group at higher PD risk.	Movement Disorders	26	2	271-9	Registers			Cross-sectional	Job title	neurological	doctor-diagnosed	France	hic
357	F. Moisan, J. Spinosi, L. Delabre, V. Gourlet, J. L. Mazurie, I. Benatru, M. Goldberg, M. G. Weisskopf, E. Imbernon, C. Tzourio and A. Elbaz	Association of Parkinson's Disease and Its Subtypes with Agricultural Pesticide Exposures in Men: A Case-Control Study in France	2015	BACKGROUND: Pesticides have been associated with Parkinson's disease (PD), but there are few data on important exposure characteristics such as dose-effect relations. It is unknown whether associations depend on clinical PD subtypes. OBJECTIVES: We examined quantitative aspects of occupational pesticide exposure associated with PD and investigated whether associations were similar across PD subtypes. METHODS: As part of a French population-based case-control study including men enrolled in the health insurance plan for farmers and agricultural workers, cases with clinically confirmed PD were identified through antiparkinsonian drug claims. Two controls were matched to each case. Using a comprehensive occupational questionnaire, we computed indicators for different dimensions of exposure (duration, cumulative exposure, intensity). We used conditional logistic regression to compute odds ratios (ORs) and 95% confidence intervals (CIs) among exposed male farmers (133 cases, 298 controls). We examined the relation between pesticides and PD subtypes (tremor dominant/non-tremor dominant) using polytomous logistic regression. RESULTS: There appeared to be a stronger association with intensity than duration of pesticide exposure based on separate models, as well as a synergistic interaction between duration and intensity (p-interaction = 0.04). High-intensity exposure to insecticides was positively associated with PD among those with low-intensity exposure to fungicides and vice versa, suggesting independent effects. Pesticide exposure in farms that specialized in vineyards was associated with PD (OR = 2.56; 95% CI: 1.31, 4.98). The association with intensity of pesticide use was stronger, although not significantly (p-heterogeneity = 0.60), for tremor-dominant (p-trend < 0.01) than for non-tremor-dominant PD (p-trend = 0.24). CONCLUSIONS: This study helps to better characterize different aspects of pesticide exposure associated with PD, and shows a significant association of pesticides with tremor-dominant PD in men, the most typical PD presentation. CITATION: Moisan F, Spinosi J, Delabre L, Gourlet V, Mazurie JL, Benatru I, Goldberg M, Weisskopf MG, Imbernon E, Tzourio C, Elbaz A. 2015. Association of Parkinson's disease and its subtypes with agricultural pesticide exposures in men: a case-control study in France. Environ Health Perspect 123:1123-1129; http://dx.doi.org/10.1289/ehp.1307970.	Environmental Health Perspectives	123	11	1123-9	Self-reported exposure			Case-control	Type of pesticide	neurological	doctor-diagnosed	France	hic
358	F. P. Manfo, P. F. Moundipa, H. Dechaud, A. N. Tchana, E. A. Nantia, M. T. Zabot and M. Pugeat	Effect of agropesticides use on male reproductive function: a study on farmers in Djutitsa (Cameroon)	2012	This study aimed at investigating the effect of agropesticides on male reproductive function in farmers in Djutitsa (West Cameroon). To this end, 47 farmers in Djutitsa were asked questions on their health status and pesticide use in agriculture. Thereafter, their blood samples were collected for assessment of sex hormones including serum luteinizing hormone (LH), follicle-stimulating hormone (FSH), androstenedione, testosterone, as well as sex hormone binding globulin (SHBG). Their serum triiodothyronine (T3) and thyroxine (T4) levels were also measured. Thirty seven men not exposed to agropesticides were recruited as control group. Fifty six pesticides containing 25 active substances were currently used by farmers enrolled in our study, and most of their symptoms were related to spread/use of these chemicals. Compared to the control group, there was no significant difference in FSH, LH, SHBG, estradiol, and thyroid hormones (T3 and T4) levels. Farmers had significantly lower serum testosterone (20.93 +/- 1.03 nM vs. 24.32 +/- 1.32 nM; P < 0.05) and higher androstenedione level (3.83 +/- 0.20 nM vs. 2.80 +/- 0.15 nM; P < 0.001). Their serum free testosterone as well as bioavailable testosterone were unchanged, while estradiol/testosterone and androstenedione/testosterone ratios were significantly increased (0.45 +/- 0.03% vs. 0.33 +/- 0.02%; P < 0.01 and 12.26 +/- 3.64 vs 19.31 +/- 6.82; P < 0.001, respectively). Our results suggest that male farmers of Djutitsa (West Cameroon) are exposed to agropesticides due to improper protective tool, and this exposure may impair their reproductive function through inhibition of testosterone synthesis; probably by inhibition of testicular 17beta-hydroxysteroid dehydrogenase (17HSD3) and induction of aromatase (CYP19).	Environmental Toxicology	27	7	423-32	Expert case-by-case assessment			Cross-sectional	Type of pesticide	reproductive	medical test result	Cameroon	lmic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
359	F. R. Da Silva, J. Da Silva, E. Nunes, D. Benedetti, V. Kahl, P. Rohr, M. B. Abreu, F. V. Thiesen and K. Kvitko	Application of the buccal micronucleus cytome assay and analysis of PON1Gln192Arg and CYP2A6 9(-48T>G) polymorphisms in tobacco farmers	2012	Tobacco is a major Brazilian cash crop. Tobacco farmers apply large amounts of pesticides to control insect growth. Workers come into contact with green tobacco leaves during the tobacco harvest and absorb nicotine through the skin. In the present study, micronucleus frequency, cell death, and the frequency of basal cells were measured in tobacco farmers using the buccal micronucleus cytome assay (BMCyt), in parallel with measurement of blood butyrylcholinesterase (BChE) and nicotine levels. Polymorphisms in PONIGln192Arg and CYP2A6*9(-48T>G) were evaluated to verify the relationship between genetic susceptibility and the measured biomarkers. Peripheral blood and buccal cell samples were collected from 106 agricultural workers, at two different crop times (during pesticide application and leaf harvest), as well as 53 unexposed controls. BMCyt showed statistically significant increases in micronuclei, nuclear buds, and binucleated cells among exposed subjects in differentiated cells, and in micronuclei in basal cells. In addition, the exposed group showed higher values for condensed chromatin, karyorrhectic, pyknotic, and karyolitic cells, indicative of cell death, and an increase in the frequency of basal cells compared to the unexposed control group. A slight difference in mutagenicity using the BMCyt assay was found between the two different sampling times (pesticide application and leaf harvest), with higher micronucleus frequencies during pesticide application. Elevated cotinine levels were observed during the leaf harvest compared to the unexposed controls, while BChE level was similar among the farmers and controls. PONIGln192Arg and CYP2A6*9(-48T>G) polymorphisms were associated with DNA damage induced by pesticides and cell death.	Environmental & Molecular Mutagenesis	53	7	525-34	Self-reported exposure			Cohort (prospective)	Pesticides in general	genetic (biomarkers)	medical test result	Brazil	umic
360	F. R. Godoy, E. O. Costa, A. A. da Silva Reis, M. P. Batista, A. V. de Melo, M. W. Goncalves, A. S. Cruz, C. O. de Araujo Melo, L. B. Minasi, C. L. Ribeiro, A. D. da Cruz and E. S. D. de Melo	Do GSTT1 and GSTM1 polymorphisms influence intoxication events in individuals occupationally exposed to pesticides?	2014	This study evaluated the variability of GSTM1 and GSTT1 polymorphisms in individuals occupationally exposed to pesticides in ten Goias municipalities that present intense agricultural activity. We evaluated blood samples of 235 individuals, which 120 were rural workers occupationally exposed to pesticides and 115 formed the control group, analyzing GST polymorphisms by quantitative polymerase chain reaction (qPCR).The exposed group consisted of 111 men and nine women only getting an average of 39+/-9 years. These workers were from ten rural municipalities situated at Goias state. It was found that 18 % of the exposed individuals had the GSTT1 null genotype and 49 % had the GSTM1 null genotype, and 10 % had both null genotypes. Data as intoxication (42 %), use of Personal Protection Equipment (PPE; 52 %) and if the worker prepared the pesticide (7 %), or if just applied the pesticide (22 %) or if the worker prepared and applied (71 %) have all been correlated with genetic polymorphisms. There were no statistically significant differences between the GSTM1 and GSTT1 polymorphisms between control and exposed groups. Finally, we could not associate a null GSTT1 or null GSTM1 polymorphisms or both to intoxication events caused by pesticides, but instead we presented the importance to use PPE to prevent such harm, once we found a statistically significant association between the use of PPE and events of intoxication (p<=0.001).	Environmental Science & Pollution Research	21	5	659964	Self-reported exposure			Cross-sectional	Pesticides in general	pesticide-related illness	medical test result	Brazil	umic
361	F. Saberi Hosnijeh, D. Boers, L. Portengen, H. B. Bueno-de-Mesquita, D. Heederik and R. Vermeulen	Long-term effects on humoral immunity among workers exposed to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	2011	OBJECTIVES: Epidemiological studies have shown inconsistent effects on immunological parameters in subjects exposed to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). In this study we investigated changes in humoral immunity and prevalence of atopic diseases among workers from a Dutch historical cohort occupationally exposed to chlorophenoxy herbicides and contaminants including TCDD. METHODS: 45 workers who had been exposed to high levels of TCDD in the past and 108 non-exposed workers (39 from the same factory as the exposed subjects (internal control group) and 69 from a comparable factory but without TCDD exposure (external control group)) were included in the study. Blood immunoglobulin (Ig) and complement factor (C) concentrations and specific IgE antibodies to a panel of common allergens were measured using quantitative nephelometry or ELISA. TCDD plasma levels were measured and back-extrapolated to the time of last exposure (TCDDmax) using a one-compartment first order kinetic model. RESULTS: A borderline significant negative association between both current and predicted TCDD levels and C4 was found in multivariate analyses (beta = -0.020; 95% CI = -0.040-0.010 and beta = -0.020; 95% CI = -0.030-0.00, respectively). History of eczema was significantly associated with current TCDD levels in both crude (OR = 1.5; 95% CI = 1.03-2.2) and adjusted models (OR = 1.7; 95% CI = 1.08-2.7). CONCLUSIONS: Our results do not support an association between TCDD exposure and markers of humoral immunity except possibly C4. Interestingly, decreased levels of C4 have been linked to lymphoma risk, which provides some support to the putative link between TCDD and non-Hodgkin lymphoma.	Occupational & Environmental Medicine	68	6	419-24	Algorithm/model			Cross-sectional	Specific active ingredient	immunological	medical test result	Netherlands	hic
362	F. Saberi Hosnijeh, P. , M. Bueno De, H. and V.	Circulating soluble CD27 and CD30 in workers exposed to 2, 3, 7, 8-tetrachlorodibenzo-p-dioxin (TCDD)	2013	Objectives Previous studies suggest that 2, 3, 7, 8-tetrachlorodibenzo-p-dioxin (TCDD) exposure may be associated with non-Hodgkin lymphoma (NHL) but findings remain inconclusive. There is a need for mechanistic studies to evaluate the biologic plausibility of this association. In this cross-sectional study we investigated changes in plasma levels of two soluble markers of B cell activation, sCD27 and sCD30 and IL1RA, which have been found to be predictive of lymphoma, among workers from a Dutch historical cohort occupationally exposed to chlorophenoxy herbicides and contaminants including TCDD. Methods Eighty-five workers who had been exposed to either high (n = 47) or low (n = 38) TCDD levels more than 30 years before serum collection were included in the current investigation. Plasma level of the sCD27, sCD30, and IL1RA was measured by ELISA. Current plasma levels of TCDD (TCDDCurrent) were determined by high-resolution gas chromatography/isotope dilution high resolution mass spectrometry. TCDD blood levels at the time of last exposure (TCDDmax) were estimated using a one-compartment first order kinetic model. Results Dose-response analyses showed no significant association between blood levels of sCD27, sCD30 and IL1RA and current and estimated past maximum TCDD levels although there was an indication of decreased levels of all markers with increasing TCDD level. Analyses excluding subjects with chronic diseases resulted in a significant decrease in IL1RA with increasing levels of TCDD. Conclusions No significant dose-response relationship was observed between the measured markers and TCDD level in our study. However, there was a suggestion that sCD27, sCD30 and IL1-RA tended to decrease with increasing TCDD levels. This later observation is consistent with the earlier observation on decreasing cytokine levels with increasing exposures.	Occupational and Environmental Medicine	70	NA	NA	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	cancer	doctor-diagnosed	Netherlands	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
363	F. Saberi Hosnijeh, V. Lenters, D. Boers, L. Portengen, E. Baeten, H. B. Bueno-de-Mesquita, D. J. Heederik, A. C. Bloem and R. Vermeulen	Changes in lymphocyte subsets in workers exposed to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	2012	OBJECTIVES: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) is known to have toxic effects on the haematopoietic system in animals but epidemiological studies in humans have shown inconsistent results. In this cross-sectional study we investigated changes in peripheral blood cell counts and lymphocyte subsets among workers from a Dutch historical cohort occupationally exposed to chlorophenoxy herbicides and contaminants including TCDD. METHODS: Forty-seven workers who had been exposed to high levels of TCDD in the past and 38 low-exposed workers were included in the current investigation. Complete blood counts and differential and major lymphocyte subsets were analysed. Current plasma levels of TCDD (TCDD(current)) were determined by high-resolution gas chromatography/isotope-dilution high resolution mass spectrometry. TCDD blood levels at the time of last exposure (TCDD(max)) were estimated using a one-compartment first order kinetic model. RESULTS: Cell counts and lymphocyte subsets were similar between high- and low-exposed workers, except for a non-dose dependent increase in CD4/CD8 ratio among high-exposed workers. Interestingly, most lymphocyte subsets, in particular the B cell compartment, showed a decrease with increasing levels of both TCDD(current) and TCDD(max). CONCLUSIONS: Overall, our study showed that plasma TCDD levels had no effect on white blood cell counts and major subsets. However, a non-significant decrease in most lymphocyte subsets was noted, with the strongest effect for B cells. The latter finding may suggest that dioxin exposure might have an adverse impact on the haematopoietic system and lends some support to B cell lymphoma induction by dioxin.	Occupational & Environmental Medicine	69	11	781-6	Algorithm/model			Cross-sectional	Specific active ingredient	immunological	medical test result	Netherlands	hic
364	F. Salazar-Garcia, E. Gallardo-Diaz, P. Ceron-Mireles, D. Loomis and V. H. Borja-Aburto	Reproductive effects of occupational DDT exposure among male malaria control workers	2004	To assess potential effects of human DDT [1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane] exposure, we evaluated the reproductive history of 2,033 workers in the antimalaria campaign of Mexico. Data on occupational exposure to DDT and reproductive outcomes were gathered through a questionnaire, and workers provided information about 9,187 pregnancies. We estimated paternal exposure to DDT before each pregnancy using three approaches: a) a dichotomous indicator for pregnancies before and after exposure began, b) a qualitative index of four exposure categories, and c) an estimation of the DDT metabolite DDE [1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene] accumulated in fat. To assess associations, we used logistic regression models that accounted for correlated observations and adjusted for parents' age at each child's birth, exposure to other pesticides, exposure to chemical substances in other employment, smoking, and alcohol consumption. The odds ratio for birth defects comparing pregnancies after and before the first exposure was 3.77 [95% confidence interval (95% CI), 1.19-9.52]. Compared with the lowest quartile of estimated DDE in fat, the ORs were 2.48 (95% CI, 0.75-8.11), 4.15 (95% CI, 1.38-12.46), and 3.76 (95% CI, 1.23-11.44) for quartiles 2, 3, and 4, equivalent to p,p -DDE in fat of 50, 82, and 298 microg/g fat, respectively. No significant association was found for spontaneous abortion or sex ratio. We found an increased risk of birth defects associated with high occupational exposure to DDT in this group of workers. The significance of this association at lower exposure levels found in the general population remains uncertain.	Environmental Health Perspectives	112	5	542-7	Self-reported exposure	Biomonitoring (adipose tissue)		Cohort (prospective)	Specific active ingredient	reproductive	medical test result	Mexico	umic
365	F. T. Kamel, C.; Umbach, D.; Hoppin, J.; Alavanja, M.; Blair, A.; Comyns, K.; Goldman, S.; Korell, M.; Langston, J.; Ross, G.; Sandler, D.	Pesticide exposure and self-reported Parkinson's disease in the agricultural health study	2007	Previous studies based on limited exposure assessment have suggested that Parkinson's disease (PD) is associated with pesticide exposure. The authors used data obtained from licensed private pesticide applicators and spouses participating in the Agricultural Health Study to evaluate the relation of self-reported PD to pesticide exposure. Cohort members, who were enrolled in 1993-1997, provided detailed information on lifetime pesticide use. At follow-up in 1999-2003, 68% of the cohort was interviewed. Cases were defined as participants who reported physician-diagnosed PD at enrollment (prevalent cases, n = 83) or follow-up (incident cases, n = 78). Cases were compared with cohort members who did not report PD (n = 79,557 at enrollment and n = 55,931 at follow-up). Incident PD was associated with cumulative days of pesticide use at enrollment (for highest quartile vs. lowest, odds ratio (OR) = 2.3, 95% confidence interval: 1.2, 4.5; p-trend = 0.009), with personally applying pesticides more than half the time (OR = 1.9, 95% confidence interval: 0.7, 4.7), and with some specific pesticides (ORs > or = 1.4). Prevalent PD was not associated with overall pesticide use. This study suggests that exposure to certain pesticides may increase PD risk. Findings for specific chemicals may provide fruitful leads for further investigation.	American Journal of Epidemiology	165	4	364-74	Self-reported exposure			Cohort (prospective)	Pesticides in general	neurological	self-reported	USA	hic
366	F. Thomke, D. Jung, R. Besser, R. Roder, J. Konietzko and H. C. Hopf	Increased risk of sensory neuropathy in workers with chloracne after exposure to 2,3,7,8-polychlorinated dioxins and furans	1999	OBJECTIVE: The existence of a peripheral neuropathy after exposure to polychlorinated dioxins (PCDD) is still discussed, as studies concerning dioxin effects on the peripheral nervous system are rare and contradictory. MATERIAL AND METHODS: Clinical and neurophysiological examinations (motor conduction velocity of the peroneal nerve, sensory conduction velocities of the sural and ulnar nerves) were made in 156 dioxin exposed workers (42 with, 114 without cloracne) from one pesticide producing plant. Because of known risk factors for peripheral neuropathy, 7 workers with and 28 without cloracne were excluded from further analysis. RESULTS: Workers with chloracne had a significantly higher exposure against PCDD as documented by back calculated lipid levels. They complained significantly more often of sexual impotence (28.6% compared to 5.8% of workers without chloracne, P<0.001), had significantly more frequent clinical signs of a sensory neuropathy (= abnormal sensory findings plus deep tendon reflex abnormalities) restricted to the legs (17.1% compared to 1.2%, P<0.001), had significantly more frequent > or =2 neurophysiologic abnormalities (34.3% compared to 14.0%, P<0.025), and had significantly lower mean amplitudes of the motor compound muscle potential of the peroneal nerve. CONCLUSION: PCDD has a mild toxic effect on the peripheral nervous system manifesting as mild sensory neuropathy of the legs in a minority of the most severely exposed persons.	Acta Neurologica Scandinavica	100	1	43105	Registers			Cross-sectional	Chemical class	neurological	doctor-diagnosed	Germany	hic
367	F. Thomke, D. Jung, R. Besser, R. Roder, J. Konietzko and H. C. Hopf	Cranial nerve function in workers exposed to polychlorinated dioxins and furans	2002	OBJECTIVE: To look for possible effects of polychlorinated dioxins and furans (PCDD/F) on cranial nerve function. MATERIAL AND METHODS: Clinical and neurophysiological examinations [visual and brainstem auditory evoked potentials (VEP and BAEP), blink reflex] in 121 PCDD/F exposed workers of one pesticide producing plant. RESULTS: BAEP abnormalities were more frequent in workers with chloracne (6 of 33 workers, 18.2%) than in those without chloracne (7 of 84, 8.3%), but this was not statistically significant (chi2: 2.33). VEP abnormalities were seen in one worker with and two without chloracne. Clinically visual functions were normal except in one worker, who was amaurotic since birth. Blink reflex abnormalities without corresponding clinical findings were observed in two patients without chloracne. CONCLUSION: Severe exposure to PCDD/F is not followed by clinical signs of cranial nerve dysfunction but may create an increased risk for abnormal BAEP findings, which were more than twice as common in workers with chloracne. Although this difference did not reach statistical significance, it cannot exclude a toxic effect of PCDD/F, as statistical significance is difficult to achieve with such small numbers of workers. In none of the workers, BAEP abnormalities were accompanied by clinical signs of hearing dysfunction.	Acta Neurologica Scandinavica	106	3	155-8	Registers			Cross-sectional	Chemical class	mental disorders	medical test result	Germany	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
368	F. Z. Akhtar, D. H. Garabrant, N. S. Ketchum and J. E. Michalek	Cancer in US Air Force veterans of the Vietnam War	2004	Cancer incidence and mortality were summarized in Air Force veterans of the Vietnam War. The index subjects were Operation Ranch Hand veterans who sprayed 2,3,7,8 tetrachlorodibenzo-p-dioxin (dioxin)-contaminated herbicides in Vietnam. Comparisons served in Southeast Asia during the same period but did not spray herbicides. We assessed cancer incidence and mortality using national rates and contrasted cancer risk in each of three Ranch Hand dioxin exposure categories relative to comparisons. The incidence of melanoma and prostate cancer was increased among white Ranch Hand veterans relative to national rates. Among veterans who spent at most 2 years in Southeast Asia, the risk of cancer at any site, of prostate cancer and of melanoma was increased in the highest dioxin exposure category. These results appear consistent with an association between cancer and dioxin exposure.	Journal of Occupational & Environmental Medicine	46	2	123-36	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
369	F. Z. Madani, M. Hafida, S. A. Merzouk, B. Loukidi, K. Taouli and M. Narce	Hemostatic, inflammatory, and oxidative markers in pesticide user farmers	2016	The aim of this work was to investigate inflammatory, oxidative, and thrombotic parameters as biomarkers in farmers exposed to pesticides. Fifty farmers using chemical pesticides and 60 unexposed control men participated in this study. The Mediterranean diet compliance, the duration of pesticide use, and personal protection for pesticides handling were recorded using self-administered questionnaires. Serum biochemical parameters, oxidant/antioxidant, inflammatory, and thrombosis markers were determined. Our findings showed oxidative stress reflected by an increase in malondialdehyde, carbonyl proteins and superoxide anion levels and a decrease in vitamins C and E, glutathione, catalase, and superoxide dismutase activities in farmers. Serum C-reactive protein, prothrombin, and fibrinogen levels were enhanced in these farmers. In conclusion, inflammation, oxidative stress, and metabolic perturbations reflected the possibility of the effects of pesticides to farmers.	Biomarkers	21	2	138-45	Self-reported exposure			Cross-sectional	Pesticides in general	endocrine/nutritional/metabolical	medical test result	Algeria	umic
370	F. Zeng, C. Lerro, J. Lavoue, H. Huang, J. Siemiatycki, N. Zhao, S. Ma, N. C. Deziel, M. C. Friesen, R. Udelsman and Y. Zhang	Occupational exposure to pesticides and other biocides and risk of thyroid cancer	2017	OBJECTIVES: To assess the associations between occupational exposure to biocides and pesticides and risk of thyroid cancer. METHODS: Using data from a population-based case-control study involving 462 incident thyroid cancer cases and 498 controls in Connecticut collected in 2010-2011, we examined the association with occupational exposure to biocides and pesticides through a job-exposure matrix. We used unconditional logistic regression models to estimate OR and 95%CI, adjusting for potential confounders. RESULTS: Individuals who were occupationally ever exposed to biocides had an increased risk of thyroid cancer (OR=1.65, 95%CI 1.16 to 2.35), and the highest risk was observed for the high cumulative probability of exposure (OR=2.18, 95%CI 1.28 to 3.73). The observed associations were similar when we restricted to papillary thyroid cancer and well-differentiated thyroid cancer. Stronger associations were observed for thyroid microcarcinomas (tumour size <=1cm). No significant association was observed for occupational exposure to pesticides. CONCLUSIONS: Our study provides the first evidence linking occupational exposure to biocides and risk of thyroid cancer. The results warrant further investigation.	Occupational & Environmental Medicine	74	7	502-510	Job exposure matrix			Case-control	Pesticides in general	cancer	doctor-diagnosed	USA	hic
371	G. A. Antonucci and I. M. de Syllos Colus	Chromosomal aberrations analysis in a Brazilian population exposed to pesticides	2000	In spite of being harmful, pesticides are widely used in Brazil. Their genotoxic effects might be studied through population monitoring by means of the analysis of chromosomal aberrations in occupationally exposed individuals. The aim of this study was to evaluate the chromosomal aberration frequencies in temporary cultures of lymphocytes from periferic blood of 23 workers professionally exposed to a mixture of pesticides. The workers were employed by the Agronomic Institute of Parana (Brazil) and used all of the prevention measures provided. A detailed history of pesticide use, as well as personal data, smoking habits, and history of recent illnesses and medical treatment were collected through a standardized questionnaire administered to each subject. Nonexposed subjects, matched for age, sex, and smoking habits, served as the negative control. A total of 100 cells were analyzed from each individual. A significant increase in chromosomal aberration frequencies was observed in exposed individuals when compared to the control group. Some individual characteristics such as age, sex, time of exposure to the pesticides, and smoking habits showed no correlation with chromosomal aberrations. Therefore, the positive results may be considered true effects of pesticides on human somatic cells.	Teratogenesis, Carcinogenesis, & Mutagenesis	20	5	265-72	Self-reported job history			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Brazil	umic
372	G. A. Chitra, V. R. Muraleedharan, T. Swaminathan and D. Veeraraghavan	Use of pesticides and its impact on health of farmers in South India	2006	The relationship between extent of pesticide use and signs and symptoms of illnesses due to exposure was assessed in a cross-sectional survey of 631 farmers (537 men and 94 women) in South India. Responses to questionnaires showed that 433 farmers (68.6%) sprayed pesticides themselves and were thus directly exposed. More than 75% used moderately or highly hazardous pesticides; 88% used no protection while handling pesticides. About 50% of sprayers mixed different brands. Retailers were the source of information about pesticides for 56%. The farmers reported excessive sweating (36.5%), burning/stinging/itching of eyes (35.7%), dry/sore throat (25.5%), and excessive salivation (14.1%), all more prevalent among sprayers. Among men, excessive sweating and eye and throat problems were significantly associated with exposure. There is a need to raise farmers' and authorities' awareness of the need to use protective gear when handling pesticides.	International Journal of Occupational & Environmental Health	12	3	228-33	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	India	lmic
373	G. A. Heeren, J. Tyler and A. Mandeya	Agricultural chemical exposures and birth defects in the Eastern Cape Province, South Africa: A case-control study	2003	Background: South Africa is one of the major users of pesticides on the African continent. The Eastern Cape is the second largest province in South Africa. There has been growing concern about the occurrence of certain birth defects which seemed to have increased in the past few years. In this paper we investigate associations between exposure to agricultural chemicals and certain birth defects. Few such studies have been undertaken in the developing world previously. Methods: Between September 2000 and March 2001 a case - control study was conducted among rural women in the area of the Eastern cape to investigate the association between women's exposure to pesticides and the occurrence of birth defects. Information on birth defects was obtained from the register of the Paediatrics Department at the Cecilia Makiwane Hospital in Mdantsane, one of the largest referral hospitals in the province. The cases were children who were diagnosed with selected birth defects. The controls were children born in the same areas as the cases. Exposure information on the mothers was obtained by interview concerning from their activities in gardens and fields. Data were analysed using conditional logistic regression. Results: A total of 89 case mothers and 178 control mothers was interviewed. Babies with birth defects were seven times more likely to be born to women exposed to chemicals used in gardens and fields compared to no reported exposure (Odds Ratio 7.18, 95% CI 3.99, 13.25); and were almost twice as likely to be born to women who were involved in dipping livestock used to prevent ticks (OR 1.92, 95% CI 1.15, 3.14). They were also 6.5 times more likely to be born to women who were using plastic containers for fetching water (OR 6.5, 95% CI 2.2, 27.9). Some of these containers had previously contained pesticides (OR 1.87, 95% CI 1.06, 3.31). Conclusions: These findings suggest a link between exposure to pesticides and certain birth defects among the children of rural South African women who work on the land. Education programmes for women alerting them to the dangers to their babies from the use of pesticides and alternative farming methods and elimination of the reuse of pesticide containers are indicated as preventive measures.	Environmental Health: A Global Access Science Source	2	NA	43108	Self-reported exposure			Case-control	Pesticides in general	offspring	NA	South Africa	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
374	G. A. Jamal, S. Hansen, A. Pilkington, D. Buchanan, R. A. Gillham, M. Abdel-Azis, P. O. Julu, S. F. Al-Rawas, F. Hurley and J. P. Ballantyne	A clinical neurological, neurophysiological, and neuropsychological study of sheep farmers and dippers exposed to organophosphate pesticides	2002	OBJECTIVES: To classify clinical diseases of the subjects with abnormal indices of peripheral neuropathy identified in field studies of sheep farmers and dippers exposed to organophosphate pesticides. To explore what neuropsychological profiles, if any, may be associated with neurophysiological damage in these subjects. METHODS: A case-control study (79 subjects) nested within the cross sectional study (685 subjects) of sheep farmers from the field study. Three groups with no, possible, and probable or definite neuropathy according to field studies were recruited. Investigations comprised symptoms of neuropathy, neurologial signs, motor and sensory nerve conduction, electromyography, quantitative sensory testing, and neuropsychological tests. RESULTS: The incidence of clinical neuropathy increased from 7% in the no neuropathy group to 52% in the probable or definite neuropathy group based on nerve conduction measurements or presence of neurological signs. Sensory abnormalities were found more often than motor deficits. Small diameter nerve fibres were also affected more than large fibres. CONCLUSIONS: The neuropathy is predominantly sensory and is characteristic of distal, chronic neuropathy with no acute features. Small fibre populations are affected more than large fibre populations. Increasing severity of neuropathy was associated with anxiety and depression as measured in the neuropsychological tests.	Occupational & Environmental Medicine	59	7	434-41	Self-reported exposure			Case-control	Chemical class	neurological	medical test result	UK	hic
375	G. A. Jamal, S. Hansen, F. A. Ecne, A. P. Ecne, M. Abdul-Aziz and J. P. Ballantyne	Peripheral nerve dysfunction in farmers using organophosphate sheep dip	2001	Purpose: To investigate the function of the peripheral and central nervous system in farmers regularly using organophosphate (OP) compounds either after acute intoxication or following low level repeated exposure. Design: Case control and cross-sectional studies. Materials and Methods: Two groups, each of sixteen farmers regularly involved in dipping sheep, were compared with a group of sixteen healthy controls of similar age range using clinical neurological and neurophysiological assessment. Farmers in group 1 had long-term ill health following episodes of mild to moderate acute OP poisoning while farmers in group 2 had none of the above. Clinical symptoms and signs of neuropathy were recorded. Motor and sensory nerve conduction, electromyography (EMG), quantitative sensory testing and visual, brainstem auditory and somatosensory evoked potentials were measured. Results: A similar pattern of significant abnormalities of distal sensory and motor peripheral nerve axonal dysfunction was found in both farmer groups, but more pronounced in the symptomatic farmers. Conclusions: The findings suggest that long-term peripheral neuropathy can follow acute OP intoxication (group 1). Furthermore, chronic effects may follow repetitive low level exposure to OP compounds (group 2). The profile of dysfunction was similar in the two groups. The parameters measured in the study are useful endpoints in future epidemiological studies.	Journal of Nutritional and Environmental Medicine	11	1	43365	Job title			Cross-sectional	Job title	neurological	medical test result	UK	hic
376	G. Andreotti, L. E. Freeman, L. Hou, J. Coble, J. Rusiecki, J. A. Hoppin, D. T. Silverman and M. C. Alavanja	Agricultural pesticide use and pancreatic cancer risk in the Agricultural Health Study Cohort	2009	Pancreatic cancer is a rapidly fatal disease that has been linked with pesticide use. Previous studies have reported excess risks of pancreatic cancer with organochlorines such as DDT, however, many other commonly used pesticides have not been examined. To further examine the potential associations between the use of a number of pesticides and pancreatic cancer, we conducted a case-control analysis in the Agricultural Health Study, one of the largest prospective cohorts with over 89,000 participants including pesticide applicators and their spouses in Iowa and North Carolina. This analysis included 93 incident pancreatic cancer cases (64 applicators, 29 spouses) and 82,503 cancer-free controls who completed an enrollment questionnaire providing detailed pesticide use, demographic and lifestyle information. Ever use of 24 pesticides and intensity-weighted lifetime days [(lifetime exposure days) x (exposure intensity score)] of 13 pesticides was assessed. Risk estimates were calculated using unconditional logistic regression controlling for age, smoking, and diabetes. Among pesticide applicators, 2 herbicides (EPTC and pendimethalin) of the 13 pesticides examined for intensity-weighted lifetime use showed a statistically significant exposure-response association with pancreatic cancer. Applicators in the top half of lifetime pendimethalin use had a 3.0-fold (95% CI 1.3-7.2, p-trend = 0.01) risk compared with never users, and those in the top half of lifetime EPTC use had a 2.56-fold (95% CI = 1.1-5.4, p-trend = 0.01) risk compared with never users. Organochlorines were not associated with an excess risk of pancreatic cancer in this study. These findings suggest that herbicides, particularly pendimethalin and EPTC, may be associated with pancreatic cancer.	International Journal of Cancer	124	10	2495-500	Self-reported exposure			Case-control	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
377	G. Andreotti, S. Koutros, S. I. Berndt, K. Hughes Barry, L. Hou, J. A. Hoppin, D. P. Sandler, J. H. Lubin, L. A. Burdette, J. Yuenger, M. Yeager, L. E. Beane Freeman and M. C. R. Alavanja	The interaction between pesticide use and genetic variants involved in lipid metabolism on prostate cancer risk	2012	Background. Lipid metabolism processes have been implicated in prostate carcinogenesis. Since several pesticides are lipophilic or are metabolized via lipid-related mechanisms, they may interact with variants of genes in the lipid metabolism pathway. Methods. In a nested case-control study of 776 cases and 1444 controls from the Agricultural Health Study (AHS), a prospective cohort study of pesticide applicators, we examined the interactions between 39 pesticides (none, low, and high exposure) and 220 single nucleotide polymorphisms (SNPs) in 59 genes. The false discovery rate (FDR) was used to account for multiple comparisons. Results. We found 17 interactions that displayed a significant monotonic increase in prostate cancer risk with pesticide exposure in one genotype and no significant association in the other genotype. The most noteworthy association was for ALOXE3 rs3027208 and terbufos, such that men carrying the T allele who were low users had an OR of 1.86 (95% CI = 1.162.99) and high users an OR of 2.00 (95% CI = 1.283.15) compared to those with no use of terbufos, while men carrying the CC genotype did not exhibit a significant association. Conclusion. Genetic variation in lipid metabolism genes may modify pesticide associations with prostate cancer; however our results require replication. <U+00AC><U+00A9> 2012 Gabriella Andreotti et al.	Journal of Cancer Epidemiology	NA	NA	NA	Self-reported exposure			Case-control	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
378	G. B. Frost, T.; Harding, A. H.	Mortality and cancer incidence among British agricultural pesticide users	2011	BACKGROUND: Although the acute effects of pesticides in humans are well known, uncertainty still exists about the health effects of chronic low-level exposure to pesticides. AIMS: To compare mortality and cancer incidence experienced by a cohort of British pesticide users to that of the Great Britain (GB) population. METHODS: The Pesticide Users Health Study (PUHS) comprises users of agricultural pesticides who have Certificates of Competence under the Control of Pesticides Regulations 1986. Participants were followed up between 1987 and 2004 (cancer incidence) or 2005 (mortality). Standardized mortality ratios (SMRs) and Standardized incidence ratios (SIRs) were estimated for outcomes of interest identified from the literature. RESULTS: Altogether, 62,960 pesticide users were followed up for 829,709 person-years (to 31 December 2005). Most participants were male (94%) and based in England (86%). All-cause mortality was lower for both men [SMR 0.58, 95% confidence interval (CI) 0.55-0.60] and women (SMR 0.71, 95% CI 0.52-0.98) compared to the GB population. Mortality and incidence were below those expected for all cancers combined among men (SMR 0.71, 95% CI 0.66-0.77; SIR 0.85, 95% CI 0.81-0.90), particularly for cancers of the lip, oral cavity and pharynx, digestive organs and respiratory system. The incidence of testicular cancer, non-melanoma skin cancer and multiple myeloma were above expected. Mortality from injury by machinery was significantly above expected for men (SMR 4.21, 95% CI 2.11-8.42). CONCLUSIONS: This study suggests that pesticide users in the PUHS are generally healthier than the national population but may have excesses of non-melanoma skin cancer, testicular cancer and multiple myeloma.	Occupational Medicine (Oxford)	61	5	303-10	Job title			Cohort (prospective)	Job title	mortality (all cause)	doctor-diagnosed	UK	hic
379	G. Balasubramaniam ,S. Saoba, M. Sarade and S. Pinjare	Case-control study of risk factors for Non-Hodgkin lymphoma in Mumbai, India	2013	BACKGROUND: In the year 2010, it is estimated that nearly 0.36 million new cases and 0.19 million deaths with Non-Hodgkin lymphoma occurred. In India, among males, NHL incidence rates vary across the country which has encouraged us to conduct a case-control study to study risk factors. MATERIALS AND METHODS: The present unmatched hospital-based case-control study conducted at Tata Memorial Hospital included subjects registered between the years 1997-99. There were 390 'lymphoma cases' and 1,383 'normal controls. RESULTS: Data on age, tobacco habits, occupational history, dietary factors, tea, coffee were collected by the social investigators. Univariate and multivariate methods were applied for obtaining the odds ratios for risk factors. CONCLUSIONS: In the study, cigarette smoking (OR=2.0) and bidi smoking (OR=2.8), were associated with excess risk of lymphoma. Among the dietary items, only consumption of mutton showed 7.3-fold significant excess risk for lymphoma. Consumption of milk showed a 6-fold excess risk (OR=1.5); while coffee showed a 50% reduction in risk for lymphoma. Among occupational exposure, exposure to use of pesticides showed 3-fold excess risk for lymphoma.	Asian Pacific Journal of Cancer Prevention: Apjcp	14	2	775-80	Self-reported job history			Case-control	Pesticides in general	cancer	doctor-diagnosed	India	lmic
380	G. C. T.-H. Windham, N.; Osorio, A. M.; Gettner, S.; Reinisch, F.; Haas, R.; Smith, M.	Genetic monitoring of malathion-exposed agricultural workers	1998	The aerial application of malathion over large urban populations in Southern California during the early 1990s raised concerns about adverse health effects, including the potential to cause genetic damage. Workers in the Mediterranean fruit fly eradication program, which involved application of malathion as ground treatment, were studied to examine micronucleus formation and mutation frequencies assessed by the glycophorin A (GPA) assay. In the 1992 pilot project the mean micronuclei level appeared higher in lymphocytes of exposed workers (n = 13) compared to controls (n = 4) (20.1 +/- 7.1 vs 14.3 +/- 7.2 respectively, P = 0.09). During the 1993 season, neither of the cohorts examined showed a higher level of micronuclei in workers exposed to malathion compared to unexposed, nor did the pooled total (n = 53; means = 17.8 +/- 7.2 vs 18.5 +/- 6.3, respectively), even after adjustment by multiple regression. The GPA variant frequency was not associated with malathion exposure in any of the cohorts. These results suggest that any potential risk of genotoxic damage from exposure to malathion is relatively low, but other assays may be more sensitive, and the sample size was small.	American Journal of Industrial Medicine	33	2	164-74	Biomonitoring (urine)			Cross-sectional	Specific active ingredient	genetic (biomarkers)	medical test result	USA	hic
381	G. C. Windham, J. K. Grether, A. Sumner, S. Xu, L. Katz and L. A. Croen	Autism spectrum disorders (ASD) and maternal occupational exposures during pregnancy	2011	To understand the rise in the number of children reported with ASDs, it is important to examine the role of exogenous exposures. We analyzed whether mothers of children with ASD were more likely to work in occupations with potential neuro- or repro-toxic exposures during pregnancy. Subjects were 284 children with ASD identified through records-based surveillance and 659 gender-matched controls, born in 1994 in the San Francisco Bay Area. Parental occupation and industry were abstracted from birth certificates and potential exposure was coded blindly by an Occupational Medicine physician and checked by an industrial hygienist. Up to 3 exposures to any of 7 chemical groups were also coded (exhaust/combustion, solvents, pesticides, heavy metals, cooling fluids, disinfectants, and auto paint). Odds ratios (AORs) were calculated adjusting for maternal age, education and child race. Among the 60% of employed mothers, 11.3% of case mothers worked in chemically-exposed occupations compared to 4.3% of controls (AOR 2.8; 95% CI 1.4-5.5). The exposure categories with the highest and statistically significant AORs were exhaust and disinfectants, but metals and solvents also had slightly elevated AORs. Occupation in the medical/dental field was highly related to ASD, but based on small numbers (AOR 11.3; 95% CI 1.3-99).Work in laboratories or as chemists was also three times more likely in mothers of cases than controls, but was not statistically significant. Although exposure assessment was rudimentary, use of birth certificates allows ascertainment of occupation before a child is diagnosed with ASD, which may affect subsequent maternal employment. These descriptive data indicate areas for additional study.	American Journal of Epidemiology	173	NA	S257	Expert case-by-case assessment			Case-control	Pesticides in general	offspring	doctor-diagnosed	USA	hic
382	G. Castano-Vinyals, A. Espinosa, V. Lope, V. Martin, P. Amiano, E. Ardanaz, I. G. A. Victor Moreno, M. Diaz-Santos, A. Tardon, R. Peiro, R. Marcos-Gragera, M. Santibanez, M. Kogevinas and J. Alguacil	Breast cancer and occupational exposures in the MCC-Spain study	2016	Introduction The objective is to study the association between occupational exposures and breast cancer risk in the framework of the population based multicase-control study (MCC-Spain). Methods 1622 breast cancer cases and 1557 population controls from the MCC-Spain study were recruited in 10 Spanish regions between 2008 and 2013. Occupational history was collected for all subjects, and occupations were coded according to the Spanish National Classification of Occupations 1994 (CNO-94). The Spanish Job Exposure Matrix (MatEmESp) was applied to assess occupational exposures to different agents. Unconditional logistic regression was applied, adjusting for age, region, education and menopausal status, showing Odds Ratios and 95% Confidence Intervals (OR; CI). Results Based on the CNO-94, plastic product workers (OR = 3.4; 1.3-8.5) and occupations related to building caretaking and cleaning (OR = 1.5; 1.2-1.9) have an increase risk in breast cancer. Breast cancer risk was associated with exposure to pesticides (OR = 1.5; 1.1-1.9), organic dusts such as paper dust and wood dust (OR = 1.3, 1.0-1.7), for both menopausal and postmenopausal women. Flour dust was associated overall and specifically for postmenopausal women. Also, welding fumes and exposure to detergents has been observed to increase breast risk. For solvents, associations were observed for formaldehyde, methylene chloride, aromatic hydrocarbons and other organic solvents only in postmenopausal women. Further analyses will be presented taking into account duration and intensity of exposure. Conclusions Several occupational exposures were associated with an increased risk of breast cancer.	Occupational and Environmental Medicine	73	NA	A26	Self-reported job history	Job exposure matrix		Case-control	Job title	cancer	doctor-diagnosed	Spain	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
383	G. Ciccone, D. Mirabelli, A. Levis, P. Gavarotti, G. Rege-Cambrin, L. Davico and P. Vineis	Myeloid leukemias and myelodysplastic syndromes: chemical exposure, histologic subtype and cytogenetics in a case-control study	1993	We conducted a case control study of 50 acute myeloid leukemias (AML), 17 chronic myeloid leukemias (CML), 19 myelodysplastic syndromes (MDS), and 246 controls. The cases were classified according to the French-American-British (FAB) classification, and chromosome aberrations were recorded according to the International System for Human Cytogenetic Nomenclature. Exposure to suspected leukemogenic agents was assessed blindly by an industrial hygienist. Increased risks were noted for mechanics, welders, electricians, and drivers among men and among farmers and textile workers among women. Increased SMRs for leukemias in a census-based cohort study conducted in the same area (Torino) were previously reported for electricians and drivers among men and for textile workers among women. We detected nonstatistically significant increased relative risks for exposure to benzene (odds ratio, OR = 1.7), petrol refining products (1.9), polycyclic aromatic hydrocarbons (1.7), and electromagnetic fields (1.6) in men; in women, a statistically significant association with exposure to pesticides was detected [OR = 4.4; 95% confidence interval (CI) 1.7-11.5]. Although exposure to pesticides was confined to AML, MDS cases included a high proportion of subjects exposed to benzene and electromagnetic fields. No particular histologic subtype of AML was associated with chemical exposures except for that of pesticides with the M4 category. Chromosome aberrations were not associated with chemical exposures (OR = 1.0), but a nonstatistically significant excess was noted in association with electromagnetic fields (OR = 2.1).	Cancer Genetics & Cytogenetics	68	2	135-9	Expert case-by-case assessment			Case-control	Pesticides in general	cancer	doctor-diagnosed	Italy	hic
384	G. De Fleurian, J. Perrin, R. Ecochard, E. Dantony, A. Lanteaume, V. Achard, J. M. Grillo, M. R. Guichaoua, A. Botta and I. Sari-Minodier	Occupational exposures obtained by questionnaire in clinical practice and their association with semen quality	2009	In industrial countries, evidence suggests that semen quality has been steadily decreasing over the past 5 decades. We employed a short questionnaire to examine the association between self-reported physical or chemical occupational exposures and semen quality. The study included 402 men consulting for couple infertility (314 with oligospermia, asthenospermia, or teratospermia and 88 with normal semen; World Health Organization criteria). Exposure effects on global sperm quality and total sperm count, sperm motility, and sperm morphology were investigated. We found significant associations between semen impairment and occupational risk factors such as exposure to heavy metals (adjusted odds ratio [OR] = 5.4; 95% confidence interval [CI], 1.6-18.1), solvents (OR = 2.5; 95% CI, 1.4-4.4), fumes (OR = 1.9; 95% CI, 1.1-3.4), and polycyclic aromatic hydrocarbons (OR = 1.9; 95% CI, 1.1-3.5). Exposure to pesticides or cement was nearly significant (OR = 3.6; 95% CI, 0.8-15.8, and OR = 2.5; 95% CI, 0.95-6.5, respectively). Physical risk factors were associated with some sperm anomalies, such as mechanical vibrations with oligospermia and teratospermia as well as excess heat and extended sitting periods with impaired motility. Exposure to ionizing radiation and electromagnetic fields was not associated with semen impairment; these results, however, may be skewed, because very few subjects reported such exposure. Despite the small dataset, self-reported exposures were correlated with semen impairment. This approach may be recommended in routine clinical practice to seek relationships between occupational exposures to reprotoxic agents and impaired semen parameters. This knowledge would allow preventive measures in the workplace to be established and could be complemented by the use of biomarkers to better characterize exposure to chemical substances and their spermiotoxic effects.	Journal of Andrology	30	5	566-79	Self-reported exposure			Case-control	Pesticides in general	reproductive	medical test result	France	hic
385	G. de Jong, G. M. Swaen and J. J. Slangen	Mortality of workers exposed to dieldrin and aldrin: a retrospective cohort study	1997	OBJECTIVE: To investigate the occurrence of long term health effects in humans exposed to aldrin and dieldrin, with an update of an earlier retrospective cohort mortality study. METHODS: A group of 570 workers employed between 1 January 1954 and 1 January 1970 either in a production or formulation plant were followed up for mortality until 1 January 1993. There were extensive industrial hygiene data available and biological monitoring data of aldrin and dieldrin for most of the workers. From these data individual estimates were made of the total intake of dieldrin. A total number of 2539.37 person-years at risk was added to the original study. RESULTS: 118 deaths were observed compared with 156 expected. No increase in mortality from liver cancer was found. However, there was an excess in mortality from rectal cancer. This excess was inversely related to the dose gradient. An analysis by job title did not show any excess cancer in any particular job. CONCLUSION: The study does not support a carcinogenic effect of dieldrin and aldrin in humans.	Occupational & Environmental Medicine	54	10	702-7	Biomonitoring (blood)	Expert case-by-case assessment		Cohort (retrospective)	Specific active ingredient	mortality (all cause)	doctor-diagnosed	Netherlands	hic
386	G. Dean	Deaths from primary brain cancers, lymphatic and haematopoietic cancers in agricultural workers in the Republic of Ireland	1994	STUDY OBJECTIVE: To ascertain if agricultural workers in the Republic of Ireland had a higher than expected mortality from brain and haematopoietic cancers than occurred in the general population. DESIGN: The Central Statistics Office of Ireland provided computer analysis of all deaths coded as cancer of the brain, ICD 191, and of lymphatic and haematopoietic cancers, ICD codes 200-208, by socioeconomic, sex, and age groups, from 1971 to 1987. The deaths were then analysed by socioeconomic group and compared with the expected number of deaths in the general population. SETTING: A cluster of four deaths from primary brain cancer, three from leukaemia, and one from Hodgkin's disease, occurred in the research and technical staff of the former Agricultural Institute of the Republic of Ireland in men under the age of 65. This raised the question, were farmers more likely to get these forms of cancer due to exposure to herbicides or fertilisers? SUBJECTS: All deaths in the Republic of Ireland from 1971 to 1987 by socioeconomic group. MAIN RESULTS: Although deaths reported as due to primary brain cancers had increased in all socioeconomic groups in the two time periods studied, there was no greater increase in farmers and a smaller increase in other agricultural workers and fishermen. Deaths from Hodgkin's disease and multiple myeloma, and to a smaller extent from leukaemia, had also increased. The increase in reported mortality of these haematopoietic cancers in farmers was no greater and in other agricultural workers it was less than in the general population. CONCLUSION: There was no evidence that farmers had any greater increase in mortality from these cancers than the general population. The cluster of brain and haematopoietic cancers in research and technical staff at the Agricultural Institute of the Republic of Ireland does not reflect a high risk of these cancers among the general farming population, but strongly supports the need for a compilation of a register of causes of death of laboratory workers in a number of countries.	Journal of Epidemiology & Community Health	48	4	364-8	Job title			Cohort (prospective)	Job title	mortality (all cause)	doctor-diagnosed	Ireland	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
387	G. E. Kisby, J. F. Muniz, J. Scherer, M. R. Lasarev, M. Koshy, Y. W. Kow and L. McCauley	Oxidative stress and DNA damage in agricultural workers	2009	Oxidative stress and DNA damage have been proposed as mechanisms linking pesticide exposure to health effects such as cancer and neurological diseases. A pilot study of pesticide applicators and farm workers working in the fruit orchards of Oregon (i.e., apples, pears) was conducted to examine the relationship between organophosphate (OP) pesticide exposure and oxidative stress and DNA damage. Urine samples were analyzed for OP metabolites and 8-hydroxy-2'-deoxyguanosine (8-OH-dG). Lymphocytes were analyzed for oxidative DNA repair activity and DNA damage (Comet assay) and serum analyzed for lipid peroxides (i.e., malondialdehyde [MDA]). Cellular DNA damage in agricultural workers was validated using lymphocyte cell cultures. Urinary OP metabolites were significantly higher in farm workers and applicators ($p < .001$) when compared to controls. 8-OH-dG levels were 8.5 times and 2.3 times higher in farm workers and applicators, respectively, than in controls. Serum MDA levels were 4.9 times and 24 times higher in farm workers and applicators, respectively, than in controls. DNA damage and oxidative DNA repair were significantly greater in lymphocytes from applicators and farm workers when compared with controls. A separate field study showed that DNA damage was also significantly greater ($p < .001$) in buccal cells (i.e., leukocytes) collected from migrant farm workers working with fungicides in the berry crops in Oregon. Markers of oxidative stress (i.e., reactive oxygen species, reduced levels of glutathione) and oxidative DNA damage were also observed in lymphocyte cell cultures treated with an OP. The findings from these in vivo and in vitro studies indicate that pesticides induce oxidative stress and DNA damage in agricultural workers. These biomarkers may be useful for increasing our understanding of the link between pesticides and cancer.	Journal of Agromedicine	14	2	206-14	Biomonitoring (urine)			Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	USA	hic
388	G. F. Gambini, C. Mantovani, E. Pira, P. G. Piolatto and E. Negri	Cancer mortality among rice growers in Novara Province, northern Italy	1997	Some excess of non-Hodgkin lymphomas (NHL) and soft tissue sarcomas (STS) was reported in the literature among agricultural workers, mainly in relation to exposure to phenoxyacids and chlorophenols. In this study, information was analyzed for a cohort of rice growers that comprised 1,493 subjects, and for a follow-up that was more than 99% complete with regard to both traced subjects and known causes of deaths. A total of 960 subjects (65%) died during the observation period (1957-1992). Lower than expected standardized mortality ratios (SMRs) were found for all causes, for cardiovascular diseases (especially ischemic heart disease) and for all cancers. Slightly increased SMRs were found for some cancer sites (oral cavity, esophagus, liver, intestines, pancreas, bladder, STS, and NHL), although none of these was statistically significant in the overall analysis. An excess risk of close to statistical significance was found for NHL among workers with longer exposure during the period when phenoxyacid herbicide was in use (1950-1992). Thus, a prolonged follow-up is advisable. At present the study should be evaluated in the context of the data set suggesting a tendency toward an increased risk of NHL among farmers.	American Journal of Industrial Medicine	31	4	435-41	Registers			Cohort (prospective)	Chemical class	mortality (all cause)	doctor-diagnosed	Italy	hic
389	G. H. Andreotti, J. A.; Hou, L.; Koutros, S.; Gadalla, S. M.; Savage, S. A.; Lubin, J.; Blair, A.; Hoxha, M.; Baccarelli, A.; Sandler, D.; Alavanja, M.; Beane Freeman, L. E.	Pesticide Use and Relative Leukocyte Telomere Length in the Agricultural Health Study	2015	Some studies suggest that telomere length (TL) may be influenced by environmental exposures, including pesticides. We examined associations between occupational pesticide use reported at three time points and relative telomere length (RTL) in the Agricultural Health Study (AHS), a prospective cohort study of pesticide applicators in Iowa and North Carolina. RTL was measured by qPCR using leukocyte DNA from 568 cancer-free male AHS participants aged 31-94 years with blood samples collected between 2006 and 2008. Self-reported information, including pesticide use, was collected at three time points: enrollment (1993-1997) and two follow-up questionnaires (1998-2003, 2005-2008). For each pesticide, we evaluated cumulative use (using data from all three questionnaires), and more recent use (using data from the last follow-up questionnaire). Multivariable linear regression was used to examine the associations between pesticide use (ever, lifetime days, intensity-weighted lifetime days (lifetime days*intensity score)) and RTL, adjusting for age at blood draw and use of other pesticides. Of the 57 pesticides evaluated with cumulative use, increasing lifetime days of 2,4-D (p-trend=0.001), diazinon (p-trend=0.002), and butylate (p-trend=0.01) were significantly associated with shorter RTL, while increasing lifetime days of alachlor was significantly associated with longer RTL (p-trend=0.03). Only the association with 2,4-D was significant after adjustment for multiple comparisons. Of the 40 pesticides evaluated for recent use, malathion was associated with shorter RTL (p=0.03), and alachlor with longer RTL (p=0.03). Our findings suggest that leukocyte TL may be impacted by cumulative use and recent use of certain pesticides.	PLoS ONE [Electronic Resource]	10	7	e0133382	NA			NA	NA	genetic (biomarkers)	medical test result	USA	hic
390	G. H. Andreotti, L.; Beane Freeman, L. E.; Mahajan, R.; Koutros, S.; Coble, J.; Lubin, J.; Blair, A.; Hoppin, J. A.; Alavanja, M.	Body mass index, agricultural pesticide use, and cancer incidence in the Agricultural Health Study cohort	2010	Obesity is associated with increased risks of several cancers including colon and female breast. Pesticide use in agricultural populations has also been linked with higher risks of various cancers. However, the interaction between obesity and pesticide use on cancer risk has not been well studied. Using data from the Agricultural Health Study, we examined the association between body mass index (BMI) and the risk of cancer at 17 sites and the interaction between BMI and pesticide use. Pesticide applicators residing in Iowa and North Carolina and their spouses were enrolled between 1993 and 1997 and given a self-administered questionnaire to obtain pesticide use and other information. This analysis included 39,628 men and 28,319 women with height and weight data who were cancer-free at enrollment. Among these participants, 4,432 were diagnosed with cancer between enrollment and 2005 and 64% were overweight or obese. BMI (per 1 kg/m(2)) was positively associated with colon cancer in men (hazard ratio (HR) 1.05, 95% confidence interval (CI) 1.02-1.09) and breast cancer in postmenopausal women (HR 1.03, 95% CI 1.01-1.06). In contrast, BMI was inversely associated with lung cancer in men, with a significant association in ever smokers (HR 0.92, 95% CI 0.88-0.97) and a null association in never smokers. The positive association between BMI and colon cancer in men was significant in those who ever used carbofuran (HR = 1.10, 95% CI 1.04-1.17; p-interaction = 0.04) or metolachlor (HR = 1.09, 95% CI 1.04-1.15; p-interaction = 0.02) but was null in non-users of these pesticides. Among male ever smokers, the inverse association between BMI and lung cancer was significant in non-users of carbofuran (HR = 0.87, 95% CI = 0.82-0.92) but was null in users of carbofuran (p-interaction = 0.02). These findings suggest that certain pesticides may modify the effects of BMI on the risks of colon and lung cancers.	Cancer Causes & Control	21	11	1759-75	Self-reported exposure	Self-reported exposure		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
391	G. J. Ohayo-Mitoko, H. Kromhout, J. M. Simwa, J. S. Boleij and D. Heederik	Self reported symptoms and inhibition of acetylcholinesterase activity among Kenyan agricultural workers	2000	OBJECTIVES: This study was part of the East African pesticides project. The general objective was to assess health hazards posed by handling, storage, and use of pesticides, on agricultural estates and small farms with a view to developing strategies for prevention and control of pesticide poisoning. The aim of this paper is to describe the prevalence of symptoms in this population, to relate levels of inhibition to reported symptoms and evaluate at which levels of inhibition symptoms become increased. METHODS: Complete data were available for 256 exposed subjects and 152 controls from four regions in Kenya. A structured questionnaire on symptoms experienced at the time of interview was given to all subjects and controls. Information was also obtained on sex, age, main occupation, and level of education. Symptoms reported during the high exposure period, were initially clustered in broader symptom categories from reference literature on health effects of pesticides that inhibit cholinesterase (organophosphate and carbamate). Prevalence ratios were estimated for symptoms with changes in cholinesterase activity in serum. RESULTS: Symptom prevalence in exposed subjects was higher during the high exposure period than the low exposure period, although these differences were not significant. Interestingly, a clear and significant change in symptoms prevalence was found in the controls with a higher prevalence in the low exposure period. Analysis of the relation between cholinesterase inhibition and symptoms showed that prevalence ratios were significantly > 1 for respiratory, eye, and central nervous system symptoms for workers with > 30% inhibition. Similar results were found for analyses with the actual level of acetylcholinesterase activity. CONCLUSION: The results suggest the presence of a relation between exposure and acetylcholinesterase inhibition, acetylcholinesterase activity, and respiratory, eye, and central nervous system symptoms. Increased symptom prevalence was found at acetylcholinesterase activities generally considered to be non-adverse.	Occupational & Environmental Medicine	57	3	195-200	Biomonitoring (blood)			Cross-sectional	Chemical class	NA	self-reported	Kenya	lmic
392	G. L. Henriksen, J. E. Michalek, J. A. Swaby and A. J. Rahe	Serum dioxin, testosterone, and gonadotropins in veterans of Operation Ranch Hand	1996	We studied whether exposure to Agent Orange and its contaminant, 2,3,7,8-tetrachlorodibenzo-p-dioxin (dioxin), during the Vietnam War is related to current testosterone, follicle-stimulating hormone, luteinizing hormone, or testicular abnormalities, sperm count, sperm abnormalities, or testicular volume. The index subjects were veterans of-Operation Ranch Hand, the unit responsible for aerial herbicide spraying in Vietnam from 1962 to 1971. The referent cohort comprises Air Force veterans who served in Southeast Asia during the same period but were not involved with spraying herbicides. Referents were matched to Ranch Hands on date of birth, race, and military occupation. We found no consistent or meaningful association between serum dioxin levels and any of these outcome variables.	Epidemiology	7	4	352-7	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	endocrine/nutritional/metabolical	medical test result	USA	hic
393	G. L. Henriksen, N. S. Ketchum, J. E. Michalek and J. A. Swaby	Serum dioxin and diabetes mellitus in veterans of Operation Ranch Hand	1997	We studied diabetes mellitus and glucose and insulin levels in Air Force veterans exposed to Agent Orange and its contaminant, 2,3,7,8-tetrachlorodibenzo-p-dioxin (dioxin), during the Vietnam War. The index subjects of the Air Force's ongoing 20-year prospective epidemiologic study are veterans of Operation Ranch Hand (N = 989), the unit responsible for aerial herbicide spraying in Vietnam from 1962 to 1971. Other Air Force veterans who served in Southeast Asia during the same period but were not involved with spraying herbicides serve as Comparisons (N = 1,276). The median serum dioxin level in the Ranch Hand group was 12.2 parts per trillion (ppt) (range = 0-617.8 ppt), and the median dioxin level in the Comparison group was 4.0 ppt (range = 0-10 ppt). We found that glucose abnormalities [relative risk = 1.4; 95% confidence limits (CL) = 1.1, 1.8], diabetes prevalence (relative risk = 1.5; 95% CL = 1.2, 2.0), and the use of oral medications to control diabetes (relative risk = 2.3; 95% CL = 1.3, 3.9) increased, whereas time-to-diabetes-onset decreased with dioxin exposure. Serum insulin abnormalities (relative risk = 3.4; 95% CL = 1.9, 6.1) increased with dioxin exposure in nondiabetics. These results indicate an adverse relation between dioxin exposure and diabetes mellitus, glucose metabolism, and insulin production.	Epidemiology	8	3	252-8	Biomonitoring (blood)			Cohort (prospective)	Chemical class	endocrine/nutritional/metabolical	doctor-diagnosed	USA	hic
394	G. Lensen, F. Jungbauer, M. Goncalo and P. J. Coenraads	Airborne irritant contact dermatitis and conjunctivitis after occupational exposure to chlorothalonil in textiles	2007	Chlorothalonil (tetrachloro-1,3-benzenedicarbonitrile, CAS 1897-45-6) is a pesticide that has been on the market for many years. It is used as a fungicide in agriculture, horticulture, and floriculture; as a wood preservative; and in paint. We report an epidemic of airborne irritant contact dermatitis, conjunctivitis, and upper airway complaints among seamstresses in a Portuguese trailer tent factory, which we attribute to chlorothalonil. All exposed workers had work-related skin symptoms. After patch testing, we showed that none of these were of allergic origin. Instead of allergic reactions, we noticed a delayed type of irritation after 72 hr to chlorothalonil and to the textile extracts containing high concentrations of chlorothalonil. Although allergic and irritant contact dermatitis from chlorothalonil has been described before, this is, as far as we know, the first time that a delayed type of dermatitis, conjunctivitis, and upper airway irritation after exposure to chlorothalonil in tent-cloth is described.	Contact Dermatitis	57	3	181-6	Job title			Cohort (prospective)	Job title	dermatological	doctor-diagnosed	Portugal	hic
395	G. M. Abdel Rasoul, M. E. Abou Salem, A. A. Mechael, O. M. Hendy, D. S. Rohlman and A. A. Ismail	Effects of occupational pesticide exposure on children applying pesticides	2008	Nearly 40% of the Egyptian workforce is employed in agriculture. The cotton industry relies on children and adolescents, who work seasonally, to apply pesticides to the cotton crops. Although previous research has examined adult pesticide exposures in this workforce in Egypt, no research has examined the health effects in adolescents. This study attempts to systematically replicate findings examining the impact of organophosphate pesticide (OP) exposure in adults on Arabic speaking children working as applicators. The aim of this study was to examine the impact of pesticide exposure on children and adolescents spraying cotton fields. Male children currently applying pesticides between the ages of 9 and 15 (Younger, n=30) and 16 and 19 (Older, n=20) were recruited for the study. They completed a neurobehavioral test battery; personality inventory; work, health, and exposure questionnaires; and medical and neurological screening exams. Blood samples were collected to measure acetylcholinesterase. Children not working in agriculture, matched on age and education, served as controls. Both Younger and Older applicator groups, performed significantly worse than the controls on the majority of neurobehavioral tests controlling for age and years of education. The applicators reported significantly more neurological symptoms than the controls and had lower acetylcholinesterase activity. A dose-effect relationship demonstrated that increased years of exposure to organophosphate pesticides is associated with cognitive deficits. This is one of the several studies demonstrating that functional cognitive effects are positively correlated with increased years of exposure to OP pesticides, though primarily in adult populations, building confidence in the association. Since children around the world are exposed to OP pesticides, these studies suggest that the need to evaluate this potential problem is urgent.	Neurotoxicology	29	5	833-8	Self-reported exposure			Cross-sectional	Chemical class	neurological	medical test result	Egypt	lmic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
396	G. M. Bortoli, M. B. Azevedo and L. B. Silva	Cytogenetic biomonitoring of Brazilian workers exposed to pesticides: micronucleus analysis in buccal epithelial cells of soybean growers	2009	Pesticides have been considered potential chemical mutagens and various agrochemical ingredients possess mutagenic properties. Biomonitoring provides a useful tool to estimate the genetic risk from exposure to a complex mixture of chemicals. In general genetic damage associated with pesticides occurs in human populations subject to high exposure levels due to intensive use, misuse or failure of control measures. Few studies have been carried out using the micronucleus (MN) analysis in buccal cells of farm workers and, from the available data, only one has found a positive relationship. Micronuclei were analyzed in 29 Brazilian workers exposed to pesticides in soybean fields and in 37 non-exposed individuals. The results obtained indicate that the mean number of cells with MN in the exposed group (3.55+/-2.13) was significantly higher than in the control group (1.78+/-1.23). The number of cells with MN was not influenced by age, smoking habit, smoking time, number of cigarettes/day, alcohol consumption and years of exposure to pesticides. The genotoxic potential of the pesticides used in soybean fields may explain the detectable increase of cells with MN in exposed workers.	Mutation Research	675	1	43104	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Brazil	umic
397	G. M. Calvert, C. A. Mueller, J. M. Fajen, D. W. Chrislip, J. Russo, T. Briggle, L. E. Fleming, A. J. Suruda and K. Steenland	Health effects associated with sulfuryl fluoride and methyl bromide exposure among structural fumigation workers	1998	OBJECTIVES: This study assessed the health effects associated with occupational exposure to methyl bromide and sulfuryl fluoride among structural fumigation workers. METHODS: A cross-sectional study of 123 structural fumigation workers and 120 referents in south Florida was conducted. Nerve conduction, vibration, neurobehavioral, visual, olfactory, and renal function testing was included. RESULTS: The median lifetime duration of methyl bromide and sulfuryl fluoride exposure among workers was 1.20 years and 2.85 years, respectively. Sulfuryl fluoride exposure over the year preceding examination was associated with significantly reduced performance on the Pattern Memory Test and on olfactory testing. In addition, fumigation workers had significantly reduced performance on the Santa Ana Dexterity Test of the dominant hand and a nonsignificantly higher prevalence of carpal tunnel syndrome than did the referents. CONCLUSIONS: Occupational sulfuryl fluoride exposures may be associated with subclinical effects on the central nervous system, including effects on olfactory and some cognitive functions. However, no widespread pattern of cognitive deficits was observed. The peripheral nerve effects were likely caused by ergonomic stresses experienced by the fumigation workers.	American Journal of Public Health	88	12	1774-80	Self-reported exposure	Self-reported job history		Cross-sectional	Specific active ingredient	pesticide-related symptoms	medical test result	USA	hic
398	G. M. Calvert, G. Talaska, C. A. Mueller, M. M. Ammenheuser, W. W. Au, J. M. Fajen, L. E. Fleming, T. Briggle and E. Ward	Genotoxicity in workers exposed to methyl bromide	1998	To address the genotoxicity of in vivo methyl bromide (CAS 74-83-9) exposure in humans, we collected blood and oropharyngeal cells as part of a cross-sectional morbidity study of methyl bromide-exposed fumigation workers and their referents. Micronuclei were measured in lymphocytes and oropharyngeal cells, and hypoxanthine-guanine phosphoribosyl transferase gene (hprt) mutations were measured in lymphocytes. A total of 32 workers and 28 referents provided specimens. Among current non-smokers, mean hprt variant frequencies (Vfs) were found to be elevated among workers compared to referents (geometric mean: workers=4.49x10(-6), referents=2.96x10-(6); two-sided p=0.22); this difference was more pronounced among workers with 4 h or more of recent methyl bromide exposure compared to referents (geometric mean: workers=6.56x10(-6), referents=2.96x10(-6); two-sided p=0.06). Mean oropharyngeal cell micronuclei were higher among workers compared to referents (mean: workers=2.00, referents=1.31; two-sided p=0.08); the results were similar when workers with 4 h or more of recent methyl bromide exposure were compared to referents (mean: workers=2.07, referents=1.31; two-sided p=0.13). No consistent differences between workers and referents were observed for frequencies of kinetochore-negative lymphocyte micronuclei, or kinetochore-positive lymphocyte micronuclei. The study was limited by a sample size sufficient only for detecting relatively large differences, absence of a reliable method to measure the intensity of workplace methyl bromide exposures, and relatively infrequent methyl bromide exposure (e.g., the median length of exposure to methyl bromide during the 2 weeks preceding the survey was 4 h). In conclusion, our findings provide some evidence that methyl bromide exposure may be associated with genotoxic effects in lymphocytes and oropharyngeal cells. Further study on the genotoxicity of methyl bromide exposure in humans is warranted.	Mutation Research	417	2	115-28	Self-reported exposure			Cross-sectional	Specific active ingredient	genetic (biomarkers)	medical test result	NA	NA
399	G. M. Calvert, J. Karnik, L. Mehler, J. Beckman, B. Morrissey, J. Sievert, R. Barrett, M. Lackovic, L. Mabee, A. Schwartz, Y. Mitchell and S. Moraga-McHaley	Acute pesticide poisoning among agricultural workers in the United States, 1998-2005	2008	BACKGROUND: Approximately 75% of pesticide usage in the United States occurs in agriculture. As such, agricultural workers are at greater risk of pesticide exposure than non-agricultural workers. However, the magnitude, characteristics and trend of acute pesticide poisoning among agricultural workers are unknown. METHODS: We identified acute pesticide poisoning cases in agricultural workers between the ages of 15 and 64 years that occurred from 1998 to 2005. The California Department of Pesticide Regulation and the SENSOR-Pesticides program provided the cases. Acute occupational pesticide poisoning incidence rates (IR) for those employed in agriculture were calculated, as were incidence rate ratios (IRR) among agricultural workers relative to non-agricultural workers. RESULTS: Of the 3,271 cases included in the analysis, 2,334 (71%) were employed as farmworkers. The remaining cases were employed as processing/packing plant workers (12%), farmers (3%), and other miscellaneous agricultural workers (19%). The majority of cases had low severity illness (N = 2,848, 87%), while 402 (12%) were of medium severity and 20 (0.6%) were of high severity. One case was fatal. Rates of illness among various agricultural worker categories were highly variable but all, except farmers, showed risk for agricultural workers greater than risk for non-agricultural workers by an order of magnitude or more. Also, the rate among female agricultural workers was almost twofold higher compared to males. CONCLUSION: The findings from this study suggest that acute pesticide poisoning in the agricultural industry continues to be an important problem. These findings reinforce the need for heightened efforts to better protect farmworkers from pesticide exposure.	American Journal of Industrial Medicine	51	12	883-98	Registers			Cohort (prospective)	Pesticides in general	pesticide-related illness	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
400	G. M. Calvert, M. Barnett, L. N. Mehler, A. Becker, R. Das, J. Beckman, D. Male, J. Sievert, C. Thomsen and B. Morrissey	Acute pesticide-related illness among emergency responders, 1993-2002	2006	BACKGROUND: Emergency responders are among the first to arrive at a pesticide-related release event. Magnitude, severity, and risk factor information on acute pesticide poisoning among those workers is needed. METHODS: Survey data collected from the SENSOR-Pesticides, CDPR and HSEES programs between 1993 and 2002 from 21 states were reviewed. Acute occupational pesticide-related illness incidence rates for each category of emergency responder were calculated, as were incidence rate ratios (IRR) among emergency responders compared to all other workers employed in non-agricultural industries. RESULTS: A total of 291 cases were identified. Firefighters accounted for 111 cases (38%), law enforcement officers for 104 cases (36%), emergency medical technicians for 34 cases (12%), and 42 cases (14%) were unspecified emergency responders. Among the 200 cases with information on activity responsible for exposure, most were exposed while performing activities related to a pesticide release event (84%) and not involving patient care, while the remainder involved exposure to pesticide-contaminated patients. A majority of cases were exposed to insecticides (51%). Most had low severity illnesses (90%). The incidence rate was highest for firefighters (39.1/million) and law enforcement officers (26.6/million). The IRRs were also elevated for these professions (firefighters, IRR = 2.67; law enforcement officers, IRR = 1.69). CONCLUSIONS: The findings suggest the need for greater efforts to prevent acute occupational pesticide-related illness among emergency responders.	American Journal of Industrial Medicine	49	5	383-93	Registers			Cohort (prospective)	Pesticides in general	pesticide-related illness	self-reported	USA	hic
401	G. M. Calvert, M. H. Sweeney, J. Deddens and D. K. Wall	Evaluation of diabetes mellitus, serum glucose, and thyroid function among United States workers exposed to 2,3,7,8-tetrachlorodibenzo-p-dioxin	1999	OBJECTIVE: Some studies suggest that exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) may affect glucose metabolism and thyroid function. To further assess the relation between exposure to TCDD and endocrine function, data from the largest morbidity study of industrial workers exposed to TCDD were examined. METHODS: A cross sectional study of workers employed > 15 years earlier in the manufacture of 2,4,5-trichlorophenol or one of its derivatives at two United States chemical plants was conducted. The referent group consisted of people with no occupational exposure to phenoxy herbicides and were recruited from the neighbourhoods where the workers lived. RESULTS: A total of 281 workers and 260 unexposed referents participated. The mean current serum lipid adjusted TCDD concentration among workers was 220 pg/g lipid, and among referents was 7 pg/g lipid ($p < 0.05$). The half life extrapolated TCDD concentrations (the estimated TCDD concentration when occupational exposure to TCDD stopped) among workers averaged 1900 pg/g lipid (range: not detected--30,000 pg/g lipid). Overall, the prevalence of diabetes mellitus was not significantly different between the workers and referents. Also, there was not a significant positive trend between prevalence of diabetes and increasing serum TCDD concentration. However, diabetes was found in six of 10 (60%) workers with current serum TCDD concentrations > 1500 pg/g lipid. After excluding subjects being treated for diabetes, workers in the group with the highest half life extrapolated TCDD concentrations had a significantly increased adjusted mean serum glucose concentration compared with referents ($p = 0.03$). Workers were also found to have a significantly higher adjusted mean free thyroxine index compared with referents ($p = 0.02$), especially among workers in the group with the highest half life extrapolated TCDD concentrations. However, no evidence was found that workers exposed to TCDD were at increased risk of thyroid disease. CONCLUSIONS: These findings provide modest evidence that exposure to TCDD may affect thyroid function and glucose metabolism.	Occupational & Environmental Medicine	56	4	270-6	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	endocrine/nutritional/metabolical	doctor-diagnosed	USA	hic
402	G. M. Ferri, G. Specchia, P. Mazza, G. Ingravallo, G. Intranuovo, C. M. Guastadisegno, M. L. Congedo, G. Lagioia, M. C. Loparco, A. Giordano, T. Perrone, F. Guadio, C. Spinosa, C. Minoia, L. D'Onghia, M. Strusi, V. Corrado, D. Cavone, L. Vimercati, N. Schiavulli and P. Cocco	Risk of lymphoma subtypes by occupational exposure in Southern Italy	2017	Background: Occupational exposure is known to play a role in the aetiology of lymphomas. The aim of the present work was to explore the occupational risk of the major B-cell lymphoma subtypes using a case-control study design. Methods: From 2009 to 2014, we recruited 158 lymphoma cases and 76 controls in the provinces of Bari and Taranto (Apulia, Southern Italy). A retrospective assessment of occupational exposure based on complete work histories and the Carcinogen Exposure (CAREX) job-exposure matrix was performed. Results: After adjusting for major confounding factors, farmers showed an increased risk of diffuse large B-cell lymphoma (DLBCL) [odds ratio (OR) = 10.9 (2.3-51.6)] and multiple myeloma (MM) [OR = 16.5 (1.4-195.7)]; exposure to the fungicide Captafol was significantly associated with risk of non-Hodgkin lymphoma (NHL) [OR = 2.6 (1.1-8.2)], particularly with the risk of DLBCL [OR = 5.3 (1.6-17.3)]. Conclusions: Agricultural activity seems to be a risk factor for developing lymphoma subtypes, particularly DLBCL, in the provinces of Bari and Taranto (Apulia Region, Southern Italy). Exposure to the pesticides Captafol, Paraquat and Radon might be implicated. Trial registration: Protocol number UNIBA 2207WE]LZB-004 registered 22/09/2008.	Journal of Occupational Medicine and Toxicology	12	1	NA	Job exposure matrix			Case-control	Specific active ingredient	cancer	doctor-diagnosed	Italy	hic
403	G. M. Rigolin, A. Cuneo, M. G. Roberti, A. Bardi, R. Bigoni, N. Piva, C. Minotto, P. Agostini, C. De Angeli, L. Del Senno, R. Spanedda and G. Castoldi	Exposure to myelotoxic agents and myelodysplasia: case-control study and correlation with clinicobiological findings	1998	To better define the role of exposure to myelotoxic agents in the genesis of myelodysplastic syndrome (MDS), we carried out (a) a case-control study for the determination of the relative risk (RR) of developing MDS, including 178 consecutive patients and 178 sex- and age-matched controls: (b) a study of clinicobiological features in MDS arising after occupational exposure to myelotoxic agents and in MDS in 'non-exposed' patients. The definition of the 'exposure' status was based on a predetermined questionnaire, with calculation of an 'exposure' index (hours/day x days/year x years). Cumulative exposure to pesticides or to organic solvents, for >2400 h, was recorded in 48 and 25 MDS patients, respectively, compared to 27 and four controls ($P<0.00001$; RR 3.74; 95% confidence interval 2.02-5.37). Older age and an excess of refractory anaemia with ringed sideroblasts and refractory anaemia with excess of blasts was noted among 'exposed' MDS-patients (group 1), compared to non-exposed MDS-patients (group 2). 68.3% patients in group 1 had clonal chromosome changes, compared with 43.2% patients in group 2. Complex karyotypes, -7/7q-, -5/5q-, +8, 7p and 17p aberrations were seen more frequently in group 1, whereas a normal karyotype, isolated 5q- or 20q- occurred more frequently in group 2. The association of exposure to myelotoxic agents with older age at presentation and with unfavourable chromosome changes accounted for the shorter survival observed in 'exposed' patients. These data show that occupational exposure to pesticides and organic solvents in our region resulted in an increased RR of developing MDS and that a distinct cytogenetic profile was associated with MDS in 'exposed' patients. These findings provide strong indirect evidence that these agents may play a role in the pathogenesis of MDS, preferentially targeting some of the chromosome regions which are frequently involved in therapy-related myeloid neoplasias.	British Journal of Haematology	103	1	189-97	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Italy	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
404	G. M. Shaw, C. R. Wasserman, C. D. O'Malley, V. Nelson and R. J. Jackson	Maternal pesticide exposure from multiple sources and selected congenital anomalies	1999	We explored the relation between various potential sources of maternal periconceptional pregnancy exposures to pesticides and congenital anomalies in offspring. Data were derived from a case-control study of fetuses and liveborn infants with orofacial clefts, neural tube defects, conotruncal defects, or limb anomalies, among 1987-1989 California births and fetal deaths. We conducted telephone interviews with mothers of 662 (85% of eligible) orofacial cleft cases, 265 (84%) neural tube defect cases, 207 (87%) conotruncal defect cases, 165 (84%) limb cases, and 734 (78%) nonmalformed controls. The odds ratio (OR) estimates did not indicate increased risk for any of the studied anomaly groups among women whose self-reported occupational tasks were considered by an industrial hygienist likely to involve pesticide exposures. Paternal occupational exposure to pesticides, as reported by the mother, revealed elevated ORs for only two of the cleft phenotypes [OR = 1.7 [95% confidence interval (CI) = 0.9-3.4] for multiple cleft lip with/without cleft palate and OR = 1.6 [95% CI = 0.7-3.4] for multiple cleft palate]. Use of pesticide products for household gardening, by mothers or by professional applicators, was associated with ORs > or =1.5 for most of the studied anomalies. Use of pesticide products for the control of pests in or around homes was not associated with elevated risks for most of the studied anomalies, although women who reported that a professional applied pesticides to their homes had increased risks for neural tube defect-affected pregnancies [OR = 1.6 (95% CI = 1.1-2.5)] and limb anomalies [OR = 1.6 (95% CI = 1.0-2.7)]. Having a pet cat or dog and treating its fleas was not associated with increased anomaly risk. Women who reported living within 0.25 miles of an agricultural crop revealed increased risks for offspring with neural tube defects [OR = 1.5 (95%CI = 1.1-2.1)]. For many of the comparisons, data were sparse, resulting in imprecise effect estimation. Despite our investigating multiple sources of potential pesticide exposures, without more specific information on chemical and level of exposure, we could not adequately discriminate whether the observed effects are valid, whether biased exposure reporting contributed to the observed elevated risks, or whether nonspecific measurement of exposure was responsible for many of the observed estimated risks not being elevated.	Epidemiology	10	1	22068	Self-reported job history	Expert case-by-case assessment		Case-control	Job title	offspring	doctor-diagnosed	USA	hic
405	G. M. Shaw, V. Nelson, D. M. Iovannisci, R. H. Finnell and E. J. Lammer	Maternal occupational chemical exposures and biotransformation genotypes as risk factors for selected congenital anomalies	2003	In a case-control study using an assessment of occupational tasks by an industrial hygienist, the authors investigated whether women's occupational exposures increased risks of delivering infants with cleft palate (CP), cleft lip with or without cleft palate (CLP), conotruncal defects, or limb deficiencies. For CP and CLP, exposures were further considered in the presence/absence of infant genetic variants for glutathione-S-transferase M1, glutathione-S-transferase T1, and N-acetyltransferases 1 and 2. The study included 1987-1989 California stillbirths and livebirths. Telephone interviews were conducted with mothers of 662 CLP and CP cases, 207 conotruncal defect cases, 165 limb deficiency cases, and 734 nonmalformed controls. Occupational tasks were assigned to a priori-defined exposure categories: 74 chemical groups and nine "end-use" chemical groups. Odds ratios of 1.5 or greater were observed for a small number of exposure-defect comparisons. Risks associated with end-use groups revealed odds ratios of 1.5 or greater for exposures to dyes and pigments (conotruncal and CP), propellants (CP), and insecticides (conotruncal and CP). Numerous odds ratios of 2.5 or greater were observed for combined effects of exposures and homozygous mutant genotypes, particularly for CP. Although potential associations were observed, most results suggested that maternal occupational chemical exposures did not contribute substantially to the occurrence of these anomalies in this California population.	American Journal of Epidemiology	157	6	475-84	Expert case-by-case assessment			Case-control	Type of pesticide	offspring	medical test result	USA	hic
406	G. M. Swaen, G. de Jong, J. J. Slangen and L. G. van Amelsvoort	Cancer mortality in workers exposed to dieldrin and aldrin: an update	2002	This study was conducted to investigate the possible long-term health effects, in particular carcinogenic effects, of occupational exposure to the organochlorine insecticides dieldrin and aldrin. We updated an earlier cohort mortality study of 570 employees involved in the production of these insecticides. All of the employees had worked in the production plants between 1 January 1954 and 1 January 1970 and were followed for cause-specific mortality until 1 January 2001. Based on dieldrin levels in blood samples taken during the exposure period, available for 343 workers, individual estimates of the total intake of dieldrin were estimated for all individual subjects in the cohort. The estimated total intake ranged from 11 to 7755 mg of dieldrin, with an average of 737 mg. One hundred and seventy-one workers had died before 1 January 2001, compared with an expected number of 226.6, giving a standardized mortality ratio (SMR) of 75.6 [95% confidence interval (CI): 64.6-87.7]. This deficit in total mortality was mainly attributable to a deficit in cardiovascular disease mortality, but cancer mortality was also lower than expected. The observed number of deaths from rectal cancer was significantly higher than expected (SMR = 300.0; 95% CI: 109.5-649.3), but was most pronounced in the low-intake subgroup and appears to be unrelated to exposure to dieldrin and aldrin. This study reinforces the earlier findings that occupational exposure of workers to significant amounts of dieldrin and aldrin has not led to a higher cancer mortality than would be found in an unexposed population.	Toxicology & Industrial Health	18	2	63-70	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	mortality (all cause)	doctor-diagnosed	Netherlands	hic
407	G. M. v. A. Swaen, L. G.; Slangen, J. J.; Mohren, D. C.	Cancer mortality in a cohort of licensed herbicide applicators	2004	OBJECTIVES: In order to expand our knowledge on the possible long-term health effects of exposure to herbicides, we updated the follow-up of a cohort of 1341 licensed herbicide applicators in the Netherlands. The earlier report indicated that there might be an increased risk for multiple myeloma in this group. Although that finding was statistically significant, the result was based on a small number of cases. METHODS: We expanded the follow-up from 1 January 1988 to 1 January 2001, which added 13 years to the follow-up. We now report on the causes of death of 196 exposed workers. RESULTS: Our findings indicate that licensed herbicide applicators were at an increased risk for skin cancer mortality [standardized mortality ratio (SMR)=357.4, 95% confidence interval (CI) 115.1-827.0]. It is not clear if this excess of skin cancer should be attributed to herbicide exposure or to excess exposure to sunlight.	International Archives of Occupational & Environmental Health	77	4	293-5	Registers			Cohort (prospective)	Type of pesticide	mortality (all cause)	doctor-diagnosed	Netherlands	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
408	G. Navaranjan, K. Hohenadel, A. Blair, P. A. Demers, J. J. Spinelli, P. Pahwa, J. R. McLaughlin, J. A. Dosman, L. Ritter and S. A. Harris	Exposures to multiple pesticides and the risk of Hodgkin lymphoma in Canadian men	2013	PURPOSE: To determine the risk of Hodgkin lymphoma (HL) associated with exposures to multiple pesticides grouped by various classes, including carcinogenic classifications. METHODS: Data collected in the Cross-Canada Study of Pesticides and Health, a population-based incident case-control study in six provinces conducted between 1991 and 1994, were analyzed using unconditional logistic regression. Cases (n = 316) were identified through provincial cancer registries and hospital records. Controls (n = 1,506) were frequency-matched to cases by age (+/- 2 years) within each province and were identified through provincial health records, telephone listings, or voter lists. The Cochran-Armitage test was used to check for trends within pesticide classes. RESULTS: Overall, there was an increase in the risk of HL among all subjects who reported use of five or more insecticides (OR 1.88, 95% CI 0.92-3.87) and among subjects younger than 40 who reported use of two acetylcholinesterase inhibitors (OR 3.16, 95% CI 1.02-9.29). There was an elevated odds ratio associated with reported use of three or more probably carcinogenic pesticides (OR 2.47, 95% CI 1.06-5.75), but no increase in risk for use of possibly carcinogenic pesticides. The risk of HL from reported use of fungicides or any pesticides was greater for cases diagnosed before age 40 than for cases diagnosed at or after age 40. When analyses excluded proxy respondents, OR estimates strengthened in some circumstances. CONCLUSIONS: This study found associations between HL and fungicides, insecticides, specifically acetylcholinesterase inhibitors, and pesticides previously identified as probable human carcinogens. These associations should be further evaluated, specifically in relation to age at diagnosis.	Cancer Causes & Control	24	9	1661-73	Self-reported exposure			Case-control	Chemical class	NA	NA	NA	NA
409	G. O. M. Skeie, B.; Haugarvoll, K.; Larsen, J. P.; Tysnes, O. B.	Differential effect of environmental risk factors on postural instability gait difficulties and tremor dominant Parkinson's disease	2010	Both environmental and genetic factors contribute to the development of Parkinson's disease (PD). We have examined environmental risk factors in a Norwegian population of incident PD patients and controls, the Norwegian ParkWest study. All five neurological wards in the study area of Western Norway participated in the study. A 4-step diagnostic procedure was used to establish a representative cohort of patients with incident PD at a high level of diagnostic accuracy. 212 incident PD patients and 175 age- and gender-matched controls were included. PD patients and controls were asked for information on occupation, education, exposure to pesticides, tobacco, alcohol, and caffeine. Agricultural work was associated with a higher risk of PD (OR 1.75 (1.03-3.0) P = 0.009). There were no differences as to other occupations. Smoking (OR 0.63 (0.42-0.95) P = 0.016) and alcohol use (OR 0.55 P = 0.008) were associated with a lower risk for PD. Interestingly, this inverse association was only seen in postural instability gait difficulties (PIGD) PD (P = 0.046 for smoking, P = 0.07 for alcohol consumption), and not in tremor dominant (TD) PD which was similar to controls. Consumption of coffee was lower in PD patients (3.3 +/- 1.8 cups per day vs. 3.8 +/- 2.0 in controls P = 0.02). In the regression model including intake of alcohol, coffee, and smoke, only coffee (P = 0.007) and alcohol intake (P = 0.021) remained significant whereas smoking was no longer significant. Thus, it seems as though only coffee intake reduces the risk of PD in general while associations to alcohol and smoking differ between PIGD and TD-PD patients.	Movement Disorders	25	12	1847-52	Self-reported exposure			Case-control	Pesticides in general	neurological	doctor-diagnosed	Norway	hic
410	G. P. Casale, D. M. Scott, J. R. Anderson, E. F. Vitzthum and R. E. Gold	A preliminary study of immunologic and hematologic profiles of peripheral blood from Nebraska farmers who apply pesticides to their fields	1998	OBJECTIVE: Laboratory studies have documented a wide range of pesticide-induced changes in the hematopoietic and lymphoreticular systems. Some of these are expressed as altered serum values, blood cell counts, and leucocyte functions. The goal of the present study was to determine whether these alterations were evident in peripheral blood of Nebraska farmers who applied pesticides to their fields. METHODS: An invitation to participate was mailed to 100 residents (70 farmers; 30 controls) of Butler County, Nebraska. All respondents (51 farmers and 21 controls) were enrolled and surveyed by written questionnaire for health status and pesticide use. Our analysis included 45 farmers and 18 controls. The farmers were divided into a high (n = 23) and a low (n = 22) pesticide use group. Statistical correlations of ten blood values with both pesticide use and age were evaluated, since pesticide use correlated with age. RESULTS: Four of the ten blood values correlated with pesticide use and age (Spearman Rho). In a multiple regression model, pesticide use (not age) proved to be a predictor of red blood cell count and hematocrit. In the same model, pesticide use was not a predictor of mean red cell volume or candida antigen-induced T-lymphocyte proliferation. Serum complement activity did not correlate with pesticide use among the farmers (n = 45) but was significantly reduced (ANOVA) in the high pesticide use group, compared to controls. CONCLUSIONS: A preliminary study of blood values in a small cohort of Nebraska farmers found no pesticide-associated effects on 1) leucocyte count, 2) antigen- and mitogen-stimulated T-cell proliferation, 3) mitogen-stimulated B-cell proliferation, and 4) concentrations of serum IgG and IgM. The study found small but statistically significant pesticide-associated effects on red blood cells and serum complement.	Journal of Toxicology - Clinical Toxicology	36	3	183-94	Self-reported exposure			Cross-sectional	Pesticides in general	immunological	medical test result	USA	hic
411	G. Petrelli and I. Figa-Talamanca	Reduction in fertility in male greenhouse workers exposed to pesticides	2001	The paper examines the possible interference of pesticide exposure on male fertility, by studying the time to pregnancy (TTP) in the first pregnancy of 127 greenhouse workers and 173 controls. The TTP of exposed and control population, analysed by logistic regression model, has shown an increase in the risk of conception delay among the greenhouse workers with high exposure (OR:2.4; 95% CI: 1.2-5.1).	European Journal of Epidemiology	17	7	675-7	Self-reported exposure			Cohort (prospective)	Pesticides in general	reproductive	medical test result	Italy	hic
412	G. Petrelli, I. Fig<U+221A><U+2020>~ Talamanca, L. Lauria and A. Mantovani	Spontaneous abortion in spouses of greenhouse workers exposed to pesticides	2003	Objective: The aim of this study was to explore the association between exposure to specific pesticides (including endocrine disrupters) of greenhouse workers and spontaneous abortion in their spouses. Methods: A group of exposed workers was compared with a non-exposed group. The risk of spontaneous abortion was evaluated using a logistic regression model. Results: A significantly higher rate of spontaneous abortion was observed among spouses of workers exposed to specific compounds (atrazine, benomyl-carbendazim, carbaryl and DDT) in comparison with spouses of the unexposed group. The logistic regression model confirmed the increased risk of spontaneous abortion (OR=11.8; 95% CI 2.3-59.6). Conclusions: These findings suggest that occupational exposure to pesticides might have an adverse effect on the partner's reproductive health.	Environmental Health and Preventive Medicine	8	3	77-81	Self-reported exposure			Cross-sectional	Specific active ingredient	reproductive	self-reported	Italy	hic
413	G. Petrelli, I. Figa-Talamanca, R. Tropeano, M. Tangucci, C. Cini, S. Aquilani, L. Gasperini and P. Meli	Reproductive male-mediated risk: spontaneous abortion among wives of pesticide applicators	2000	This study was conducted among 32 pesticide applicators occupationally exposed to pesticides to determine whether paternal exposure is associated with an increased risk of spontaneous abortion. The ratio of abortion was compared between applicators and a group of 51 food retailers (control population). The ratio of abortions/pregnancies for applicators was 0.27 and for retailers 0.07. OR for spontaneous abortion adjusted for age of wife and smoking of parents is 3.8 times greater than for the control population in the multiple logistic regression model and 7.6 times with interaction effects model.	European Journal of Epidemiology	16	4	391-3	Self-reported exposure			Cross-sectional	Pesticides in general	reproductive	self-reported	Italy	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
414	G. Potashnik and A. Porath	Dibromochloropropane (DBCP): a 17-year reassessment of testicular function and reproductive performance	1995	The current study summarizes a 17-year reevaluation of testicular function and reproductive performance of 15 production workers with dibromochloropropane (DBCP)-induced testicular dysfunction. Sperm count recovery was evident within 36 to 45 months in three of the nine azoospermic and in three of the six oligozoospermic men with no improvement thereafter. A significant increase in plasma follicle-stimulating hormone (FSH) and luteinizing hormone (LH) and a nonsignificant decrease in testosterone level were detected in the severely affected individuals. There was no increase in the rate of spontaneous abortions and congenital malformations among pregnancies conceived during or after exposure. A low prevalence of male infants conceived during paternal exposure was found as compared with the preexposure period (16.6% versus 52.9%; P<.025). Restoration of fertility was followed by a gradual increase of this value to 41.4%.	Journal of Occupational & Environmental Medicine	37	11	1287-92	EAM not reported			Cohort (prospective)	Specific active ingredient	reproductive	medical test result	Israel	hic
415	G. S. Cooper, C. G. Parks, E. L. Treadwell, E. W. St Clair, G. S. Gilkeson and M. A. Dooley	Occupational risk factors for the development of systemic lupus erythematosus	2004	OBJECTIVE: There have been few studies of occupational exposures and systemic lupus erythematosus (SLE). We examined the association between the risk of SLE and occupational exposures (mercury, solvents, and pesticides), specific jobs (ever worked in teaching, healthcare, and cosmetology), and working night or rotating shifts. METHODS: Patients with recently diagnosed SLE (n = 265) were recruited through 4 university based and 30 community based rheumatology practices in North Carolina and South Carolina, USA. Controls (n = 355) were identified through driver's license records and were frequency matched to patients by age, sex, and state. Data collection included an in-person interview with detailed farming and work histories. RESULTS: Associations were seen with self-reported occupational exposure to mercury (OR 3.6, 95% CI 1.3, 10.0), mixing pesticides for agricultural work (OR 7.4, 95% CI 1.4, 40.0), and among dental workers (OR 7.1, 95% CI 2.2, 23.4). Although these associations were fairly strong and statistically significant, the prevalence of these exposures was very low and thus these estimates are based on a small number of exposed cases and controls. Weaker associations were seen between SLE and shift work (OR 1.6, 95% CI 0.99, 2.7) and among healthcare workers with patient contact (OR 1.7, 95% CI 0.99, 2.9). There was no association of SLE with use of solvents or among teachers or cosmetologists. CONCLUSION: This study reveals the potential contribution of occupational exposures to the development of SLE, and highlights some exposures and experiences that should be examined in other studies using more extensive exposure assessment techniques and in experimental studies of autoimmunity.	Journal of Rheumatology	31	10	1928-33	Self-reported job history			Case-control	Job title	neurological	doctor-diagnosed	USA	hic
416	G. S. Cooper, C. G. Parks, P. S. Schur and P. A. Fraser	Occupational and environmental associations with antinuclear antibodies in a general population sample	2006	Antinuclear antibodies are a hallmark feature of the autoimmune disease systemic lupus erythematosus, and can occur many years before onset of symptoms. The objective of this study was to examine the association between exposures and high-titer antinuclear antibodies in the general population (i.e., people who do not have lupus or other systemic autoimmune diseases). Serum was collected from 266 population-based controls who had been frequency-matched to the age and gender distribution of lupus cases in a 60-county study area in the southeastern United States. A detailed occupational history was collected using a structured interview; information was also collected on hair dye use. Antinuclear antibodies were assayed using HEp-2 cells as substrate. Logistic regression was used to estimate the odds ratio (OR) as a measure of association between exposures and high-titer antinuclear antibody levels, adjusting for age, gender, and race. High-titer antinuclear antibodies (> or =1:160) were observed in 21 subjects (8%). A twofold increased prevalence of high-titer antinuclear antibodies was seen with some occupational exposures (silica dust, pesticides, and sunlight), although none of these individual estimates were statistically significant. The association seen with use of hair dyes was weaker (OR 1.4). There was a suggestion of a dose response with a combined measure based on the summation of exposures (ORs of 1.7, 2.1, and 5.9 for 1, 2, and > or = 3 exposures). These data suggest that occupational exposures may influence the expression of antinuclear antibodies. Larger studies addressing these exposures may provide insights into the mechanisms by which various environmental factors affect the development of autoantibodies and the progression to clinical disease.	Journal of Toxicology & Environmental Health Part A	69	23	59780	Self-reported exposure			Case-control	Pesticides in general	immunological	medical test result	USA	hic
417	G. S. Cooper, S. A. Martin, M. P. Longnecker, D. P. Sandler and D. R. Germolec	Associations between plasma DDE levels and immunologic measures in African-American farmers in North Carolina	2004	Experimental studies in rodents demonstrate evidence of immunosuppressive effects of dietary exposure to DDT [2,2-bis({italic}p{/italic}-chlorophenyl)-1,1,1-trichloroethane], but human data pertaining to immunomodulating effects of DDT exposure are limited. In this study we examined the association between the persistent organochlorine breakdown product 1,1-dichloro-2,2,bis(p-chlorophenyl)ethylene p,p'-DDE) and immunologic measures using blood samples in a relatively highly exposed population of farmers in the United States. Levels of serum immunoglobulin A (IgA) and IgG and the prevalence of antinuclear antibodies in relation to plasma p,p'-DDE levels were evaluated in samples from 137 African-American male farmers (30-88 years of age; median, 64 years). Participants were recruited through black churches in four rural counties in eastern North Carolina. Data collection included a telephone interview pertaining to farming practices and health history, and one blood sample was collected from each participant. Linear and logistic regression, adjusting for age, cholesterol, triglycerides, smoking status, and years of any kind of pesticide use, was used to assess the association between immunologic parameters and plasma levels of p,p'-DDE. The median plasma p,p'-DDE concentration was 7.7 microg/L (range, 0.6-77.4 microg/L). There was no association between p,p'-DDE and IgA in any of the models. IgG levels decreased with increasing p,p'-DDE levels, with a statistically significant decrease of approximately 50% in the highest two categories of exposure (greater than or equal to 6.0 microg/L) compared with values of < 3.0 microg/L. Sixteen (12%) were positive for antinuclear antibodies. The prevalence of antinuclear antibodies was somewhat elevated in the highest category of p,p'-DDE exposure (odds ratio, 1.9; 95% confidence interval, 0.32-11.3; for > or = 12.0 microg/L compared with < 3.0 microg/L p,p'-DDE), but this difference was not statistically significant. These analyses provide evidence that p,p'-DDE modulates immune responses in humans.	Environmental Health Perspectives	112	10	1080-4	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	immunological	medical test result	USA	hic

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418	G. Toft, A. Flyvbjerg and J. P. Bonde	Thyroid function in Danish greenhouse workers	2006	BACKGROUND: From animal studies it is known that currently used pesticides can disturb thyroid function. METHODS: In the present study we investigated the thyroid function in 122 Danish greenhouse workers, to evaluate if greenhouse workers classified as highly exposed to pesticides experiences altered thyroid levels compared to greenhouse workers with lower exposure. Serum samples from the greenhouse workers were sampled both in the spring and the fall to evaluate if differences in pesticide use between seasons resulted in altered thyroid hormone levels. RESULTS: We found a moderate reduction of free thyroxine (FT4) (10-16%) among the persons working in greenhouses with a high spraying load both in samples collected in the spring and the fall, but none of the other measured thyroid hormones differed significantly between exposure groups in the cross-sectional comparisons. However, in longitudinal analysis of the individual thyroid hormone level between the spring and the fall, more pronounced differences where found with on average 32% higher thyroid stimulating hormone (TSH) level in the spring compared to the fall and at the same time a 5-9% lower total triiodthyroxin (TT3), free triiodthyroxine (FT3) and FT4. The difference between seasons was not consistently more pronounced in the group classified as high exposure compared to the low exposure groups. CONCLUSION: The present study indicates that pesticide exposure among Danish greenhouse workers results in only minor disturbances of thyroid hormone levels.	Environmental Health: A Global Access Science Source	5	NA	32	Expert case-by-case assessment			Cohort (prospective)	Chemical class	endocrine/nutritional/metabolical	medical test result	Denmark	hic
419	G. Verma, N. L. Sharma, V. K. Shanker, V. K. Mahajan and G. R. Tegta	Pesticide contact dermatitis in fruit and vegetable farmers of Himachal Pradesh (India)	2007	BACKGROUND: Not many studies on pesticide allergic contact dermatitis are available from Himachal Pradesh (India). OBJECTIVE: We studied the role of commonly used pesticides in causing allergic contact dermatitis in fruit and vegetable farmers in the region. METHODS: 30 fruit and vegetable farmer patients having dermatitis involving face, neck, hands, and feet and 20 controls comprising 2 groups of 10 subjects each: Group-1 had history of exposure to pesticides but no dermatitis and Group-2 having neither dermatitis nor history of exposure to pesticides, were patch tested with 10 most common pesticides used in the region. RESULTS AND CONCLUSION: These 30 patients (M : F 21 : 9) were between 22-81 years of age having dermatitis for 4 days to 20 years with relapses and remissions. 21 patients had seasonal exacerbation. 10 patients attributed exacerbation of dermatitis to exposure to pesticides. Positive patch test reactions from pesticides were observed in 8 patients only. Captan was the most common sensitizer (5 patients), 2 patients were sensitive to propargite. Chlorpyrifos, tree spray oil and thiuram gave positive reaction in 1 patient each. 3 controls from Group-1 showed positive reactions to multiple pesticides. Pesticide related contact dermatitis appears more common than expected.	Contact Dermatitis	57	5	316-20	Job title			Cross-sectional	Job title	dermatological	doctor-diagnosed	India	lmic
420	H. A. Young, P. K. Mills, D. G. Riordan and R. D. Cress	Triazine herbicides and epithelial ovarian cancer risk in central California	2005	OBJECTIVE: We sought to determine whether women with ovarian cancer have increased occupational exposure to triazine herbicides. METHODS: A population-based case-control study of incident cases (n=256) and random digit-dialed control subjects (n=1122) was conducted. Participants were administered telephone interviews to obtain agricultural work history. These histories were used with the statewide pesticide usage database to calculate cumulative exposure estimates. The data were analyzed by stratified analysis and unconditional logistic regression techniques. RESULTS: The analysis of ever versus never occupational exposure to triazines demonstrated that cases were slightly but not significantly more likely to be exposed than control subjects (adjusted odds=1.34; 95% confidence interval=0.77-2.33). There was no evidence of a dose-response relationship between triazines and ovarian cancer (P=0.22). CONCLUSIONS: Considered with previous studies and animal laboratory data, the current evidence is not persuasive as to the presence or absence of an association between ovarian cancer and triazine exposure.	Journal of Occupational & Environmental Medicine	47	11	1148-56	Self-reported exposure			Case-control	Chemical class	cancer	doctor-diagnosed	USA	hic
421	H. B. D. Bueno de Mesquita, G.; Van der Kuip, D. A.; Kogevinas, M.; Winkelmann, R.	Occupational exposure to phenoxy herbicides and chlorophenols and cancer mortality in The Netherlands	1993	As part of the "IARC International Register of Persons Exposed to Phenoxy Herbicides and Contaminants," a cohort of workers who manufacture and prepare chlorophenoxy herbicides was recruited in The Netherlands. The cohort comprised 2,310 workers from two plants, operated by different companies, who were followed during the periods 1955-1985 and 1965-1986, respectively. In 1963, there had been an industrial accident in one factory with concomitant release of dioxin into the environment. Loss to follow-up was 3%. Mortality data on 963 exposed and 1,111 nonexposed men were evaluated by external and internal comparison. Compared with national rates, total mortality (94 deaths, standardized mortality ratio [SMR] = 101; 95% confidence interval [CI], 82-124) and cancer mortality (31 deaths, SMR = 107; 95% CI, 73-152) for exposed workers were not significantly increased. A statistically insignificant increase was observed for non-Hodgkin's lymphoma (2 deaths, SMR = 299; 95% CI, 36-1,078). No cases of soft-tissue sarcoma were encountered. There was no increase in either total mortality (25 deaths, SMR = 111; 95% CI, 72-163) or cancer mortality (10 deaths, SMR = 137; 95% CI, 66-252) among the 139 workers probably exposed to dioxins during the 2,4,5-trichlorophenol production accident or the subsequent clean-up operations. Compared with nonexposed workers, exposed workers did not exhibit a higher total mortality (rate ratio [RR] = 1.28; 95% CI, 0.89-1.82). Mortality due to all cancers (RR = 1.7; 95% CI, 0.9-3.4) and respiratory cancer (RR = 1.7; 95% CI, 0.5-6.3) was insignificantly elevated. These findings suggest that the increases in cancer mortality among workers exposed to phenoxy herbicides and chlorophenols may be attributable to chance. Lack of power prevented evaluation with respect to specific cancers.	American Journal of Industrial Medicine	23	2	289-300	Job title			Cohort (retrospective)	Chemical class	mortality (all cause)	doctor-diagnosed	Netherlands	hic
422	H. Becher, D. Flesch-Janys, T. Kauppinen, M. Kogevinas, K. Steindorf, A. Manz and J. Wahrendorf	Cancer mortality in German male workers exposed to phenoxy herbicides and dioxins	1996	In an occupational cohort study, the relation between exposure to phenoxy herbicides, and contaminants (dioxins and furans) and cancer mortality was investigated. A total of 2,479 workers from four plants in Germany were included, with a mortality follow-up until the end of 1989 (for one cohort, until the end of 1992). A total of 484 deaths were recorded yielding a standardized mortality ratio (SMR) of 101 (95 percent confidence interval [CI] = 92-111) for total mortality, and an SMR of 119 (CI = 100-141) for all malignant diseases. A variety of herbicides was produced, including those which are known to have been contaminated with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). High dioxin and furan exposure (in particular, exposure to TCDD, but also to higher chlorinated dioxins) had occurred in two of the four plants as shown by blood-fat measurements in a sample of workers. Mortality from all neoplasms increased with latency and was highest in the largest plant where the highest TCDD blood levels were recorded. An increased mortality in the total cohort from respiratory cancer (SMR = 154, CI = 115-202), cancer of the buccal cavity and pharynx (SMR = 295, CI = 135-560), and non-Hodgkin's lymphoma (SMR = 326, CI = 119-710) was observed. Our findings are consistent with results from other cohorts which showed an increased overall cancer mortality and mortality of respiratory cancer after long-term exposure to these phenoxy herbicides and dioxins.	Cancer Causes & Control	7	3	312-21	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	Germany	hic

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423	H. Bosma, M. P. van Boxtel, R. W. Ponds, P. J. Houx and J. Jolles	Pesticide exposure and risk of mild cognitive dysfunction	2000	Little is known about the adverse effects of substances, such as pesticides and metals, on the development of mild cognitive dysfunction (MCD). Cross-sectional and prospective data from the Maastricht Aging Study were used to find out the potential neurotoxicity of particular substances. Exposure to pesticides, for example by arable farmers and gardeners, was associated with increased risks of MCD. Exposure to metals and organic solvents was not associated with MCD. Our findings might reflect subtle changes in brain function among people exposed to pesticides.	Lancet	356	9233	912-3	Score	Self-reported exposure		Cohort (prospective)	Pesticides in general	mental disorders	medical test result	Netherlands	hic
424	H. C. Catano, E. Carranza, C. Huamani and A. F. Hernandez	Plasma cholinesterase levels and health symptoms in peruvian farm workers exposed to organophosphate pesticides	2008	The purpose of this study was to examine plasma cholinesterase (PChE) changes and the adverse health effects associated with chronic low-dose exposure to organophosphates (OPs) in a Peruvian agricultural population. A cross-sectional study with a clinical interview and blood tests was performed among 213 farm workers from two subtropical valleys in Peru. The control group consisted of 78 nonexposed workers from the same areas. PChE levels from the two exposed subgroups (pesticide applicators and other agricultural jobs) were significantly lower than those of controls (1554 +/- 315 U/l, 1532 +/- 340 U/l, and 1787 +/- 275 U/l, respectively). Fifteen percent of the exposed population reported a past poisoning by pesticides, all of them needing medical evaluation and treatment. They had significantly lower PChE levels as compared to those without this antecedent. Approximately 61% of the exposed workers reported pesticide-related symptoms, but no significant difference was found in their PChE as compared to workers without symptoms. On the other hand, the use of personal protective equipment (PPE) was significantly associated with higher PChE levels and with a lower risk of reporting pesticide-related symptoms, which supports the benefit from using appropriate protective measures. In conclusion, data indicate that farm workers exposed to OPs in developing countries need to be monitored by means of PChE and an examination of their clinical status, which would allow identification of farm workers most at risk from pesticide toxicity. The use of correct PPE is highly recommended.	Archives of Environmental Contamination & Toxicology	55	1	153-9	Job title			Cross-sectional	Chemical class	NA	self-reported	Peru	umic
425	H. C. Srivastava, G. P. Kumar, A. Hassan, M. Dabhi, C. S. Pant and R. S. Yadav	Evaluation of possible health effects of pyrethroid insecticides, bifenthrin 10% WP, and deltamethrin 25% WG, on spraymen exposed in a field trial in India	2005	NA	Bulletin of Environmental Contamination & Toxicology	75	3	413-20	EAM not reported			NA	NA	NA	NA	China	umic
426	H. D. Bailey, L. Fritschi, C. Infante-Rivard, D. C. Glass, L. Miligi, J. D. Dockerty, T. Lightfoot, J. Clavel, E. Roman, L. G. Spector, P. Kaatsch, C. Metayer, C. Magnani, E. Milne, S. Polychronopoulou, J. Simpson, J. Rudant, V. Sidi, R. Rondelli, L. Orsi, A. Y. Kang, E. Petridou and J. Schuz	Parental occupational pesticide exposure and the risk of childhood leukemia in the offspring: findings from the childhood leukemia international consortium	2014	Maternal occupational pesticide exposure during pregnancy and/or paternal occupational pesticide exposure around conception have been suggested to increase risk of leukemia in the offspring. With a view to providing insight in this area we pooled individual level data from 13 case-control studies participating in the Childhood Leukemia International Consortium (CLIC). Occupational data were harmonized to a compatible format. Pooled individual analyses were undertaken using unconditional logistic regression. Using exposure data from mothers of 8,236 cases, and 14,850 controls, and from fathers of 8,169 cases and 14,201 controls the odds ratio (OR) for maternal exposure during pregnancy and the risk of acute lymphoblastic leukemia (ALL) was 1.01 [95% confidence interval (CI) 0.78, 1.30] and for paternal exposure around conception 1.20 (95% 1.06, 1.38). For acute myeloid leukemia (AML), the OR for maternal exposure during pregnancy was 1.94 (CI 1.19, 3.18) and for paternal exposure around conception 0.91 (CI 0.66, 1.24.) based on data from 1,329 case and 12,141 control mothers, and 1,231 case and 11,383 control fathers. Our finding of a significantly increased risk of AML in the offspring with maternal exposure to pesticides during pregnancy is consistent with previous reports. We also found a slight increase in risk of ALL with paternal exposure around conception which appeared to be more evident in children diagnosed at the age of 5 years or more and those with T cell ALL which raises interesting questions on possible mechanisms.	International Journal of Cancer	135	9	2157-72	Job exposure matrix			Case-control	Pesticides in general	offspring	doctor-diagnosed	AHIC	AHIC
427	H. D. Vlajinac, S. B. Sipetic, J. M. Maksimovic, J. M. Marinkovic, E. D. Dzoljic, I. S. Ratkov and V. S. Kostic	Environmental factors and Parkinson's disease: a case-control study in Belgrade, Serbia.[Erratum appears in Int J Neurosci. 2010 Jul;120(7):521 Note: Hristina, Vlajinac D [corrected to Vlajinac, Hristina D]]	2010	A case-control study was performed in Belgrade in order to investigate the association between Parkinson's disease (PD) and some environmental factors. During the period 2001-2005, 110 new PD cases and 220 hospital controls were interviewed. Cases and controls were matched by sex, age (+/-2 years), and place of residence (urban/rural). According to multivariate conditional logistic regression analysis, PD was positively asssociated with exposure to insecticides (odds ratio (OR) 3.22, 95% confidence interval (95% CI) 1.32-7.87), dyes (OR 25.33; 95% CI, 2.89-222.0), and naphtha and its derivates (OR 9.53; 95% CI, 1.04-86.96), and with gardening (OR 5.51; 95% CI, 3.04-10.01), well water drinking (OR 2.62; 95% CI, 1.40-4.90), and spring water drinking (OR 2.19; 95% CI, 1.15-4.16). Negative association was found for service-sector working (OR 0.15; 95% CI, 0.04-0.59). The results obtained did not changed after adjustment for smoking. The findings of the present study support the role of environmental factors in the occurence of PD.	International Journal of Neuroscience	120	5	361-7	Self-reported exposure			Case-control	Type of pesticide	neurological	medical test result	Serbia	umic
428	H. Dimich-Ward, C. Hertzman, K. Teschke, R. Hershler, S. A. Marion, A. Ostry and S. Kelly	Reproductive effects of paternal exposure to chlorophenate wood preservatives in the sawmill industry.[Erratum appears in Scand J Work Environ Health 1998 Oct;24(5):416]	1996	OBJECTIVES: The purpose of the study was to determine whether paternal occupational exposure to dioxincontaminated chlorophenols is associated with an increased risk of congenital anomalies or other adverse reproductive outcomes in offspring. METHODS: As a result of a multistep linkage, 19675 births between 1952 and 1988 were identified as children of a cohort of 9512 fathers who had worked at least one year in British Columbia sawmills where chlorophenate wood preservatives had been used. A nested case-referent analysis was applied, using conditional logistic regression, with five referents matched per case according to year of birth and gender. Chlorophenate exposure was based on expert raters' estimations of hours of exposure applied to specific time windows prior to birth. RESULTS: The offspring of male sawmill workers were at increased risk for developing congenital anomalies of the eye, particularly congenital cataracts; elevated risks for developing anencephaly or spina bifida and congenital anomalies of genital organs were shown according to specific windows of exposure. No associations were found for low birthweight, prematurity, stillbirths, or neonatal deaths. CONCLUSIONS: The study adds further support to the hypothesis of male-mediated developmental toxicity. Paternal exposure to chlorophenates was associated with the development of certain congenital anomalies in offspring.	Scandinavian Journal of Work, Environment & Health	22	4	267-73	Expert case-by-case assessment			Case-control	Specific active ingredient	reproductive	medical test result	Canada	hic

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429	H. F. W. Thomas, P. D.; Donaldson, L. J.	Cancer mortality among local authority pest control officers in England and Wales	1996	OBJECTIVE: To examine cancer mortality by tumour site among local authority pest control officers. METHODS: Prospective mortality study, and follow up to the end of 1994, of 1485 male pest control officers aged between 17 and 69 and employed in 296 local authorities in England and Wales for at least six months between January 1980 and April 1984. Observed numbers of deaths were compared with those expected on the basis of the rates for relevant calendar year, cause, sex, and age specific groups for England and Wales. RESULTS: 200 deaths occurred during the follow up period of which 65 were certified as due to malignant neoplasms. No tumour type showed significantly more deaths than expected. Total all cause, lung cancer, and respiratory disease mortality were significantly lower than expected. CONCLUSIONS: 15 year follow up of a group of men handling a wide range of pesticides did not show any significant risk of cancer. This may be partially explained by the healthy worker effect and also the limited power of the study to detect significant increases in the less common tumours. Further long term follow up of this cohort will continue. Chemical control of pests that can cause human disease and can contaminate food and water has been, and will continue to be, a major public health measure. It is important to ensure that the health of those applying pesticides is not at excess risk. Negative results are important.	Occupational & Environmental Medicine	53	11	787-90	Job title			Cohort (prospective)	Job title	mortality (all cause)	doctor-diagnosed	UK	hic
430	H. H. McDuffie, P. Pahwa, C. P. Karunanayake, J. J. Spinelli and J. A. Dosman	Clustering of cancer among families of cases with Hodgkin Lymphoma (HL), Multiple Myeloma (MM), Non-Hodgkin's Lymphoma (NHL), Soft Tissue Sarcoma (STS) and control subjects	2009	BACKGROUND: A positive family history of chronic diseases including cancer can be used as an index of genetic and shared environmental influences. The tumours studied have several putative risk factors in common including occupational exposure to certain pesticides and a positive family history of cancer. METHODS: We conducted population-based studies of Hodgkin lymphoma (HL), Multiple Myeloma (MM), non-Hodgkin's Lymphoma (NHL), and Soft Tissue Sarcoma (STS) among male incident case and control subjects in six Canadian provinces. The postal questionnaire was used to collect personal demographic data, a medical history, a lifetime occupational history, smoking pattern, and the information on family history of cancer. The family history of cancer was restricted to first degree relatives and included relationship to the index subjects and the types of tumours diagnosed among relatives. The information was collected on 1528 cases (HL (n = 316), MM (n = 342), NHL (n = 513), STS (n = 357)) and 1506 age +/- 2 years and province of residence matched control subjects. Conditional logistic regression analyses adjusted for the matching variables were conducted. RESULTS: We found that most families were cancer free, and a minority included two or more affected relatives. HL [(OR(adj) (95% CI) 1.79 (1.33, 2.42)], MM (1.38(1.07, 1.78)), NHL (1.43 (1.15, 1.77)), and STS cases (1.30(1.00, 1.68)) had higher incidence of cancer if any first degree relative was affected with cancer compared to control families. Constructing mutually exclusive categories combining "family history of cancer" (yes, no) and "pesticide exposure > or = 10 hours per year" (yes, no) indicated that a positive family history was important for HL (2.25(1.61, 3.15)), and for the combination of the two exposures increased risk for MM (1.69(1.14,2.51)). Also, a positive family history of cancer both with (1.72 (1.21, 2.45)) and without pesticide exposure (1.43(1.12, 1.83)) increased risk of NHL. CONCLUSION: HL, MM, NHL, and STS cases had higher incidence of cancer if any first degree relative affected with cancer compared to control families. A positive family history of cancer and/or shared environmental exposure to agricultural chemicals play an important role in the development of cancer.	BMC Cancer	9	NA	70	Self-reported job history			Case-control	Job title	cancer	doctor-diagnosed	Canada	hic
431	H. H. McDuffie, P. Pahwa, D. Robson, J. A. Dosman, S. Fincham, J. J. Spinelli and J. R. McLaughlin	Insect repellents, phenoxyherbicide exposure, and non-Hodgkin's lymphoma	2005	OBJECTIVE: We sought to test a hypothetical explanation of contradictory results in studies of phenoxyherbicides and NHL, that the exposure of rubber gloves recommended for use by farmers when mixing or applying pesticides simultaneously to 2,4-D (2,4-dichlorophenoxyacetic acid), DEET (N,N-diethyl-m-toluamide), and ultraviolet rays increased their permeability to 2,4-D. METHODS: We conducted a case (NHL n = 513)/control (n = 1506) study among men using age; province of residence; exposure to insect repellents containing DEET, phenoxy-herbicides, or dicamba; and gloves when handling pesticides. RESULTS: Using conditional logistic regression, the stratum with reported exposure to mecoprop, to DEET and the use of rubber gloves had higher odds ratios (3.86; 95% confidence interval = 1.57-9.49) compared with strata with other combinations. CONCLUSIONS: In conclusion, the etiologic complexity of NHL was demonstrated.	Journal of Occupational & Environmental Medicine	47	8	806-16	Self-reported exposure			Case-control	Chemical class	cancer	doctor-diagnosed	Canada	hic
432	H. H. P. McDuffie, P.; Spinelli, J. J.; McLaughlin, J. R.; Fincham, S.; Robson, D.; Dosman, J. A.; Hu, J.	Canadian male farm residents, pesticide safety handling practices, exposure to animals and non-Hodgkin's lymphoma (NHL)	2002	BACKGROUND: A majority of published studies indicate that farmers have an elevated risk of developing non-Hodgkin's lymphoma (NHL) compared to other workers. METHODS: We evaluated accidental exposure to pesticides, the use of personal protective equipment, and exposure to animals among male farm residents in a Canadian population-based, multi-centre, NHL-control questionnaire study. RESULTS: In a multivariate model, the following variables had statistically significant adjusted odds ratios (OR) using 95% confidence intervals (95% CI) (a) higher risk: having more than 13 head of swine, raising bison, elk or ostriches, a personal history of cancer, > 4 and < or = 15 years of farm residence and occupational exposure to diesel fuel and exhaust; (b) lower risk: raising cattle and a personal history of measles. CONCLUSIONS: Future multidisciplinary studies of NHL should include a comprehensive review of exposure to animals in sufficient detail to assess etiological mechanisms to explain the putative associations between exposure to farm animals and NHL.	American Journal of Industrial Medicine	NA	NA	54-61	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Canada	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
433	H. Hamsan, Y. B. Ho, S. Z. Zaidon, Z. Hashim, N. Saari and A. Karami	Occurrence of commonly used pesticides in personal air samples and their associated health risk among paddy farmers	2017	Tanjung Karang, Selangor, is widely known for its paddy cultivation activity and hosts the third largest paddy field in Malaysia. Pesticides contamination in agriculture fields has become an unavoidable problem, as pesticides are used to increase paddy productivity and reduce plant disease. Human exposure to agrichemicals is common and could results in both acute and chronic health effects, such as acute and chronic neurotoxicity. This study aims to determine the concentrations of commonly used pesticides (azoxystrobin, buprofezin, chlorantraniliprole, difenoconazole, fipronil, imidacloprid, isoprothiolane, pretilachlor, propiconazole, pymetrozine, tebuconazole, tricyclazole, and trifloxystrobin) in personal air samples and their associated health risks among paddy farmers. Eighty-three farmers from Tangjung Karang, Selangor were involved in this study. A solid sorbent tube was attached to the farmer's breathing zone with a clip, and an air pump was fastened to the belt to collect personal air samples. Pesticides collected in the XAD-2 resin were extracted with acetone, centrifuged, concentrated via nitrogen blowdown and reconstituted with 1<U+00AC><U+2020>mL of 3:1 ultrapure water/HPLC-grade methanol solution. The extract was analyzed using ultra-high-performance liquid chromatography tandem mass spectrometry (UHPLC-MS/MS). The target compounds were detected with a maximum concentration reaching up to 462.5<U+00AC><U+2020>ng<U+00AC><U+2020>m<U+201A><U+00E0><U+00ED><U+00AC><U+2020>3 (fipronil). The hazard quotient (HQ) was less than 1 and the hazard index (HI) value was 3.86<U+00AC><U+2020><U+221A><U+00F3><U+00AC><U+2020>10<U+201A><U+00E0><U+00ED><U+00AC><U+2020>3, indicating that the risk of pesticides related diseases was not significant. The lifetime cancer risk (LCR) for pymetrozine was at an acceptable level (LCR<U+00AC><U+2020><<U+00AC><U+2020>10<U+201A><U+00E0><U+00ED><U+00AC><U+2020>6) with 4.10<U+00AC><U+2020><U+221A><U+00F3><U+00AC><U+2020>10<U+201A><U+00E0><U+00ED><U+00AC><U+2020>8. The results reported in this study can be beneficial in terms of risk management within the agricultural community.	Science of the Total Environment	603	NA	381-389	Personal air sampling			Cross-sectional	Specific active ingredient	cancer	doctor-diagnosed	Malaysia	umic
434	H. Haydeh	Evaluation of risk factors in children with acute lymphoblastic leukemia in mashhad-iran	2013	Background: Childhood leukemia comprises 35% of all malignancies in Children fewer than 15 years of age. Acute lymphoblastic leukemia (ALL) accounts for approximately 75-80% of childhood leukemia with an incidence of 0. 004%, that shows a peak between 3-5 years of age. The cause of leukemia is not exactly clear, but some researches have shown a significant relation between some factors and this type of cancer. In this survey we wanted to find the effective factors causing cancer in children in Mashhad Iran. Materials and Methods: Since cancer is a rare disease, the best method for the study is the case - control study. The adequate sample size was 100 cases and 400 controls. Controls were matched with cases regarding their sex, age and habitation. Data collection method was face to face interview with patients' mothers and the questionnaires were filled out by the investigator. After data collection, they were analyzed by conditional logistic regression. For data analyzing SPSS softwares were used. Findings: According to the findings of this study, maternal use of oral contraceptives, living in proximity to high voltage power lines, in-utero ionizing radiation exposure, pesticide exposure in fathers and paternal occupation and parental smoking had a significant relation with this type of cancer. Conclusion: According to the results of this study, it seems that genetic, prenatal, perinatal and environmental factors have an important role in etiology of this cancer and knowing these facts are important for the prevention of cancer.	Iranian Journal of Pediatrics	23	NA	S95	Self-reported exposure			Cross-sectional	Pesticides in general	offspring	doctor-diagnosed	Iran	umic
435	H. Heacock, C. Hertzman, P. A. Demers, R. Gallagher, R. S. Hogg, K. Teschke, R. Hershler, C. D. Bajdik, H. Dimich-Ward, S. A. Marion, A. Ostry and S. Kelly	Childhood cancer in the offspring of male sawmill workers occupationally exposed to chlorophenate fungicides	2000	The objective of this study was to determine whether paternal occupational exposure to chlorophenol fungicides and their dioxin contaminants is associated with childhood cancer in the offspring of sawmill workers. We used data from 23,829 British Columbian sawmill workers employed for at least 1 continuous year between 1950 and 1985 in 11 sawmills that used chlorophenates. Probabilistic linkage of the sawmill worker cohort to the provincial marriage and birth files produced an offspring cohort of 19,674 children born at least 1 year after the initiation of employment in the period 1952-1988. We then linked the offspring cohort to the British Columbia Cancer Registry. We included all malignancies in cases younger than 20 years of age that appeared on the cancer registry between 1969 and 1993. We calculated standardized incidence ratios (SIRs) using the British Columbia population as a reference. A nested case-control analysis assessed the effects of paternal cumulative exposure and windows of exposure on the risk of developing cancer in the offspring. We identified 40 cases of cancer during 259,919 person-years of follow-up. The all-cancer SIR was 1.0 [95% confidence interval (CI), 0.7-1.4]; the SIR for leukemia was 1.0 (CI, 0.5-1.8); and the SIR for brain cancer was 1.3 (CI, 0.6-2.5). The nested case-control analysis showed slightly increased risks in the highest categories of chlorophenol exposure, although none was statistically significant. Our analyses provide little evidence to support a relationship between the risk of childhood cancer and paternal occupational exposure to chlorophenate fungicides in British Columbian sawmills.	Environmental Health Perspectives	108	6	499-503	Registers			Case-control	Chemical class	offspring	doctor-diagnosed	Canada	hic
436	H. Heacock, R. Hogg, S. A. Marion, R. Hershler, K. Teschke, H. Dimich-Ward, P. Demers, S. Kelly, A. Ostry and C. Hertzman	Fertility among a cohort of male sawmill workers exposed to chlorophenate fungicides	1998	The purpose of this study was to determine whether exposure to chlorophenate fungicides and their dioxin contaminants is associated with male infertility among sawmill workers. The study was conducted using fertility data compiled from 26,487 sawmill workers in 14 British Columbian sawmills. Our analysis was restricted to workers who had been employed for at least 1 continuous year between 1950 and 1985 and to live-births born at least 1 year after the initiation of employment in the period 1955-1988. We assessed fertility trends by internal comparison using Mantel-Haenszel rate ratios and by calculating standardized fertility ratios using an external and an internal reference population. We identified 19,684 births in the study period. Initially, both external and internal analyses showed that sawmill workers from mills using chlorophenates had lower fertility than workers employed in mills not using chlorophenates. After controlling for time since first hire, however, we found no inverse relation between cumulative exposure to chlorophenate fungicides and fertility. Based on the results of our study, there is little evidence for a reduction in fertility among chlorophenate-exposed sawmill workers in British Columbia. The analyses indicate the importance of time since hire as a potentially strong confounder in this type of investigation.	Epidemiology	9	1	56-60	Index			Cohort (prospective)	Chemical class	reproductive	medical test result	Canada	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
437	H. Heiskel, D. Gunzenh<U+221A><U+00A7>user, S. Volk, B. Pflug, G. Elsner and A. Seidler	Occupational influencing factors on obstructive sleep apnea - A case-control study	2003	In a case-control study, we investigated the connection of sleep apnea (OSA) with occupations and occupational exposure to neurotoxic substances such as varnish, pesticides, lead, arsenic and mercury. 443 OSA cases were compared with 397 population controls (1st control group) and with 106 patients with OSA having been excluded during the investigation period (2nd control croup). Data were gathered by means of a self-administered questionnaire. Adjusted odds ratios were calculated for age, region, body-mass index (BMI), cigarette smoking and alcohol consumption using logistic regression analysis. There were discrete indications of a possible relationship between OSA and exposure to mercury and to pesticides. At the time of diagnosis, OSA patients were significantly more often occupied in service occupations; this might be explained by epidemiological aspects (reporting and treatment behaviour, insurance in case of illness). In summary, these results do not support any indications of an etiological significance of occupational factors.	Zentralblatt fur Arbeitsmedizin, Arbeitsschutz und Ergonomie	53	9	497-507	Self-reported exposure			Case-control	Pesticides in general	circulatory	doctor-diagnosed	Germany	hic
438	H. K. Jensen, F. Konradsen, E. J<U+221A><U+220F>rs, J. H. Petersen and A. Dalsgaard	Pesticide use and self-reported symptoms of acute pesticide poisoning among aquatic farmers in phnom penh, cambodia	2011	Organophosphates and carbamates (OPs/CMs) are known for their acetylcholinesterase inhibiting character. A cross-sectional study of pesticide handling practices and self-perceived symptoms of acute pesticide poisoning was conducted using questionnaire-based interviews with 89 pesticide sprayers in Boeung Cheung Ek (BCE) Lake, Phnom Penh, Cambodia. The study showed that 50 of the pesticides used belonged to WHO class I + II and personal protection among the farmers were inadequate. A majority of the farmers (88) had experienced symptoms of acute pesticide poisoning, and this was significantly associated with the number of hours spent spraying with OPs/CMs (OR = 1.14, CI 95: 1.02-1.28). The higher educated farmers reduced their risk of poisoning by 55 for each extra personal protective measure they adapted (OR = 0.45, CI 95: 0.22-0.91). These findings suggest that improving safe pesticide management practices among the farmers and enforcing the effective banning of the most toxic pesticides will considerably reduce the number of acute pesticide poisoning episodes. <U+00AC><U+00A9> 2011 Hanne Klith Jensen et al.	Journal of Toxicology	2011	NA	NA	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	Cambodia	lmic
439	H. K. Kang, N. A. Dalager, L. L. Needham, D. G. Patterson, Jr., P. S. Lees, K. Yates and G. M. Matanoski	Health status of Army Chemical Corps Vietnam veterans who sprayed defoliant in Vietnam.[Erratum appears in Am J Ind Med. 2018 Apr;61(4):358; PMID: 29542197]	2006	BACKGROUND: U.S. Army Chemical Corps veterans handled and sprayed herbicides in Vietnam resulting in exposure to Agent Orange and its contaminant 2,3,7, 8-tetrachlorodibenzo-p-dioxin (TCDD or dioxin). This study examined the long-term health effects associated with herbicide exposure among these Vietnam veterans. METHODS: A health survey of these 1,499 Vietnam veterans and a group of 1,428 non-Vietnam veterans assigned to chemical operations jobs was conducted using a computer-assisted telephone interview (CATI) system. Exposure to herbicides was assessed by analyzing serum specimens from a sample of 897 veterans for dioxin. Logistic regression analyses were used to estimate the risk of selected medical outcomes associated with herbicide exposure. RESULTS: Odds ratios for diabetes, heart disease, hypertension, and chronic respiratory disease were elevated, but not significantly (P>0.05) for those who served in Vietnam. However, they were significantly elevated among those Vietnam veterans who sprayed herbicides: diabetes, odds ratio (OR)=1.50 (95% confidence interval [95%CI]=1.15-1.95); heart disease, OR=1.52 (1.18-1.94); hypertension, OR=1.32 (1.08-1.61); and chronic respiratory condition, OR=1.62 (1.28-2.05). Hepatitis was associated with Vietnam service, but not with herbicide application. CONCLUSIONS: Vietnam veterans who were occupationally exposed to herbicide experienced a higher risk of several chronic medical conditions relative to other non-Vietnam veterans. A potential selection bias is of concern. However, there were relatively high participation rates in both the Vietnam and non-Vietnam veteran groups, and the prevalence rates of some of these medical conditions among non-Vietnam veterans were comparable to general populations. Therefore, self-selection factors are considered unlikely to have biased the study results.	American Journal of Industrial Medicine	49	11	875-84	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	NA	self-reported	USA	hic
440	H. Kelsall, R. Macdonell, M. Sim, A. Forbes, D. McKenzie, D. Glass, J. Ikin and P. Ittak	Neurological status of Australian veterans of the 1991 Gulf War and the effect of medical and chemical exposures	2005	BACKGROUND: Since the 1991 Gulf War, concerns have been voiced about the effects on the health of veterans of Gulf War related medical and chemical exposures. METHODS: Our cross-sectional study compared 1424 male Australian Gulf War veterans and a randomly sampled military comparison group (n = 1548). A postal questionnaire asked about the presence of current neurological type symptoms, medically diagnosed neurological conditions, and medical and chemical exposures. A neurological examination was performed as part of a physical assessment. RESULTS: Veterans have a higher prevalence of neurological type symptoms (ratio of means 1.4, 95% confidence interval (CI) 1.2-1.5). Although the odds ratio (OR) of lower limb neurological type symptoms and signs in veterans compared with the comparison group was increased (OR = 1.6, 95% CI 1.0-2.7), it was of borderline significance, and there was no difference between groups according to a Neuropathy Score based on neurological signs alone (ratio of means 1.1, 95% CI 0.9-1.3). The increased OR of neurological type symptoms and signs suggestive of a central nervous system disorder (OR = 1.8, 95% CI 1.0-3.1) was also of borderline significance. Veterans were not more likely to have self-reported medically diagnosed neurological conditions, or to have neurological type symptoms and signs suggestive of an anterior horn cell disorder (OR = 0.9, 95% CI 0.5-1.6). The total number of neurological type symptoms reported by veterans, but not the Neuropathy Score, was associated with Gulf War related exposures including immunizations and pyridostigmine bromide in dose-response relationships, anti-biological warfare tablets, solvents, pesticides, and insect repellents. CONCLUSIONS: This study shows increased reporting of neurological type symptoms in Gulf War veterans, but no evidence for increased neurological effects based on objective physical signs. There may be a number of factors, including information bias, relating to increased neurological type symptom reporting in veterans.	International Journal of Epidemiology	34	4	810-9	Self-reported exposure			Cross-sectional	Pesticides in general	neurological	self-reported	Australia	hic
441	H. L. Guida, R. G. Morini and A. C. Cardoso	Audiological evaluation in workers exposed to noise and pesticide	2010	UNLABELLED: Noise-induced hearing loss has been studied for many years and today many experts also investigate the synergic action of chemical products, since they can be potentially ototoxic. AIM: to investigate the audiological findings in workers exposed to occupational noise and pesticide and to compare it to data from noise-exposed workers. STUDY DESIGN: Clinical retrospective. MATERIAL AND METHOD: individuals that had been exposed to pesticide and noise (group I), and individuals that had been exposed to noise only (group II). RESULTS: The classification of the audiometric findings showed in that group I: 35% had normal hearing thresholds, 53.75% had degree 1 hearing loss and 11.25% had degree 2 hearing loss; and group II had 57.5% of normal hearing, 40% had degree 1 hearing loss and only 2.5% had degree 2 hearing loss. The analysis of the audiometric findings also showed a significant worsening after comparing groups I and II thresholds, in the frequency of 3 kHz on the left ear and 4 kHz on both ears. CONCLUSION: The analysis showed that group I had worse audiometric thresholds compared to group II.	Revista Brasileira de Otorrinolaringologia	76	4	423-7	Job title			Cohort (retrospective)	Job title	other	other	Brazil	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
442	H. L. Kelsall, M. R. Sim, A. B. Forbes, D. C. Glass, D. P. McKenzie, J. F. Ikin, M. J. Abramson, L. Blizzard and P. Ittak	Symptoms and medical conditions in Australian veterans of the 1991 Gulf War: relation to immunisations and other Gulf War exposures	2004	AIMS: To investigate whether Australian Gulf War veterans have a higher than expected prevalence of recent symptoms and medical conditions that were first diagnosed in the period following the 1991 Gulf War; and if so, whether these effects were associated with exposures and experiences that occurred in the Gulf War. METHODS: Cross-sectional study of 1456 Australian Gulf War veterans and a comparison group who were in operational units at the time of the Gulf War, but were not deployed to that conflict (n = 1588). A postal questionnaire was administered and the likelihood of the diagnosis of self-reported medical conditions was assessed and rated by a medical practitioner. RESULTS: Gulf War veterans had a higher prevalence of all self-reported health symptoms than the comparison group, and more of the Gulf War veterans had severe symptoms. Increased symptom reporting was associated with several exposures, including having more than 10 immunisations, pyridostigmine bromide tablets, anti-biological warfare tablets, pesticides, insect repellents, reportedly being in a chemical weapons area, and stressful military service experiences in a strong dose-response relation. Gulf War veterans reported psychological (particularly post-traumatic stress disorder), skin, eye, and sinus conditions first diagnosed in 1991 or later more commonly than the comparison group. Over 90% of medical conditions reported by both study groups were rated by a medical practitioner as having a high likelihood of diagnosis. CONCLUSION: More than 10 years after the 1991 Gulf War, Australian veterans self-report all symptoms and some medical conditions more commonly than the comparison group. Further analysis of the severity of symptoms and likelihood of the diagnosis of medical conditions suggested that these findings are not due to over-reporting or to participation bias.	Occupational & Environmental Medicine	61	12	1006-13	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	Australia	hic
443	H. P. Rees, A.; Thompson, J.; Karalliedde, L.	Sheep dipping, related treatments and <U+201A><U+00C4><U+00FA>dippers' flu<U+201A><U+00C4><U+00F9>	2011	Objectives Study of acute health effects in farmers following treatment of sheep for ectoparasites. Methods Prospective cohort study of UK sheep farmers in 2005-6. Data collected before treatment included medical history, a detailed symptom questionnaire, serum butyrylcholinesterase and urine organophosphate & synthetic pyrethroid metabolites. After treatment urine metabolites, serology for infectious agents, clinical haematology & biochemistry were collected. Results 8747 subjects were randomly selected. 781 (8.9%) participated before treatment (56%, 21% & 22% from Wales, NW & SE England respectively). 156 were studied after treatment. These response rates are unlikely to be bettered in this population. Farmers treated a mean number of 500 sheep over 1days. 28% dipped with organophosphates, others used synthetic pyrethroids cyromazine and avermectins. Following treatment farmers exhibited rises in the metabolites of licensed pesticides, but mean levels were similar to those found in non-occupationally exposed populations. There were no significant changes in butyrylcholinesterase activity. There was very low symptom prevalence before and after treatment and little relationship between symptoms and pesticide metabolites. General health status before treatment was the principal factor associated with symptoms at all stages of the study. Farmers reported symptoms commonly found in the general population and these suggested neither pesticide toxicity nor a distinct syndrome. Serology, biochemistry & haematology did not indicate significant pathological effects. Conclusions In recent decades a putative syndrome <U+201A><U+00C4><U+00FA>dippers' flu<U+201A><U+00C4><U+00F9> has been the subject of intense speculation unsupported by evidence. In this study a distinct syndrome was not found. This was unlikely to have been masked by biases and confounders.	Occupational and Environmental Medicine	68	NA	A120	Job title			Cohort (prospective)	Job title	pesticide-related symptoms	self-reported	UK	hic
444	H. Petrovitch, G. W. Ross, R. D. Abbott, W. T. Sanderson, D. S. Sharp, C. M. Tanner, K. H. Masaki, P. L. Blanchette, J. S. Popper, D. Foley, L. Launer and L. R. White	Plantation work and risk of Parkinson disease in a population-based longitudinal study	2002	CONTEXT: Parkinson disease (PD) has an unknown cause; however, convincing evidence is emerging that indicates pesticides can selectively injure the dopaminergic system in laboratory animals. Retrospective studies in humans demonstrate a link between exposure to agricultural lifestyle factors and PD. OBJECTIVE: To determine whether working on a plantation in Hawaii and exposure to pesticides are associated with an increased risk of PD decades later. DESIGN AND SETTING: Prospective cohort study based on the island of Oahu, Hawaii, with 30 years of follow-up. Years of work on a plantation were assessed by questionnaire at study enrollment in 1965. Self-reported information on pesticide exposure was collected at a separate examination 6 years later. PARTICIPANTS: Participants were 7986 Japanese American men born between 1900 and 1919 who were enrolled in the longitudinal Honolulu Heart Program. MAIN OUTCOME MEASURES: Incident PD was determined by medical record review or by an examination conducted by a study neurologist at a later date. RESULTS: During follow-up, 116 men developed PD. Age-adjusted incidence increased significantly among men who worked more than 10 years on a plantation. The relative risk of PD was 1.0 (95% confidence interval, 0.6-1.6), 1.7 (95% confidence interval, 0.8-3.7), and 1.9 (95% confidence interval, 1.0-3.5) for men who worked on a plantation 1 to 10 years, 11 to 20 years, and more than 20 years compared with men who never did plantation work (P =.006, test for trend). Age-adjusted incidence of PD was higher in men exposed to pesticides than in men not exposed to pesticides although this was not statistically significant (P =.10, test for trend). CONCLUSION: These longitudinal observations regarding plantation work in Hawaii support case-control studies suggesting that exposure to pesticides increases the risk of PD.	Archives of Neurology	59	11	1787-92	Self-reported exposure			Cohort (prospective)	Pesticides in general	neurological	doctor-diagnosed	USA	hic
445	H. R. Andersen, C. Wohlfahrt-Veje, C. Dalgard, L. Christiansen, K. M. Main, C. Nellemann, K. Murata, T. K. Jensen, N. E. Skakkebaek and P. Grandjean	Paraoxonase 1 polymorphism and prenatal pesticide exposure associated with adverse cardiovascular risk profiles at school age	2012	BACKGROUND: Prenatal environmental factors might influence the risk of developing cardiovascular disease later in life. The HDL-associated enzyme paraoxonase 1 (PON1) has anti-oxidative functions that may protect against atherosclerosis. It also hydrolyzes many substrates, including organophosphate pesticides. A common polymorphism, PON1 Q192R, affects both properties, but a potential interaction between PON1 genotype and pesticide exposure on cardiovascular risk factors has not been investigated. We explored if the PON1 Q192R genotype affects cardiovascular risk factors in school-age children prenatally exposed to pesticides. METHODS: Pregnant greenhouse-workers were categorized as high, medium, or not exposed to pesticides. Their children underwent a standardized examination at age 6-to-11 years, where blood pressure, skin folds, and other anthropometric parameters were measured. PON1-genotype was determined for 141 children (88 pesticide exposed and 53 unexposed). Serum was analyzed for insulin-like growth factor I (IGF-I), insulin-like growth factor binding protein 3 (IGFBP3), insulin and leptin. Body fat percentage was calculated from skin fold thicknesses. BMI results were converted to age and sex specific Z-scores. RESULTS: Prenatally pesticide exposed children carrying the PON1 192R-allele had higher abdominal circumference, body fat content, BMI Z-scores, blood pressure, and serum concentrations of leptin and IGF-I at school age than unexposed children. The effects were related to the prenatal exposure level. For children with the PON1 192QQ genotype, none of the variables was affected by prenatal pesticide exposure. CONCLUSION: Our results indicate a gene-environment interaction between prenatal pesticide exposure and the PON1 gene. Only exposed children with the R-allele developed adverse cardiovascular risk profiles thought to be associated with the R-allele.	PLoS ONE [Electronic Resource]	7	5	e36830	Expert case-by-case assessment			Cohort (prospective)	Pesticides in general	genetic (biomarkers)	medical test result	Denmark	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
446	H. R. Andersen, I. M. Schmidt, P. Grandjean, T. K. Jensen, E. Budtz-Jorgensen, M. B. Kjaerstad, J. Baelum, J. B. Nielsen, N. E. Skakkebaek and K. M. Main	Impaired reproductive development in sons of women occupationally exposed to pesticides during pregnancy	2008	OBJECTIVES: The aim of this prospective study was to investigate whether occupational pesticide exposure during pregnancy causes adverse effects on the reproductive development in the male infants. DESIGN AND MEASUREMENTS: Pregnant women employed in greenhouses in Denmark were consecutively recruited, and 113 mother-son pairs were included. The mothers were categorized as occupationally exposed (91 sons) or unexposed (22 sons) to pesticides during pregnancy. Testicular position and volume, penile length, and position of urethral opening were determined at 3 months of age using standardized techniques. Concentrations of reproductive hormones in serum from the boys were analyzed. RESULTS: The prevalence of cryptorchidism at 3 months of age was 6.2% [95% confidence interval (CI), 3.0-12.4]. This prevalence was considerably higher than among Danish boys born in the Copenhagen area (1.9%; 95% CI, 1.2-3.0) examined by the same procedure. Boys of pesticide-exposed mothers showed decreased penile length, testicular volume, serum concentrations of testosterone, and inhibin B. Serum concentrations of sex hormone-binding globulin, follicle-stimulating hormone, and the luteinizing hormone:testosterone ratio were increased compared with boys of nonexposed mothers. For individual parameters, only the decreased penile length was statistically significant (p = 0.04). However, all observed effects were in the anticipated direction, and a joint multivariate test showed that this finding had a p-value of 0.012. CONCLUSIONS: Our findings suggest an adverse effect of maternal occupational pesticide exposure on reproductive development in the sons despite current greenhouse safeguards and special measures to protect pregnant women.	Environmental Health Perspectives	116	4	566-72	Self-reported exposure			Cohort (prospective)	Pesticides in general	offspring	medical test result	Denmark	hic
447	H. R. D. Andersen, F.; Wohlfahrt-Veje, C.; Murata, K.; Grandjean, P.	Occupational pesticide exposure in early pregnancy associated with sex-specific neurobehavioral deficits in the children at school age	2015	Prenatal exposure to pesticides may affect neurodevelopment, while the impact of modern pesticides is unclear. From 1997-2001, women working in greenhouse horticultures were recruited at the beginning of their pregnancy. Based on detailed interview of the women and their employers, those categorized as occupationally exposed to pesticides were moved to unexposed work functions or went on paid leave, while women without any exposure were considered unexposed controls. Of the resulting birth cohort of 203 children, 133 (65%) were examined at age 6 to 11. years together with 44 newly recruited children of same age whose mothers were not occupationally exposed to pesticides in pregnancy. All children underwent a standardized examination including a battery of neurodevelopmental tests. Maternal occupational pesticide exposure in early pregnancy was associated with prolonged brainstem auditory evoked potential latencies in the children as a whole and with impaired neuropsychological function in girls, while no effect was apparent in boys. In girls, language and motor speed functions were significantly inversely associated with prenatal exposure, and a non-significant tendency toward decreased function was also seen for other neuropsychological outcomes. A structural equation model that combined all these test results showed an overall impaired neuropsychological function in girls prenatally exposed to pesticides. Thus, our findings suggest an adverse effect of maternal occupational pesticide exposure on their children's neurodevelopment, despite the fact that the exposures occurred solely during early pregnancy and under well regulated working conditions, where special measures to protect pregnant women were applied.	Neurotoxicology and Teratology	47	NA	43109	Self-reported exposure			Cohort (prospective)	Pesticides in general	offspring	doctor-diagnosed	Denmark	hic
448	H. R. Joshaghani, A. R. Ahmadi and A. R. Mansourian	Effects of occupational exposure in pesticide plant on workers' serum and erythrocyte cholinesterase activity	2007	OBJECTIVES: The determination of cholinesterase activity has been commonly applied in the biomonitoring of exposure to organophosphates and carbamates and in the diagnosis of poisoning with anticholinesterase compounds. One of the groups who are at risk of pesticide intoxication are the workers engaged in the production of these chemicals. AIMS: The aim of this study was to assess the effect of pesticides on erythrocyte and serum cholinesterase activity in workers occupationally exposed to these chemicals. METHODS: The subjects were 63 workers at a pesticide plant. Blood samples were collected before they were employed (phase I) and after 3 months of working in the plant (phase II). Cholinesterase level in erythrocytes (EChE) was determined using the modified Ellman method, and serum cholinesterase (SChE) by butyrylthiocholine substrate assay. RESULTS: The mean EChE levels were 48+/-11 IU/g Hb in phase I and 37+/-17 IU/g Hb in phase II (paired t-test, mean=-29; 95% CI=-43-14), p<0.001). The mean SChE level was 9569+/-2496 IU/l in phase I, and 7970+/-2067 IU/l in phase II (paired t-test, mean=1599; 95% CI=1140-2058, p<0.001). There was a significant increase in ALT level (p < 0.001) and a decrease in serum albumin level (p<0.001). CONCLUSION: In view of the significant decrease in EChE and SChE levels among pesticide workers, it seems that routine assessment of cholinesterase level in workers employed in such occupations and people handling pesticides should be made obligatory.	International Journal of Occupational Medicine & Environmental Health	20	4	381-5	Self-reported exposure			Cohort (prospective)	Pesticides in general	neurological	medical test result	Iran	umic
449	H. Rees	Exposure to sheep dip and the incidence of acute symptoms in a group of Welsh sheep farmers	1996	OBJECTIVES: To measure the exposure of a group of farmers to organophosphate pesticide in sheep dip, and to record the incidence of symptoms after exposure. DESIGN: A prospective study of the autumn 1992 dipping period. Working methods were assessed by questionnaire. Absorption of organophosphate pesticide was estimated before, immediately after, and six weeks after dipping by measuring plasma cholinesterase, erythrocyte cholinesterase, and dialkylphosphate urinary metabolites of organophosphates. Symptoms were recorded by questionnaire at the same time as biological monitoring. Possible confounding factors were identified by medical examination of the subjects. SETTING: Three community council electoral wards in Powys, typical of hill sheep farming areas in Wales. SUBJECTS: All (38) men engaged in sheep dipping living in the three community council electoral wards. RESULTS: 23 sheep farmers and one dipping contractor completed the study--a response rate of 63%. A sample of seven men who refused to enter the full study had similar working practices to the 24 subjects. Subjects reported inadequate handling precautions, and significant skin contamination with dip. Two men reported under diluting dip concentrate for use. Both had significant depression of erythrocyte cholinesterase after dipping. This indicated some absorption of organophosphate pesticide--but this did not reach levels usually associated with toxicity. It was not clear whether the symptoms of these two mens were caused by organophosphate exposure. Measurement of dialkylphosphate urinary metabolites in a single specimen of urine voided shortly after the end of dipping could not be correlated with individual exposure. CONCLUSIONS: Sheep dipping is strenuous and dirty work and sheep farmers find it difficult to wear personal protective equipment and avoid skin contamination with dip. In this limited study, farmers did not seem to have significant organophosphate toxicity, despite using inadequate handling precautions.	Occupational & Environmental Medicine	53	4	258-63	Biomonitoring (blood)			Cohort (prospective)	Chemical class	pesticide-related symptoms	self-reported	UK	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
450	H. S. Becher, K.; Flesch-Janys, D.	Quantitative cancer risk assessment for dioxins using an occupational cohort	1998	We consider a cohort of 1189 male German factory workers (production period 1952-1984) who produced phenoxy herbicides and were exposed to dioxins. Follow-up until the end of 1992 yielded a significantly increased standardized mortality ratio (SMR) for total cancer (SMR 141; 95% confidence interval 117-168). 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) concentrations up to 2252 ng/kg body fat were measured in 275 cohort members. Other higher chlorinated dioxins and furans also occurred in high concentrations. For quantitative analysis, the integrated TCDD concentration over time was used as an exposure variable, which was calculated using results from half-life estimation for TCDD and workplace history data. The other congeners were expressed as toxic equivalency (TEQ) and compared to TCDD using international toxic equivalency factors. Poisson and Cox regressions were used to investigate dose-response relationships. Various covariables (e.g., exposure to beta-hexachlorocyclohexane, employment characteristics) were considered. In all analyses, TCDD and TEQ exposures were related to total cancer mortality. The power model yielded a relative risk (RR) function RR(x) = (1 + 0.17x)0.326 for TCDD (in microgram/kilogram blood fat x years)--only a slightly better fit than a linear RR function--and RR(x) = (1 + 0.023x)0.795 for TEQ. Investigations on latency did not show strong effects. Different methods were applied to investigate the robustness of the results and yielded almost identical results. The results were used for unit risk estimation. Taking into account different sources of variation, an interval of 10(-3) to 10(-2) for the additional lifetime cancer risk under a daily intake of 1 pg TCDD/kg body weight/day was estimated from the dose-response models considered. Uncertainties regarding the dose-response function remain. These data did not indicate the existence of a threshold value; however, such a value cannot be excluded with any certainty.	Environmental Health Perspectives	106	NA	663-70	Biomonitoring (adipose tissue)			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	Germany	hic
451	H. S. Mahapatra and S. K. Agarwal	Chronic kidney disease of unknown cause (CKDU) in villages of srikakulum district	2017	BACKGROUND: Recent reports from the coastal district of Srikakulam of Andhra Pradesh have indicated a high prevalence of CKD of unexplained etiology. However; it is still a debatable issue about the prevalence; aetiology and pattern of Kidney disease in these areas. AIM OF THE STUDY: This study was done to assess the pattern of CKDu and to evaluate managerial ongoing corrective measures to the existing medical facilities for the target population. METHODS: On the directions of Government of India; a central team visited these areas and a detailed house to house survey was done through a questionnaire in a village Gunupalli at Uddanam area. Services of medical officer working in district were utilized for doing survey. Past medical records and other information such as socio demographic profile; smoking: eating habits; alcohol consumption; agricultural practices; use of fertilizers and pesticide were recorded. Medicines; clinical status and family history were also recorded. RESULTS: Of the Srikakulum district; 58 villages in 7 PHC have reported CKD cases. In which <15 cases in 42 mandals; 15-30 cases in 11 mandals and more than 30 cases in 6 mandals and three villages have reported more than 60 cases. The Gunupalli village is having a population of approximately 1300. Affected patients were mostly farmers with few symptoms and disease progression was insidious A total of 47 patients of CKD were found during the survey. Of 47; 34 (72%) were females. Mean age of subjects with CKD was 58.4 <U+00AC><U+00B1> 13.5 (range 32-100 years). Mean age in males was 55.3 <U+00AC><U+00B1>9.4 and in females was 59.6 <U+00AC><U+00B1> 14.7 years. All females were house wife only. Of 47 patients; 27 (57%) were hypertensive; 11 (23%) were diabetics; 32 (68%) had known proteinuria. None of them had known renal stone disease. Of the 32 patients who had proteinuria; 8 were diabetic and 19 had hypertension. Mean last serum creatinine at the time of survey was 3.9 <U+00AC><U+00B1> 2.1 (range 1.5-9.8 mg%). CONCLUSIONS: At present no single risk factor could be considered directly attributable to the CKD in these areas. Certain cases are due to known diseases like DM and HTN. However; clustering of CKD cases in certain pockets needs further study.	Indian Journal of Nephrology	27	NA	S26	Self-reported exposure			Cross-sectional	Type of pesticide	genitourinary	doctor-diagnosed	India	lmic
452	H. T. Nguyen, S. A. Quandt, P. Summers, T. M. Morgan, H. Chen, F. O. Walker, T. D. Howard, L. Galvan and T. A. Arcury	Learning Ability as a Function of Practice: Does It Apply to Farmworkers?	2015	OBJECTIVE: Farmworkers experience significant work-related health risks including pesticide-associated cognitive impairment. Practice effect is a surrogate for learning ability. This study examined differences in cognitive function and learning capacity in Latino farmworkers and nonfarmworkers. METHODS: Tasks of learning and short-term memory, executive function and working memory, perceptual coding, and psychomotor function were assessed at baseline and 3-month follow-up in 136 farmworkers and 116 nonfarmworkers. RESULTS: Farmworkers had better performance on visuospatial learning and short-term memory at baseline ($P < 0.05$). Nevertheless, nonfarmworkers showed more practice effects, or improvement on cognitive performance, at 3-month follow-up relative to farmworkers. Furthermore, the amount of improvement on visuospatial learning ability, short-term visuospatial memory, and perceptual coding ability was significantly higher in nonfarmworkers than in farmworkers. CONCLUSIONS: Practice effects may serve as an additional cognitive readout to differentiate healthy individuals from those with cognitive impairment.	Journal of Occupational & Environmental Medicine	57	6	676-81	Self-reported exposure			Cohort (prospective)	Pesticides in general	mental disorders	doctor-diagnosed	USA	hic
453	H. W. Davies, S. M. Kennedy, K. Teschke, P. Jenny and E. Quintana	Cytogenetic analysis of South Asian berry pickers in British Columbia using the micronucleus assay in peripheral lymphocytes	1998	Micronuclei in peripheral blood lymphocytes from British Columbia seasonal farmworkers and controls were evaluated using the cytokinesis-block technique. The farmworkers harvested berry crops and were likely occupationally exposed to pesticides. Subjects were 39 female subjects of South Asian descent; 18 farmworkers employed during 1993 and 21 age-matched controls. The mean age was 55.9 years. Micronuceli were also scored for the presence of kinetochores. No significant difference was found between the frequency of micronucleated binucleates in the farmworkers group (19.20/1000 binucleates), and the control group (21.76/1000 binucleates). However, among the farmworkers employed in 1993, there was a positive, but not statistically significant, association between micronucleated cell frequency and weeks worked: 16.44/1000 binucleates in those working less than 20 weeks; 23.78/1000 binucleates in those working 20 to 23 weeks; and 25.43/1000 binucleates in those working more than 23 weeks. In those who had ever been employed as farmworkers, there was an elevated frequency of micronucleated cells in the group with the longest history of employment as a farmworker (25.28/1000 binucleates) compared to those with the shortest employment history (16.48/1000 binucleates). This trend remained evident after adjusting for age, red blood cell folate, meat consumption, coffee consumption and recent vaccination. A positive association between the consumption of meat and micronucleus frequency was also observed. Non-meat eaters were likely life-long vegetarians. Micronuclei in farmworkers had a lower frequency of kinetochore positive micronuclei than controls. This study indicates that South Asian berry pickers in British Columbia may be at risk for genetic damage. More studies in other ethnic groups and in males are needed to generalize the findings of this study. More direct measures of exposure are needed to elucidate the sources of genotoxicity.	Mutation Research	416	1	101-13	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Canada	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
454	I. B. W. Stanaway, J. C.; Shojaie, A.; Griffith, W. C.; Hong, S.; Wilder, C. S.; Green, F. H.; Tsai, J.; Knight, M.; Workman, T.; Vigoren, E. M.; McLean, J. S.; Thompson, B.; Faustman, E. M.	Human Oral Buccal Microbiomes Are Associated with Farmworker Status and Azinphos-Methyl Agricultural Pesticide Exposure	2017	In a longitudinal agricultural community cohort sampling of 65 adult farmworkers and 52 adult nonfarmworkers, we investigated agricultural pesticide exposure-associated changes in the oral buccal microbiota. We found a seasonally persistent association between the detected blood concentration of the insecticide azinphos-methyl and the taxonomic composition of the buccal swab oral microbiome. Blood and buccal samples were collected concurrently from individual subjects in two seasons, spring/summer 2005 and winter 2006. Mass spectrometry quantified blood concentrations of the organophosphate insecticide azinphos-methyl. Buccal oral microbiome samples were 16S rRNA gene DNA sequenced, assigned to the bacterial taxonomy, and analyzed after "centered-log-ratio" transformation to handle the compositional nature of the proportional abundances of bacteria per sample. Nonparametric analysis of the transformed microbiome data for individuals with and without azinphos-methyl blood detection showed significant perturbations in seven common bacterial taxa (>0.5% of sample mean read depth), including significant reductions in members of the common oral bacterial genus Streptococcus Diversity in centered-log-ratio composition between individuals' microbiomes was also investigated using principal-component analysis (PCA) to reveal two primary PCA clusters of microbiome types. The spring/summer "exposed" microbiome cluster with significantly less bacterial diversity was enriched for farmworkers and contained 27 of the 30 individuals who also had azinphos-methyl agricultural pesticide exposure detected in the blood. IMPORTANCE: In this study, we show in human subjects that organophosphate pesticide exposure is associated with large-scale significant alterations of the oral buccal microbiota composition, with extinctions of whole taxa suggested in some individuals. The persistence of this association from the spring/summer to the winter also suggests that long-lasting effects on the commensal microbiota have occurred. The important health-related outcomes of these agricultural community individuals' pesticide-associated microbiome perturbations are not understood at this time. Future investigations should index medical and dental records for common and chronic diseases that may be interactively caused by this association between pesticide exposure and microbiome alteration.	Applied & Environmental Microbiology	83	2	15	Biomonitoring (blood)			Cohort (prospective)	Type of pesticide	immunological	medical test result	USA	hic
455	I. Baldi, A. Cantagrel, P. Lebailly, F. Tison, B. Dubroca, V. Chrysostome, J. F. Dartigues and P. Brochard	Association between Parkinson's disease and exposure to pesticides in southwestern France	2003	A case-control study was performed in southwestern France in order to assess the relationship between pesticide exposure and Parkinson's disease (PD) in the elderly. During the period from 1997 to 1999, 84 cases were recruited together with 252 population-based controls. Experts in occupational health reviewed job codes and provided pesticide exposure levels, making it possible to calculate cumulated exposure lifelong for individuals. Environmental pesticide exposure was considered in relation to the place of residence. A positive association was found with occupational pesticide exposure (odds ratio = 2.2, 95% confidence interval 1.1-4.3) in conditional logistic multiple regression analysis taking into account age, sex, educational level and smoking; however, no clear dose relationship was found. Our results support the hypothesis of an association between occupational pesticide exposure and PD and point to the need to investigate the role of fungicides, for which toxicological hypotheses exist.	Neuroepidemiology	22	5	305-10	Self-reported job history	Expert case-by-case assessment		Case-control	Job title	neurological	doctor-diagnosed	France	hic
456	I. Baldi, L. Filleul, B. Mohammed-Brahim, C. Fabrigoule, J. F. Dartigues, S. Schwall, J. P. Dreyet, R. Salamon and P. Brochard	Neuropsychologic effects of long-term exposure to pesticides: results from the French Phytoner study	2001	The Phytoner study investigated a possible association between neuropsychologic performances and long-term exposure to pesticides in Bordeaux vineyard workers, most of whom use fungicides. Among the 917 subjects interviewed from February 1997 to August 1998, 528 were directly exposed to pesticides through mixing and/or spraying (mean exposure duration: 22 years), 173 were indirectly exposed through contact with treated plants, and 216 were never exposed. All subjects performed neuropsychologic tests administered at home by trained psychologists. The risk of scoring a low performance on the tests was constantly higher in exposed subjects. When taking into account educational level, age, sex, alcohol consumption, smoking, environmental exposures, and depressive symptoms and when restricting analysis to subgroups, results remained significant for most tests, with odds ratios (OR) exceeding 2. These results point to long-term cognitive effects of low-level exposure to pesticides in occupational conditions. Given the frequency of pesticide use and the potential disabilities resulting from cognitive impairments, further toxicologic and epidemiologic research is needed to confirm these results and assess the impact on public health.	Environmental Health Perspectives	109	8	839-44	Self-reported exposure			Cohort (prospective)	Pesticides in general	neurological	medical test result	France	hic
457	I. Dialyna, G. Tzanakakis, G. Dolapsakis and A. Tsatsakis	A tetranucleotide repeat polymorphism in the CYP19 gene and breast cancer susceptibility in a Greek population exposed and not exposed to pesticides	2004	Epidemiological studies have suggested that hormones, genetic factors, and environmental agents are significant risk factors in breast carcinogenesis. Some pesticides have the ability to act as xenoestrogens in vivo. The CYP19 gene encodes the aromatase enzyme which is involved in the estrogens biosynthetic pathways. We have assessed the frequency alleles of a (TTTA)(n) repeat of CYP19 gene in breast cancer patients which were either exposed or not exposed to specific pesticides. No differences were observed in the distribution of the alleles between the two groups showing that the polymorphism does not have a significant functional role on the aromatase activity. When compared to healthy control Greek women group, only the (TTTA)(10) repeat variant presented a non-significant increased risk in breast cancer susceptibility [odds ratio (OR): 2.46, P>0.05]. Lack of strong association suggests that the polymorphic TTTA short tandem repeat of CYP19 gene may have not a functional effect on the enzyme's activity and thus its role in the development of breast cancer remains unclear.	Toxicology Letters	151	1	267-71	Self-reported job history			Cross-sectional	Pesticides in general	cancer	doctor-diagnosed	Greece	hic
458	I. G. Baldi, A.; Rondeau, V.; Lebailly, P.; Brochard, P.; Fabrigoule, C.	Neurobehavioral effects of long-term exposure to pesticides: results from the 4-year follow-up of the PHYTONER study	2011	OBJECTIVE: The aim of the PHYTONER study is to investigate the role of pesticides on neurobehavioral performances in French vineyard workers. METHODS: 929 workers affiliated to the health insurance system for farmers in the Bordeaux area of south-western France were enrolled in the study in 1997-1998. They were contacted for a first follow-up in 2001-2003. Participants completed a questionnaire and nine neurobehavioral tests. They were classified according to their life-long pesticide exposure, as directly exposed, indirectly exposed or non-exposed. Educational level, age, sex, alcohol consumption, smoking, psychotropic drug use and depressive symptoms were taken into account in the analysis. RESULTS: 614 subjects were available for investigation at follow-up. Follow-up analysis confirmed that the risk of obtaining a low performance on the tests was higher in exposed subjects, with ORs ranging from 1.35 to 5.60. Evolution of performances over the follow-up period demonstrated that exposed subjects had the worst decreases in performance. The risk of having a two-point lower score on the Mini-Mental State Examination was 2.15 (95% CI 1.18 to 3.94) in exposed subjects. CONCLUSION: These results suggest long-term cognitive effects of chronic exposure to pesticides and raise the issue of the risk of evolution towards dementia. The PHYTONER study is the first to provide prospective data on the natural history of neurological disorders associated with pesticide exposure.	Occupational & Environmental Medicine	68	2	108-15	Self-reported exposure			Cohort (prospective)	Pesticides in general	neurological	medical test result	France	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
459	I. J. Casta<U+221A>< U+00B1>eda-Yslas, M. E. Arellano-Garc<U+221A><U +2260>a, M. A. Garc<U+221A><U +2260>a-Zarate, B. Ru<U+221A><U+ 2260>z-Ru<U+221A><U+ 2260>z, M. G. Zavala-Cerna and O. Torres-Bugar<U+221A>< U+2260>n	Biomonitoring with Micronuclei Test in Buccal Cells of Female Farmers and Children Exposed to Pesticides of Maneadero Agricultural Valley, Baja California, Mexico	2016	Feminization of the agricultural labor is common in Mexico; these women and their families are vulnerable to several health risks including genotoxicity. Previous papers have presented contradictory information with respect to indirect exposure to pesticides and DNA damage. We aimed to evaluate the genotoxic effect in buccal mucosa from female farmers and children, working in the agricultural valley of Maneadero, Baja California. Frequencies of micronucleated cells (MNc) and nuclear abnormalities (NA) in 2000 cells were obtained from the buccal mucosa of the study population (n=144), divided in four groups: (1) farmers (n=37), (2) unexposed (n=35), (3) farmers' children (n=34), and (4) unexposed children (n=38). We compared frequencies of MNc and NA and fitted generalized linear models to investigate the interaction between these variables and exposition to pesticides. Differences were found between farmers and unexposed women in MNc (p<0.0001), CC (p=0.3376), and PN (p<0.0001). With respect to exposed children, we found higher significant frequencies in MNc (p<0.0001), LN (p<0.0001), CC (p<0.0001), and PN (p<0.004) when compared to unexposed children. Therefore working as a farmer is a risk for genotoxic damage; more importantly indirectly exposed children were found to have genotoxic damage, which is of concern, since it could aid in future disturbances of their health.	Journal of Toxicology	2016	NA	NA	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	USA	hic
460	I. Kato, H. Watanabe-Meserve, K. L. Koenig, M. S. Baptiste, P. P. Lillquist, G. Frizzera, J. S. Burke, M. Moseson and R. E. Shore	Pesticide product use and risk of non-Hodgkin lymphoma in women	2004	A population-based, incidence case-control study was conducted among women in upstate New York to determine whether pesticide exposure is associated with an increase in risk of non-Hodgkin lymphoma (NHL) among women. The study involved 376 cases of NHL identified through the State Cancer Registry and 463 controls selected from the Medicare beneficiary files and state driver's license records. Information about history of farm work, history of other jobs associated with pesticide exposure, use of common household pesticide products, and potential confounding variables was obtained by telephone interview. Odds ratios (ORs) and 95% confidence intervals (CIs) were estimated using an unconditional logistic regression model. The risk of NHL was doubled (OR = 2.12; 95% CI, 1.21-3.71) among women who worked for at least 10 years at a farm where pesticides were reportedly used. When both farming and other types of jobs associated with pesticide exposure were combined, there was a progressive increase in risk of NHL with increasing duration of such work (p = 0.005). Overall cumulative frequency of use of household pesticide products was positively associated with risk of NHL (p = 0.004), which was most pronounced when they were applied by subjects themselves. When exposure was analyzed by type of products used, a significant association was observed for mothballs. The associations with both occupational and household pesticides were particularly elevated if exposure started in 1950-1969 and for high-grade NHL. Although the results of this case-control study suggest that exposure to pesticide products may be associated with an increased risk of NHL among women, methodologic limitations related to selection and recall bias suggest caution in inferring causation.	Environmental Health Perspectives	112	13	1275-81	Self-reported job history			Case-control	Job title	cancer	doctor-diagnosed	USA	hic
461	I. L. Bernstein, J. A. Bernstein, M. Miller, S. Tierzieva, D. I. Bernstein, Z. Lummus, M. K. Selgrade, D. L. Doerfler and V. L. Seligy	Immune responses in farm workers after exposure to Bacillus thuringiensis pesticides	1999	Although health risks to pesticides containing Bacillus thuringiensis (Bt) have been minimal, the potential allergenicity of these organisms has not been evaluated. Therefore, a health survey was conducted in farm workers before and after exposure to Bt pesticides. Farm workers who picked vegetables that required Bt pesticide spraying were evaluated before the initial spraying operation (n = 48) and 1 and 4 months after (n = 32 and 20, respectively). Two groups of low- (n = 44) and medium- (n = 34) exposure workers not directly exposed to Bt spraying were also assessed. The investigation included questionnaires, nasal/mouth lavages, ventilatory function assessment, and skin tests to indigenous aeroallergens and to a variety of Bt spore and vegetative preparations. To authenticate exposure to the organism present in the commercial preparation, isolates from lavage specimens were tested for Bt genes by DNA-DNA hybridization. Humoral immunoglobulin G (IgG) and immunoglobulin E (IgE) antibody responses to spore and vegetative Bt extracts were assayed. There was no evidence of occupationally related respiratory symptoms. Positive skin-prick tests to several spore extracts were seen chiefly in exposed workers. In particular, there was a significant ($p < 0.05$) increase in the number of positive skin tests to spore extracts 1 and 4 months after exposure to Bt spray. The number of positive skin test responses was also significantly higher in high ($p < 0.05$) than in low- or medium-exposure workers. The majority of nasal lavage cultures from exposed workers was positive for the commercial Bt organism, as demonstrated by specific molecular genetic probes. Specific IgE antibodies were present in more high-exposure workers ($p < 0.05$) than in the low and medium groups. Specific IgG antibodies occurred more in the high ($p < 0.05$) than in the low-exposure group. Specific IgG and IgE antibodies to vegetative organisms were present in all groups of workers. Exposure to Bt sprays may lead to allergic skin sensitization and induction of IgE and IgG antibodies, or both.	Environmental Health Perspectives	107	7	575-82	Job title			Cross-sectional	Job title	immunological	medical test result	USA	hic
462	I. Litvan, P. S. Lees, C. R. Cunningham, S. N. Rai, A. C. Cambon, D. G. Standaert, C. Marras, J. Juncos, D. Riley, S. Reich, D. Hall, B. Kluger, Y. Bordelon, D. R. Shprecher and E.-P. for	Environmental and occupational risk factors for progressive supranuclear palsy: Case-control study	2016	BACKGROUND: The cause of progressive supranuclear palsy (PSP) is largely unknown. Based on evidence for impaired mitochondrial activity in PSP, we hypothesized that the disease may be related to exposure to environmental toxins, some of which are mitochondrial inhibitors. METHODS: This multicenter case-control study included 284 incident PSP cases of 350 cases and 284 age-, sex-, and race-matched controls primarily from the same geographical areas. All subjects were administered standardized interviews to obtain data on demographics, residential history, and lifetime occupational history. An industrial hygienist and a toxicologist unaware of case status assessed occupational histories to estimate past exposure to metals, pesticides, organic solvents, and other chemicals. RESULTS: Cases and controls were similar on demographic factors. In unadjusted analyses, PSP was associated with lower education, lower income, more smoking pack-years, more years of drinking well water, more years living on a farm, more years living 1 mile from an agricultural region, more transportation jobs, and more jobs with exposure to metals in general. However, in adjusted models, only more years of drinking well water was significantly associated with PSP. There was an inverse association with having a college degree. CONCLUSIONS: We did not find evidence for a specific causative chemical exposure; higher number of years of drinking well water is a risk factor for PSP. This result remained significant after adjusting for income, smoking, education and occupational exposures. This is the first case-control study to demonstrate PSP is associated with environmental factors. <U+00AC><U+00A9> 2016 International Parkinson and Movement Disorder Society.	Movement Disorders	31	5	644-52	Self-reported job history			Case-control	Job title	neurological	doctor-diagnosed	USA/Canada	AHIC

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
463	I. Lopez-Flores, M. Lacasana, J. Blanco-Munoz, C. Aguilar-Garduno, P. Sanchez-Villegas, O. A. Perez-Mendez and R. Gamboa-Avila	Relationship between human paraoxonase-1 activity and PON1 polymorphisms in Mexican workers exposed to organophosphate pesticides	2009	Paraoxonase-1 (PON1) is a serum enzyme which catalyzes the hydrolysis of organophosphate pesticides. In this study we conducted a cross-sectional study and reported on the distribution of three common genetic polymorphisms of the PON1 gene in a population of floriculture workers from Mexico as well as the association between those polymorphisms and other predictors with serum PON1 activity on paraoxon, diazoxon and phenylacetate. The genotype frequencies at position PON1(55) were 89% (LL), 10% (LM) and 0.6% (MM), at position PON1(192) they were 16% (QQ), 47% (QR) and 37% (RR), and 26% (TT), 42% (TC) and 32% (CC) at position PON1(-108). Thus, the frequencies of alleles L, Q and T were 0.94, 0.40 and 0.47, respectively. The PON1(55) polymorphism had no significant effect on serum PON1 activity on any substrate. We found a significant association between the PON1(192) polymorphism and PON1 activity towards paraoxon and diazoxon, which increased in genotypes as follows: 192RR>192QR>192QQ for paraoxonase activity and, inversely, 192QQ>192QR>192RR for diazoxonase activity. The PON1(-108) polymorphism also had a significant effect on PON1 activity level towards paraoxon in the following order among the genotype groups: -108CC>-108TC>-108TT. Serum PON1 activity towards diazoxon was not associated with the PON1(-108) polymorphism but it was influenced by the intensity exposure to pesticides at the floriculture industry and the years of the occupational exposure to pesticides. No polymorphism significantly influenced serum PON1 activity on phenylacetate.	Toxicology Letters	188	2	84-90	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Mexico	umic
464	I. M. Figa-Talamanca, I.; Valente, P.	Mortality in a cohort of pesticide applicators in an urban setting	1993	The mortality of a cohort of 168 pesticide applicators employed in the disinfestation service of the city of Rome for an average of 20 years is examined. Exposure data were abstracted from work records, and causes of death for the 42 workers who had died, were obtained from death certificates. Standardized mortality ratios (SMR) for specific causes of death were computed on the basis of provincial mortality rates. An excess in mortality from cancer of the liver and bile ducts with four cases observed and 0.7 expected (SMR = 571, 95% confidence interval (CI): 154-1463) was found. Increased risk for other cancers was also observed, but the SMR were not statistically different from unity. An increased risk of liver cancer occurs in those exposed to organochlorine pesticides between 1960 and 1965.	International Journal of Epidemiology	22	4	674-6	Registers			Cohort (prospective)	Job title	mortality (all cause)	doctor-diagnosed	Italy	hic
465	I. M. Figa-Talamanca, I.; Valente, P.; Bascherini, S.	Cancer mortality in a cohort of rural licensed pesticide users in the province of Rome	1993	The mortality of a cohort of 2310 male workers who obtained a licence to handle pesticides in the period 1973-1979 in the province of Rome was investigated. The cohort contributed 26,846 person-years of exposure. The vital status of the cohort was determined up to the end of 1988. The causes of death of the 207 who had died were ascertained from death certificates. Standardized mortality ratios (SMR) were computed using both the provincial and the national mortality rates. The two methods yielded very similar results. Using the national rates, the SMR for all causes was 56 (95% confidence interval (CI) : 45.3-59.8), for cardiovascular diseases 47 (95% CI : 37.1-59.1), and for all cancers 72 (95% CI : 57.8-89.3). A statistically significant excess was noted for brain cancer (SMR = 270, 95% CI : 108.6-556.9). In addition, the cohort experienced statistically significant lower lung cancer mortality (SMR = 57, 95% CI : 35.6-80.0).	International Journal of Epidemiology	22	4	579-83	Job title			Cohort (prospective)	Job title	mortality (all cause)	doctor-diagnosed	Italy	hic
466	I. Marie, J. F. Gehanno, M. Bubenheim, A. B. Duval-Modeste, P. Joly, S. Dominique, P. Bravard, D. Noel, A. F. Cailleux, J. Weber, P. Lagoutte, J. Benichou and H. Levesque	Prospective study to evaluate the association between systemic sclerosis and occupational exposure and review of the literature	2014	INTRODUCTION: Systemic sclerosis (SSc) has complex pathogenesis and likely multifactorial causes. Environmental exposures have been suggested to play a role in SSc pathogenesis, including occupational exposure to pollutants and chemicals as well as use of drugs leading to modulation of immune response. Thus, this case-control study aimed to assess: the relationship between SSc and occupational exposure; and the risk of SSc related to occupational exposure in male and female patients. METHODS: From 2005 to 2008, 100 patients with a definite diagnosis of SSc were included in the study; 3 age, gender, and smoking habits matched controls were selected for each patient. A committee of experts evaluated blindly occupational exposure to crystalline silica, white spirit, organic solvents, ketones, welding fumes, epoxy resins, and pesticides; an occupational exposure score was calculated for all subjects. Our findings were compared with previous data in the literature. RESULTS: Increased ORs for SSc were found for: crystalline silica (p<0.0001), white spirit (p<0.0001), aromatic solvents (p=0.0002), chlorinated solvents (p=0.014), trichlorethylene (p=0.044), ketones (p=0.002) and welding fumes (p=0.021). Elevated risk associated with high final cumulative score in SSc was observed for: crystalline silica, white spirit, chlorinated solvents, trichlorethylene, aromatic solvents, any type of solvents, ketones and welding fumes. A marked association between SSc and occupational exposure was further found for: 1) crystalline silica, chlorinated solvents, trichloroethylene, white spirit, ketones and welding fumes in male patients; and 2) white spirit, aromatic solvents, any type of solvent and ketones in female patients. Finally, we did not find an association between SSc and: 1) the use of drugs that have been speculated to play a role in SSc onset (anorexigens, pentazocine, bromocriptine, l-tryptophan); 2) implants - that are prosthesis, silicone implants, and contact lenses; and 3) dyeing hair. In the literature, SSc has been associated with occupational exposure to silica and solvents, while the association between SSc and specific organic solvents and welding fumes has been anecdotally reported. CONCLUSION: The following occupational factors have an impact in the development of SSc: crystalline silica, white spirit, aromatic solvents, chlorinated solvents, trichlorethylene, ketones and welding fumes. The risk of SSc appears to be markedly associated with high cumulative exposure. Finally, the association between SSc and occupational exposure may be variable according to gender.	Autoimmunity Reviews	13	2	151-6	Expert case-by-case assessment			Case-control	Pesticides in general	NA	NA	NA	NA
467	I. R. Baldi, C.; Piantoni, F.; Tual, S.; Bouvier, G.; Lebailly, P.; Raherison, C.	Agricultural exposure and asthma risk in the AGRICAN French cohort	2014	Epidemiological studies have reported an increased risk of respiratory diseases in agricultural population, but a protective "farm-effect" has also been reported for asthma. In the AGRICAN cohort, self-reported doctor-diagnosed asthma was analyzed according to allergy, in relation with history of life-time exposure to 13 crops and 5 livestock, pesticide exposure and early life on a farm, taking into account sex, age, education and body mass index. Among the 1246 asthmatics (8.0%), 505 were allergic (3.3%) and 719 non-allergic (4.6%). In multivariate analysis, a significant excess was observed, only for allergic asthma, in vine-growing (OR=1.43, p=0.002), fruit-growing (OR=1.58, p=0.001), greenhouses (OR=1.66, p=0.02), grasslands (OR=1.35, p=0.009), beets (OR=1.52, p=0.003) and horses (OR=1.35, p=0.04). Pesticide use and history of pesticide poisoning were significantly associated with allergic asthma in grassland, vineyards and fruit-growing and with non-allergic asthma in beets. Living on a farm in the first year of life tended to be protective for childhood allergic asthma in farms with livestock (OR=0.72, p=0.07) but deleterious in farms with vineyards, fruit or vegetables (OR=1.44, p=0.07). In AGRICAN, an increased risk of allergic asthma was observed with crop exposure, pesticide use and early life on a farm, especially in vine-growing, grassland, beets, fruit and vegetable-growing.	International Journal of Hygiene & Environmental Health	217	4	435-42	Self-reported exposure			Cohort (prospective)	Pesticides in general	respiratory	self-reported	France	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
468	J. A. Bhalli, Q. M. Khan and A. Nasim	DNA damage in Pakistani pesticide-manufacturing workers assayed using the Comet assay	2006	The production and use of chemical pesticides has increased in recent years. Although the increased use of pesticides may benefit agriculture, they are also the potential source of environmental pollution, and exposure to pesticides can have negative consequences for human health. In the present study, we have assessed DNA damage in blood leukocytes from 29 Pakistani pesticide-factory workers and 35 controls of similar age and smoking history. The workers were exposed to various mixtures of organophosphates, carbamates, and pyrethroids. DNA damage was measured with the single cell gel electrophoresis (SCGE) assay or Comet assay, using the mean comet tail length (microm) as the DNA damage metric. Exposed workers had significantly longer comet tail lengths than the controls (mean +/- SD 19.98 +/- 2.87 vs. 7.38 +/- 1.48, P < 0.001). Of the possible confounding factors, smokers had significantly longer mean comet tail lengths than nonsmokers and exsmokers for both the workers (21.48 +/- 2.58 vs.18.37 +/- 2.28, P < 0.001) and the controls (8.86 +/- 0.56 vs. 6.79 +/- 1.31, P < 0.001), while age had a minimal effect on DNA damage (P > 0.05 and P < 0.05 for workers and controls, respectively). The results of this study indicate that occupational exposure to pesticides causes DNA damage.	Environmental & Molecular Mutagenesis	47	8	587-93	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Pakistan	lmic
469	J. A. Bhalli, Q. M. Khan, M. A. Haq, A. M. Khalid and A. Nasim	Cytogenetic analysis of Pakistani individuals occupationally exposed to pesticides in a pesticide production industry	2006	Although several cytogenetic biomonitoring studies on workers exposed to pesticides have been reported, there is only limited information on this topic from developing countries where pesticides have been widely used over the years. People in developing countries are at higher risk from exposure, due to poor working conditions and a lack of awareness of the potential hazards during manufacturing and application of the pesticides. The present study has assessed the genotoxic effects of pesticides on workers involved in the pesticide manufacturing industry. Subjects in the exposed group (29) were drawn from workers at a pesticide production plant in district Multan (Pakistan). The control group (unexposed) composed of 35 individuals from the same area but was not involved in pesticide production. Liver enzymes, serum cholinesterase (SChE), micronucleus assay and some haematological parameters were used as biomarkers in this study. A statistically significant (P < 0.001) increase in levels of alanine aminotransferase, aspartate aminotransferase and alkaline phosphatase was detected in exposed workers with respect to the control group. There was a significant (P < 0.001) decrease in the level of SChE in the exposed group. Exposed individuals exhibited cytogenetic damage with increased frequencies (P < 0.001) of binucleated cells with micronuclei and total number of micronuclei in binucleated lymphocytes in comparison with subjects of the control group. A decrease (P < 0.001) in cytokinesis block proliferation index similarly demonstrates a genotoxic effect due to pesticide exposure. The results indicate that the pesticide industry workers have experienced significant genotoxic exposure. This study highlights the risk to workers in the pesticide manufacturing industries of developing countries such as Pakistan and the need for implementation of suitable safety measures to prevent/limit exposure to harmful toxins.	Mutagenesis	21	2	143-8	Self-reported exposure			Cohort (prospective)	Pesticides in general	genetic (biomarkers)	medical test result	Pakistan	lmic
470	J. A. Bhalli, T. Ali, M. R. Asi, Z. M. Khalid, M. Ceppi and Q. M. Khan	DNA damage in Pakistani agricultural workers exposed to mixture of pesticides	2009	A cross-sectional study was designed to determine whether occupational exposure to a complex mixture of pesticides results in a significant increase of DNA damage in farmers chronically exposed to pesticides in open fields. Leukocytes from 47 agriculture workers exposed to pesticides and 50 controls were evaluated with comet assay. Workers recruitment was based on their exposure to pesticides during the spraying season on cotton crop. Serum from these individuals was also analyzed for pesticides presence using high performance liquid chromatography. Statistically significant difference (P < 0.001) in DNA damage of exposed individuals (mean +/- S.D 14.80 +/- 3.04 microm) was observed when compared with control group (6.54 +/- 1.73 microm) as studied on the basis of comet tail length. Smokers had significantly higher mean comet tail length than nonsmokers and ex-smokers in both workers (20.26 +/- 3.53 vs. 14.19 +/- 4.25, P < 0.001) and controls (7.86 +/- 1.09 vs. 5.80 +/- 1.59, P < 0.001), whereas age had a minimal effect on DNA damage (P < 0.05). The length of pesticide exposure is positively associated with DNA damage in exposed individuals (P < 0.001). Our study shows that chronic exposure to pesticides produces DNA damage in pesticide sprayers and suggests that this type of monitoring is recommended in preventive policies for pesticide sprayers.	Environmental & Molecular Mutagenesis	50	1	37-45	Biomonitoring (blood)			Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	Pakistan	lmic
471	J. A. D. R. Rusiecki, A.; Lee, W. J.; Dosemeci, M.; Lubin, J. H.; Hoppin, J. A.; Blair, A.; Alavanja, M. C.	Cancer incidence among pesticide applicators exposed to atrazine in the Agricultural Health Study	2004	BACKGROUND: Atrazine is the most heavily applied agricultural pesticide for crop production in the United States. Both animal and human studies have suggested that atrazine is possibly carcinogenic, but results have been mixed. We evaluated cancer incidence in atrazine-exposed pesticide applicators among 53,943 participants in the Agricultural Health Study, a prospective cohort study of licensed pesticide applicators in Iowa and North Carolina. METHODS: We obtained detailed pesticide exposure information using a self-administered questionnaire completed at the time of enrollment (1993-1997). Cancer incidence was followed through December 31, 2001. We used adjusted Poisson regression to calculate rate ratios (RRs) and 95% confidence intervals (CIs) of multiple types of cancer among atrazine exposed applicators. P(trend) values were calculated using atrazine exposure as a continuous variable, and all statistical tests were two-sided. Two exposure metrics were used: quartiles of lifetime days of exposure and quartiles of intensity-weighted lifetime days of exposure. RESULTS: 36,513 (68%) applicators reported ever using atrazine; exposure was not associated with overall cancer incidence. Comparisons of cancer incidence in applicators with the highest atrazine exposure and those with the lowest exposure, assessed by lifetime days (RR{LD}) and intensity-weighted lifetime days (RR{IWLD}) of exposure yielded the following results: prostate cancer, RR{LD} = 0.88, 95% CI = 0.63 to 1.23, P{trend} =.26, and RR{IWLD} = 0.89, 95% CI = 0.63 to 1.25, P{trend} =.35; lung cancer, RR{LD} = 1.91, 95% CI = 0.93 to 3.94, P{trend} =.08, and RR{IWLD} = 1.37, 95% CI = 0.65 to 2.86, P{trend} =.19; bladder cancer, RR{LD} = 3.06, 95% CI = 0.86 to 10.81, P{trend} =.18, and RR{IWLD} = 0.85, 95% CI = 0.24 to 2.94, P{trend} =.71; non-Hodgkin lymphoma, RR{LD} = 1.61, 95% CI = 0.62 to 4.16, P{trend} =.35, and RR{IWLD} = 1.75, 95% CI = 0.73 to 4.20, P{trend} =.14; and multiple myeloma, RR{LD} = 1.60, 95% CI = 0.37 to 7.01, P{trend} =.41, and RR{IWLD} = 2.17, 95% CI = 0.45 to 10.32, P{trend} =.21. CONCLUSIONS: Our analyses did not find any clear associations between atrazine exposure and any cancer analyzed. However, further studies are warranted for tumor types in which there was a suggestion of trend (lung, bladder, non-Hodgkin lymphoma, and multiple myeloma).	Journal of the National Cancer Institute	96	18	1375-82	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
472	J. A. Firestone, J. I. Lundin, K. M. Powers, T. Smith-Weller, G. M. Franklin, P. D. Swanson, W. T. Longstreth, Jr. and H. Checkoway	Occupational factors and risk of Parkinson's disease: A population-based case-control study	2010	BACKGROUND: Parkinson's disease (PD) has been associated with various workplace factors, but the evidence is inconsistent. OBJECTIVE: To estimate the risk of PD associated with various jobs and workplace exposures. METHODS: We conducted a population-based, case-control study of 404 incident PD cases and 526 age and sex-matched controls, collecting self-reported work histories including job titles and exposures to various industrial toxicants. Relative risks of PD from these exposures were estimated with odds ratios (OR) and 95% confidence intervals (CI) using logistic regression. RESULTS: Risk was not significantly affected by farming work, by metal work, or by exposure to pesticides, metals, or solvents. CONCLUSIONS: These findings do not provide support for the hypothesis that workplace factors affect the risk of PD.	American Journal of Industrial Medicine	53	3	217-23	Self-reported job history	Self-reported exposure		Case-control	Job title	neurological	doctor-diagnosed	USA	hic
473	J. A. Firestone, T. Smith-Weller, G. Franklin, P. Swanson, W. T. Longstreth, Jr. and H. Checkoway	Pesticides and risk of Parkinson disease: a population-based case-control study	2005	BACKGROUND: Pesticide exposures are suspected risk factors for Parkinson disease (PD), but epidemiological observations have been inconsistent. OBJECTIVE: To investigate associations between pesticide exposures and idiopathic PD. DESIGN: Population-based case-control study. SETTING: Group Health Cooperative, a health care system in western Washington State, and the University of Washington. PARTICIPANTS: Two hundred fifty incident PD case patients and 388 healthy control subjects (age- and sex-matched). We assessed self-reported pesticide exposures using a structured interview. Odds ratios (ORs) and 95% confidence intervals (CIs) were determined using logistic regression models, controlling for age, sex, and smoking. RESULTS: Odds ratios for occupational exposures were not significant but suggested a gradient that paralleled occupational exposures (pesticide worker: OR, 2.07; 95% CI, 0.67-6.38; crop farmer: OR, 1.65; 95% CI, 0.84-3.27; animal and crop farmer: OR, 1.10; 95% CI, 0.60-2.00; and dairy farmer: OR, 0.88; 95% CI, 0.46-1.70). Odds ratios for organophosphates paralleled the World Health Organization hazard classifications, with parathion much higher than diazinon or malathion. We also found elevated ORs from herbicides (OR, 1.41; 95% CI, 0.51-3.88) and paraquat (OR, 1.67; 95% CI, 0.22-12.76). We found no evidence of risk from home-based pesticide exposures. We found significantly increased ORs from lifelong well water consumption (OR, 1.81; 95% CI, 1.02-3.21). CONCLUSIONS: The findings for occupational pesticide exposures are consistent with a growing body of information linking pesticide exposures with PD. However, the lack of significant associations, absence of associations with home-based exposures, and weak associations with rural exposures suggest that pesticides did not play a substantial etiologic role in this population.	Archives of Neurology	62	1	33359	Self-reported exposure			Case-control	Specific active ingredient	neurological	doctor-diagnosed	USA	hic
474	J. A. H. Rusiecki, L.; Lee, W. J.; Blair, A.; Dosemeci, M.; Lubin, J. H.; Bonner, M.; Samanic, C.; Hoppin, J. A.; Sandler, D. P.; Alavanja, M. C.	Cancer incidence among pesticide applicators exposed to metolachlor in the Agricultural Health Study	2006	Metolachlor is one of the most widely used herbicides in the United States. We evaluated the incidence of cancer among pesticide applicators exposed to metolachlor in the Agricultural Health Study, a prospective cohort study of licensed pesticide applicators in Iowa and North Carolina. A total of 50,193 pesticide applicators were included. Detailed information on pesticide exposure and lifestyle factors was obtained from self-administered enrollment questionnaires completed between 1993 and 1997; average length of follow-up was 7.33 years. Two metolachlor exposure metrics were used : (i) lifetime days personally mixed or applied metolachlor and (ii) intensity-weighted lifetime days (lifetime days x an intensity level). Poisson regression analysis was used to estimate relative risks (RR) and 95% confidence intervals (95%CI) for cancer subtypes by tertiles of metolachlor exposure. No clear risk for any cancer subtype was found for exposure to metolachlor. A significantly decreased RR was found for prostate cancer in the highest category of lifetime days exposure (RR = 0.59; 95%CI, 0.39-0.89) and in the second highest category of intensity-weighted lifetime days exposure (RR = 0.66; 95%CI, 0.45-0.97); however, the test for trend was not significant for either exposure metric. A nonsignificantly increased risk was found for lung cancer with lifetime days exposure in the highest category (RR = 2.37; 95%CI, 0.97-5.82, p-trend = 0.03) but not with intensity-weighted lifetime days. Given the widespread use of metolachlor and the frequent detection of metolachlor in both surface and ground water, future analyses of the AHS will allow further examination of long-term health effects, including lung cancer and the less common cancers.	International Journal of Cancer	118	12	3118-23	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
475	J. A. Hoppin, D. M. Umbach, G. J. Kullman, P. K. Henneberger, S. J. London, M. C. Alavanja and D. P. Sandler	Pesticides and other agricultural factors associated with self-reported farmer's lung among farm residents in the Agricultural Health Study	2007	BACKGROUND: Farmer's lung, or hypersensitivity pneumonitis, is an important contributor to respiratory morbidity among farmers. METHODS: Using the 1993-7 enrolment data from the Agricultural Health Study, we conducted a cross-sectional study of occupational risk factors for farmer's lung among 50,000 farmers and farm spouses in Iowa and North Carolina using hierarchical logistic regression controlling for age, state, and smoking status. Participants provided information on agricultural exposures, demographic characteristics, and medical history via self-administered questionnaires. Approximately 2% of farmers (n = 481) and 0.2% of spouses (n = 51) reported doctor-diagnosed farmer's lung during their lifetime. We assessed farmers and spouses separately due to different information on occupational exposure history. Only pesticide exposures represented lifetime exposure history, all other farm exposures represented current activities at enrolment. RESULTS: Among farmers, handling silage (OR = 1.41, 95% CI 1.10 to 1.82), high pesticide exposure events (OR = 1.75, 95% CI 1.39 to 2.21), and ever use of organochlorine (OR = 1.34, 95% CI 1.04 to 1.74) and carbamate pesticides (OR = 1.32, 95% CI 1.03 to 1.68) were associated with farmer's lung in mutually-adjusted models. The insecticides DDT, lindane, and aldicarb were positively associated with farmer's lung among farmers. Current animal exposures, while not statistically significant, were positively associated with farmer's lung, particularly for poultry houses (OR = 1.55, 95% CI 0.93 to 2.58) and dairy cattle (OR = 1.28, 95% CI 0.86 to 1.89). The occupational data were more limited for spouses; however, we saw similar associations for dairy cattle (OR = 1.50, 95% CI 0.72 to 3.14) and organochlorine pesticides (OR = 1.29, 95% CI 0.64 to 2.59). CONCLUSION: While historic farm exposures may contribute to the observed associations with pesticides, these results suggest that organochlorine and carbamate pesticides should be further evaluated as potential risk factors for farmer's lung	Occupational & Environmental Medicine	64	5	334-41	Self-reported exposure			Cross-sectional	Specific active ingredient	NA	self-reported	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
476	J. A. Hoppin, D. M. Umbach, S. J. London, C. F. Lynch, M. C. Alavanja and D. P. Sandler	Pesticides associated with wheeze among commercial pesticide applicators in the Agricultural Health Study	2006	Pesticides are potential risk factors for respiratory disease among farmers, but farmers are also exposed to other respiratory toxicants. To explore the association of pesticides with wheeze in a population without other farming exposures, the authors analyzed data from 2,255 Iowa commercial pesticide applicators enrolled in the Agricultural Health Study. Controlling for age, smoking status, asthma and atopy history, and body mass index, the authors calculated odds ratios for the relationship between wheeze and 36 individual pesticides participants had used during the year before enrollment (1993-1997). Eight of 16 herbicides were associated with wheeze in single-agent models; however, the risk was almost exclusively associated with the herbicide chlorimuron-ethyl (odds ratio (OR) = 1.62, 95% confidence interval (CI): 1.25, 2.10). Inclusion of chlorimuron-ethyl in models for the other herbicides virtually eliminated the associations. The odds ratios for four organophosphate insecticides (terbufos, fonofos, chlorpyrifos, and phorate) were elevated when these chemicals were modeled individually and remained elevated, though attenuated somewhat, when chlorimuron-ethyl was included. The association for dichlorvos, another organophosphate insecticide, was not attenuated by chlorimuron-ethyl (OR = 2.48, 95% CI: 1.08, 5.66). Dose-response trends were observed for chlorimuron-ethyl, chlorpyrifos, and phorate; the strongest odds ratio was for applying chlorpyrifos on more than 40 days per year (OR = 2.40, 95% CI: 1.24, 4.65). These results add to the emerging literature linking organophosphate insecticides and respiratory health and suggest a role for chlorimuron-ethyl.	American Journal of Epidemiology	163	12	1129-37	Self-reported exposure			Cross-sectional	Specific active ingredient	respiratory	self-reported	USA	hic
477	J. A. Hoppin, D. M. Umbach, S. J. London, P. K. Henneberger, G. J. Kullman, J. Coble, M. C. Alavanja, L. E. Beane Freeman and D. P. Sandler	Pesticide use and adult-onset asthma among male farmers in the Agricultural Health Study	2009	Although specific pesticides have been associated with wheeze in farmers, little is known about pesticides and asthma. Data from 19,704 male farmers in the Agricultural Health Study were used to evaluate lifetime use of 48 pesticides and prevalent adult-onset asthma, defined as doctor-diagnosed asthma after the age of 20 yrs. Asthma cases were categorised as allergic (n = 127) and nonallergic (n = 314) based on their history of eczema or hay fever. Polytomous logistic regression, controlling for age, state, smoking and body mass, was used to assess pesticide associations. High pesticide exposure events were associated with a doubling of both allergic and nonallergic asthma. For ever-use, 12 individual pesticides were associated with allergic asthma and four with nonallergic asthma. For allergic asthma, coumaphos (OR 2.34; 95% CI 1.49-3.70), heptachlor (OR 2.01; 95% CI 1.30-3.11), parathion (OR 2.05; 95% CI 1.21-3.46), 80/20 mix (carbon tetrachloride/carbon disulfide) (OR 2.15; 95% CI 1.23-3.76) and ethylene dibromide (OR 2.07; 95% CI 1.02-4.20) all showed ORs of >2.0 and significant exposure-response trends. For nonallergic asthma, DDT (dichlorodiphenyltrichloroethane) showed the strongest association (OR 1.41; 95% CI 1.09-1.84), but with little evidence of increasing asthma with increasing use. Current animal handling and farm activities did not confound these results. There was little evidence that allergy alone was driving these associations. In conclusion, pesticides may be an overlooked contributor to asthma risk among farmers.	European Respiratory Journal	34	6	1296-303	Self-reported exposure			Cohort (prospective)	Specific active ingredient	respiratory	doctor-diagnosed	USA	hic
478	J. A. Hoppin, D. M. Umbach, S. J. London, P. K. Henneberger, G. J. Kullman, M. C. Alavanja and D. P. Sandler	Pesticides and atopic and nonatopic asthma among farm women in the Agricultural Health Study	2008	RATIONALE: Risk factors for asthma among farm women are understudied. OBJECTIVES: We evaluated pesticide and other occupational exposures as risk factors for adult-onset asthma. METHODS: Studying 25,814 farm women in the Agricultural Health Study, we used self-reported history of doctor-diagnosed asthma with or without eczema and/or hay fever to create two case groups: patients with atopic asthma and those with nonatopic asthma. We assessed disease-exposure associations with polytomous logistic regression. MEASUREMENTS AND MAIN RESULTS: At enrollment (1993-1997), 702 women (2.7%) reported a doctor's diagnosis of asthma after age 19 years (282 atopic, 420 nonatopic). Growing up on a farm (61% of all farm women) was protective for atopic asthma (odds ratio [OR], 0.55; 95% confidence interval [CI], 0.43-0.70) and, to a lesser extent, for nonatopic asthma (OR, 0.83; 95%CI, 0.68-1.02; P value for difference = 0.008). Pesticide use was almost exclusively associated with atopic asthma. Any use of pesticides on the farm was associated only with atopic asthma (OR, 1.46; 95% CI, 1.14-1.87). This association with pesticides was strongest among women who had grown up on a farm. Women who grew up on farms and did not apply pesticides had the lowest overall risk of atopic asthma (OR, 0.41; 95% CI, 0.27-0.62) compared with women who neither grew up on farms nor applied pesticides. A total of 7 of 16 insecticides, 2 of 11 herbicides, and 1 of 4 fungicides were significantly associated with atopic asthma; only permethrin use on crops was associated with nonatopic asthma. CONCLUSIONS: These findings suggest that pesticides may contribute to atopic asthma, but not nonatopic asthma, among farm women.	American Journal of Respiratory & Critical Care Medicine	177	1	43412	Self-reported exposure			Cross-sectional	Specific active ingredient	respiratory	self-reported	USA	hic
479	J. A. Hoppin, M. Valcin, P. K. Henneberger, G. J. Kullman, D. M. Umbach, S. J. London, M. C. Alavanja and D. P. Sandler	Pesticide use and chronic bronchitis among farmers in the Agricultural Health Study	2007	BACKGROUND: Farmers have increased risk for chronic bronchitis. Few investigators have considered pesticides. METHODS: We evaluated pesticides as risk factors for chronic bronchitis using the Agricultural Health Study enrollment data on lifetime pesticide use and history of doctor-diagnosed chronic bronchitis from 20,908 private pesticide applicators, primarily farmers. RESULTS: A total of 654 farmers (3%) reported chronic bronchitis diagnosed after age 19. After adjustment for correlated pesticides as well as confounders, 11 pesticides were significantly associated with chronic bronchitis. Heptachlor use had the highest odds ratio (OR=1.50, 95% Confidence Interval (CI)=1.19, 1.89). Increased prevalence for chronic bronchitis was also seen for individuals who had a history of a high pesticide exposure event (OR=1.85, 95% CI=1.51, 2.25) and for those who also applied pesticides in off-farm jobs (OR=1.40, 95% CI=1.04, 1.88). Co-morbid asthma and current farm activities did not explain these results. CONCLUSIONS: These results provide preliminary evidence that pesticide use may increase chronic bronchitis prevalence.	American Journal of Industrial Medicine	50	12	969-79	Self-reported exposure			Cross-sectional	Specific active ingredient	respiratory	self-reported	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
480	J. A. Hoppin, P. E. Tolbert, E. A. Holly, J. W. Brock, S. A. Korrick, L. M. Altshul, R. H. Zhang, P. M. Bracci, V. W. Burse and L. L. Needham	Pancreatic cancer and serum organochlorine levels	2000	Occupational exposure to p,p'-dichlorodiphenyltrichloroethane (DDT) has been associated with increased pancreatic cancer risk. We measured organochlorine levels in serum obtained at the study enrollment from 108 pancreatic cancer cases and 82 control subjects aged 32-85 years in the San Francisco Bay Area between 1996 and 1998. Cases were identified using rapid case-ascertainment methods; controls were frequency-matched to cases on age and sex via random digit dial and random sampling of Health Care Financing Administration lists. Serum organochlorine levels were adjusted for lipid content to account for variation in the lipid concentration in serum between subjects. Median concentrations of p,p'-dichlorodiphenyldichloroethylene (DDE, 1290 versus 1030 ng/g lipid; P = 0.05), polychlorinated biphenyls (PCBs; 330 versus 220 ng/g lipid; P<0.001), and transnonachlor (54 versus 28 ng/g lipid; P = 0.03) were significantly greater among cases than controls. A significant dose-response relationship was observed for total PCBs (P for trend <0.001). Subjects in the highest tertile of PCBs (> or =360 ng/g lipid) had an odds ratio (OR) of 4.2 [95% confidence interval (CI) = 1.8-9.4] compared to the lowest tertile. The OR of 2.1 for the highest level of p,p'-DDE (95% CI = 0.9-4.7) diminished (OR = 1.1; 95% CI = 0.4-2.8) when PCBs were included in the model. Because pancreatic cancer is characterized by cachexia, the impact of this on the serum organochlorine levels in cases is difficult to predict. One plausible effect of cachexia is bioconcentration of organochlorines in the diminished lipid pool, which would lead to a bias away from the null. To explore this, a sensitivity analysis was performed assuming a 10-40% bioconcentration of organochlorines in case samples. The OR associated with PCBs remained elevated under conditions of up to 25% bioconcentration.	Cancer Epidemiology, Biomarkers & Prevention	9	2	199-205	Biomonitoring (blood)			Case-control	Chemical class	cancer	doctor-diagnosed	USA	hic
481	J. A. Hoppin, P. E. Tolbert, R. F. Herrick, D. S. Freedman, B. D. Ragsdale, K. R. Horvat and E. A. Brann	Occupational chlorophenol exposure and soft tissue sarcoma risk among men aged 30-60 years	1998	To evaluate the association of chlorophenol exposure with soft tissue sarcoma risk independent of phenoxyherbicide exposure, the authors analyzed data from the Selected Cancers Study, a population-based case-control study that included 295 male soft tissue sarcoma cases, aged 32-60 years, from eight population-based cancer registries and 1,908 male controls. Chlorophenol exposure was assigned using both an intensity and a confidence estimate by an industrial hygienist based on verbatim job descriptions. Seventeen percent of the jobs rated as high intensity involved wood preservation, while 82% involved cutting oils. Soft tissue sarcoma risk, modeled using conditional logistic regression, was significantly associated with ever having high-intensity chlorophenol exposure (odds ratio = 1.79, 95% confidence interval 1.10-2.88). A duration-response trend was evident among more highly exposed subjects (p for trend < 0.0001). For subjects with 10 or more years of substantial exposure, the odds ratio was 7.78 (95% confidence interval 2.46-24.65). These results suggest that chlorophenol exposure independent of phenoxyherbicides may increase the risk of soft tissue sarcoma. Because of the large number of machinists in the exposed group and the complex composition of cutting fluids, it is possible that another exposure involved in machining is responsible for the observed excess risk.	American Journal of Epidemiology	148	7	693-703	Expert case-by-case assessment			Case-control	Chemical class	cancer	doctor-diagnosed	USA	hic
482	J. A. Hoppin, P. E. Tolbert, W. D. Flanders, R. H. Zhang, D. S. Daniels, B. D. Ragsdale and E. A. Brann	Occupational risk factors for sarcoma subtypes	1999	Herbicides, chlorophenols, and other occupational exposures are suspected risk factors for soft-tissue sarcoma, but the epidemiologic evidence is inconsistent. Given that soft-tissue sarcomas represent a heterogeneous mix of cancer subtypes and that these subtypes have different disease patterns by race, sex, and age at diagnosis, studying all soft-tissue sarcomas combined may mask subtype-specific associations. Using the Selected Cancers Study, a large population-based case-control study of sarcoma conducted among U.S. men aged 30 to 60 in 1984 to 1988, we explored the occupational risk factors for soft-tissue sarcoma subtypes and skeletal sarcoma. The analysis included 251 living sarcoma cases (48 dermatofibrosarcoma protuberans, 32 malignant fibrohistiocytic sarcoma, 67 leiomyosarcoma, 53 liposarcoma, and 51 skeletal sarcoma) and 1908 living controls. Exact conditional logistic regression models suggested patterns of subtype specificity for occupational exposures. Self-reported herbicide use was associated with malignant fibrohistiocytic sarcoma (OR = 2.9, 95% CI = 1.1-7.3). We found elevated risks for chlorophenol exposure and cutting oil exposure and malignant fibrohistiocytic sarcoma and leiomyosarcoma. We found no occupational risk factor for liposarcoma. Polytomous regression models identified different odds ratios across subtypes for plywood exposure and exposure to wood and saw dust. Although exploratory, this analysis suggests that occupational risk factors for sarcoma are not uniform across subtypes.	Epidemiology	10	3	300-6	Self-reported exposure			Case-control	Type of pesticide	cancer	doctor-diagnosed	USA	hic
483	J. A. Makelarski, P. A. Romitti, C. M. Rocheleau, T. L. Burns, P. A. Stewart, M. A. Waters, C. C. Lawson, E. M. Bell, S. Lin, G. M. Shaw, R. S. Olney and S. National Birth Defects Prevention	Maternal periconceptional occupational pesticide exposure and neural tube defects	2014	BACKGROUND: Adverse associations between maternal pesticide exposure and neural tube defects (NTDs) have been suggested but not consistently observed. This study used data from the multisite National Birth Defects Prevention Study to examine associations between maternal periconceptional (1 month preconception through 2 months postconception) occupational pesticide exposure and NTDs. METHODS: Mothers of 502 NTD cases and 2950 unaffected live-born control infants with estimated delivery dates from 1997 through 2002 were included. Duration, categorical intensity scores, and categorical frequency scores for pesticide classes (e.g., insecticides) were assigned using a modified, literature-based job-exposure matrix and maternal-reported occupational histories. Adjusted odds ratios (aORs) and 95% confidence intervals were estimated based on fitted multivariable logistic regression models that described associations between maternal periconceptional occupational pesticide exposure and NTDs. The aORs were estimated for pesticide exposure (any [yes/no] and cumulative exposure [intensity x frequency x duration] to any pesticide class, each pesticide class, or combination of pesticide classes) and all NTD cases combined and NTD subtypes. RESULTS: Positive, but marginally significant or nonsignificant, aORs were observed for exposure to insecticides+herbicides for all NTD cases combined and for spina bifida alone. Similarly, positive aORs were observed for any exposure and cumulative exposure to insecticides + herbicides + fungicides and anencephaly alone and encephalocele alone. All other aORs were near unity. CONCLUSION: Pesticide exposure associations varied by NTD subtype and pesticide class. Several aORs were increased, but not significantly. Future work should continue to examine associations between pesticide classes and NTD subtypes using a detailed occupational pesticide exposure assessment and examine pesticide exposures outside the workplace.	Birth Defects Research	100	11	877-86	Job exposure matrix	Self-reported job history		Case-control	Type of pesticide	offspring	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
484	J. A. P. Patil, A. J.; Sontakke, A. V.; Govindwar, S. P.	Occupational pesticides exposure of sprayers of grape gardens in western Maharashtra (India): effects on liver and kidney function	2009	We compared hematologic parameters and liver and kidney function tests in occupationally exposed pesticide sprayers of grape gardens (n = 60) and normal healthy participants (n = 30), 20-45 years of age, in Western Maharashtra (India). Venous blood samples were collected from both groups. Compared with control participants, sprayers showed the following-significantly increased serum C reactive protein (117.6%), liver function marker enzymes-serum aspartate transaminase (57%), alanine transaminase (37.4%), alkaline phosphatase (16.9%), serum bilirubin (41.8%), creatinine (18.4%), blood glucose (11.4%), and urea (13.%); and decreased acetyl cholinesterase activity (30.9%) and serum cholesterol (12.12%). Serum total protein, globulin, and the A/G ratio were not significantly altered, however, but serum albumin decreased slightly (3.3%, P <.05). Compared with the control group, hematologic parameters significantly decreased in sprayers-hemoglobin (6.9%), hematocrit (3%), mean corpuscular volume (3.8%), mean corpuscular hemoglobin (4.5%), mean corpuscular hemoglobin concentration (5.8%), and red blood cell count (7.7%), whereas the white blood cell count increased (18.2%). The decreased serum acetyl cholinesterase value indicates a high degree of pesticides absorption, which leads to impairment of liver and kidney functions and slightly altered hematologic parameters in the occupationally exposed pesticides sprayers of grape gardens studied here.	Journal of Basic & Clinical Physiology & Pharmacology	20	4	335-55	Job title			Cohort (prospective)	Job title	genitourinary	medical test result	India	lmic
485	J. A. P. Rusiecki, R.; Koutros, S.; Beane-Freeman, L.; Landgren, O.; Bonner, M. R.; Coble, J.; Lubin, J.; Blair, A.; Hoppin, J. A.; Alavanja, M. C.	Cancer incidence among pesticide applicators exposed to permethrin in the Agricultural Health Study	2009	BACKGROUND: Permethrin is a synthetic pyrethroid insecticide widely used in agriculture, in public health, and in many U.S. homes and gardens. OBJECTIVE: In this study we evaluated the incidence of cancer among pesticide applicators exposed to permethrin in the Agricultural Health Study (AHS). METHODS: A total of 49,093 pesticide applicators were included in this analysis of the AHS, a prospective cohort study of licensed pesticide applicators in Iowa and North Carolina. Detailed information on pesticide exposure and lifestyle factors was obtained from self-administered questionnaires completed in 1993-1997. Average length of follow-up since applicator enrollment in the cohort was 9.14 years. We used two permethrin exposure metrics: a) lifetime days applicators personally mixed or applied permethrin and b) intensity-weighted lifetime days (lifetime days weighted by estimated intensity of exposure). We used Poisson regression analysis to estimate relative risks (RRs) and 95% confidence intervals (CIs) for malignancies by tertiles of exposure. RESULTS: We found no associations between permethrin and all malignant neoplasms combined, or between permethrin and melanoma, non-Hodgkin lymphoma, leukemia, or cancers of the colon, rectum, lung, or prostate. We found elevated and statistically significant risks for multiple myeloma in the highest tertiles of both lifetime exposure-days (RR = 5.72; 95% CI, 2.76-11.87) and intensity-weighted lifetime exposure-days (RR = 5.01; 95% CI, 2.41-10.42), compared with applicators reporting they never used permethrin; these results are based on only 15 exposed cases. These findings were similar across a variety of alternative exposure metrics, exposure categories, and reference groups. CONCLUSIONS: This study found no association with most cancers analyzed. Although the suggested association with multiple myeloma was based on a small number of cases, it warrants further evaluation.	Environmental Health Perspectives	117	4	581-6	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
486	J. A. Patil, A. J. Patil and S. P. Govindwar	Biochemical effects of various pesticides on sprayers of grape gardens	2003	A total of 85 healthy male pesticide sprayers in grape garden exposed to different class of pesticides for 3 to 10 years were compared with 75 controls matched for age with respect to serum cholinesterase, serum total protein, albumin, AST, ALT, hematological parameters such as Hb, Hct, RBC and serum lipid peroxidation. Serum lipid peroxidation was estimated in the form of thiobarbituric acid reactive substances (TBARS) produced. Significant decrease was observed in serum cholinesterase, serum total proteins, albumin and hematological parameters viz. Hb, Hct and RBC. Significant increase in lipid peroxidation, AST, ALT, was observed in exposed group when compared with control. These results suggest that the long term exposure of various pesticides on sprayers of grape garden affect liver, heme biosynthesis and decrease serum cholinesterase.	Indian Journal of Clinical Biochemistry	18	2	16-22	Job title			Cohort (prospective)	Job title	biochemical	medical test result	India	lmic
487	J. A. Patil, A. J. Patil, A. V. Sontakke and S. P. Govindwar	Effect of vitamin e supplementation on biochemical parameters in pesticides sprayers of grape gardens of Western Maharashtra (India)	2012	The aim of this study was to see the biochemical effects of pesticides on sprayers of grape gardens before and after 15 days of vitamin E supplementations in Western Maharashtra (India), who were occupationally exposed to various pesticides over a long period of time (about 5 to 15 years). Blood samples were collected from all study group subjects for biochemical parameters assays before and after 15 days of vitamin E supplementation. Sprayers of grape gardens were given 400 mg of vitamin E tablet/day for 15 days. After 15 days of vitamin E supplementation to sprayers of grape gardens, we observed significantly decreased aspartate transaminase (10.88 %, P < 0.05, r = 0.88), alanine transaminase (25.92 %, P < 0.01, r = 0.46) and total proteins (3.32 %, P < 0.01, r = 0.33), whereas, no statistically significant change was found in serum acetyl cholinesterase, C-reactive proteins, albumin (ALB), globulins and ALB/globulin ratio as compared to before vitamin E supplementation. Sprayers of grape gardens, who received vitamin E supplementation, showed significantly decreased serum lipid peroxide (LP) (18.75 %, P <0.001, r = 0.63) and significantly increased RBC-superoxide dismutase (SOD) (12.88 %, P <0.001, r = 0.85), RBC-Catalase (CAT) (24.49 %, P <0.001, r = 0.70), plasma ceruloplasmin (CP) (4.6 %, P < 0.01, r = 0.80), serum zinc (4.57 %, P < 0.01, r = 0.83) and serum copper (4.37 %, P <0.01, r = 0.79) as compared to values before vitamin E supplementation. These results showed that vitamin E supplementation has ameliorating effects on these transaminase enzymes, suggesting that it may have a protective effect on liver, from pesticides induced damage. In this study vitamin E supplementation might have decreased LP levels by breaking chain reaction of lipid peroxidation. Present results indicate that vitamin E plays a crucial role in restoring the antioxidant enzymes such as SOD, CAT and CP, in population exposed to pesticides. This helps to enhance its antioxidant ability. Therefore, it is suggested that farmers, pesticide applicators, workers in the pesticide industry and other pesticide users, who come in regular contact with pesticides, may be benefited by supplementation with vitamin E. <U+00AC><U+00A9> 2012 Association of Clinical Biochemists of India.	Indian Journal of Clinical Biochemistry	27	2	134-140	Job title			Cohort (prospective)	Job title	NA	NA	India	lmic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
488	J. A. Rusiecki, L. E. Beane Freeman, M. R. Bonner, M. Alexander, L. Chen, G. Andreotti, K. H. Barry, L. E. Moore, H. M. Byun, F. Kamel, M. Alavanja, J. A. Hoppin and A. Baccarelli	High pesticide exposure events and DNA methylation among pesticide applicators in the agricultural health study	2017	Pesticide exposure has been associated with acute and chronic adverse health effects. DNA methylation (DNAm) may mediate these effects. We evaluated the association between experiencing unusually high pesticide exposure events (HPEEs) and DNAm among pesticide applicators in the Agricultural Health Study (AHS), a prospective study of applicators from Iowa and North Carolina. DNA was extracted from whole blood from male AHS pesticide applicators (n=695). Questionnaire data were used to ascertain the occurrence of HPEEs over the participant's lifetime. Pyrosequencing was used to quantify DNAm in CDH1, GSTp1, and MGMT promoters, and in the repetitive element, LINE-1. Linear and robust regression analyses evaluated adjusted associations between HPEE and DNAm. Ever having an HPEE (n=142; 24%) was associated with elevated DNAm in the GSTp1 promoter at CpG7 (chr11:67,351,134; P<0.01) and for the mean across the CpGs measured in the GSTp1 promoter (P<0.01). In stratified analyses, elevated GSTP1 promoter DNAm associated with HPEE was more pronounced among applicators >59 years and those with plasma folate levels <=16.56 ng/mL (p-interaction <0.01); HPEE was associated with reduced MGMT promoter DNAm at CpG2 (chr10:131,265,803; P=0.03), CpG3 (chr10:131,265,810; P=0.05), and the mean across CpGs measured in the MGMT promoter (P= 0.03) among applicators >59 years and reduced LINE-1 DNAm (P=0.05) among applicators with <=16.56 ng/mL plasma folate. Non-specific HPEEs may contribute to increased DNAm in GSTp1, and in some groups, reduced DNAm in MGMT and LINE-1. The impacts of these alterations on disease development are unclear, but elevated GSTp1 promoter DNAm and subsequent gene inactivation has been consistently associated with prostate cancer. Environ. Mol. Mutagen. 58:19-29, 2017. <U+00AC><U+00A9> 2016 Wiley Periodicals, Inc.	Environmental & Molecular Mutagenesis	58	1	19-29	Self-reported exposure			Cohort (prospective)	Pesticides in general	genetic (biomarkers)	medical test result	USA	hic
489	J. A. Tomenson and G. A. Matthews	Causes and types of health effects during the use of crop protection chemicals: data from a survey of over 6,300 smallholder applicators in 24 different countries	2009	PURPOSE: The present investigation looks in detail at the causes and types of health incidents reported by 6,300 mainly smallholder agrochemical users in 24 countries during 2005 and 2006. METHODS: The investigation is based on a questionnaire survey of knowledge, attitude and practice that concentrated on the sequence of events from purchasing the pesticide to disposal. Information was also collected about health problems experienced while using agrochemicals. The survey targeted mainly smallholder knapsack spray operators who were expected to be at a highest risk of exposure. RESULTS: In the 12 months prior to interview, 1.2% of users reported an agrochemical-related incident that required hospital treatment, 5.8% reported an incident requiring at least trained medical treatment but not hospitalisation and 19.8% reported only a minor sign or symptom. Users who had experienced an incident involving agricultural equipment were 3.38 (95% CI 2.29-4.99) times more likely to experience an agrochemical-related health incident, but confident users who felt that their use of personal protective equipment while spraying was best practice were 0.60 (95% CI 0.44-0.84) times less likely to experience such an incident. Over 80% of product-related incidents were caused by insecticides and the incidence rate per spraying time for incidents linked to insecticides was significantly higher than that for fungicides or herbicides. Headache/dizziness and nausea/vomiting, often smell related, were the most common symptoms reported by users who listed agrochemical products that had caused them health problems (52 and 38% of product mentions, respectively). CONCLUSIONS: In most countries, the incidence of serious health effects was low; however, there was a high incidence of minor signs and symptoms in a few countries, especially in Africa. A disproportionate number of incidents occurred during insecticide use relative to the time that they were sprayed. Failure to exercise caution as indicated by whether users had incidents involving agricultural equipment or livestock, and lack of confidence in their practices were the most important predictors of agrochemical-related incidents.	International Archives of Occupational & Environmental Health	82	8	935-49	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	SHIC	SHIC
490	J. A. Tomenson, D. R. Taves, A. T. Cockett, J. McCusker, L. Barraj, M. Francis, T. P. Pastoor, G. A. Wickramaratne and H. L. Northrop	An assessment of fertility in male workers exposed to molinate	1999	Molinate is a thiocarbamate herbicide used for weed control in rice fields. Since the late 1970s, findings from reproductive toxicology studies of rats have led to concern that molinate might affect human male fertility. Semen samples were collected from 272 formulation and production workers at three US plants. The samples were collected at the end of four alternate monitoring periods of either high or low exposure to molinate. In addition, 222 married workers provided reproductive-history information. Workers' mean exposures to molinate during the monitoring periods ranged from 12.7 micrograms/m3 to 210.9 micrograms/m3. There was no evidence that sperm and serum hormone levels were related to exposure to molinate before the study or exposure during the four monitoring periods. There was also no evidence of a molinate exposure-related effect on the ratio of observed to expected births.	Journal of Occupational & Environmental Medicine	41	9	771-87	Environmental air monitoring	Expert case-by-case assessment		NA	Specific active ingredient	reproductive	medical test result	USA	hic
491	J. A. U. Hoppin, D. M.; London, S. J.; Alavanja, M. C.; Sandler, D. P.	Chemical predictors of wheeze among farmer pesticide applicators in the Agricultural Health Study	2002	Pesticides may contribute to respiratory symptoms among farmers. Using the Agricultural Health Study, a large cohort of certified pesticide applicators in Iowa and North Carolina, we explored the association between wheeze and pesticide use in the past year. Self-administered questionnaires contained items on 40 currently used pesticides and pesticide application practices. A total of 20,468 applicators, ranging in age from 16 to 88 years, provided complete information; 19% reported wheezing in the past year. Logistic regression models controlling for age, state, smoking, and history of asthma or atopy were used to evaluate associations between individual pesticides and wheeze. Among pesticides suspected to contribute to wheeze, paraquat, three organophosphates (parathion, malathion, and chlorpyrifos), and one thiocarbamate (*S*-ethyl-dipropylthiocarbamate [EPTC]) had elevated odds ratios (OR). Parathion had the highest OR (1.5, 95% confidence interval [CI] 1.0, 2.2). Chlorpyrifos, EPTC, paraquat, and parathion demonstrated significant dose-response trends. The herbicides, atrazine and alachlor, but not 2,4-D, were associated with wheeze. Atrazine had a significant dose-response trend with participants applying atrazine more than 20 days/year having an OR of 1.5 (95% CI 1.2,1.9). Inclusion of crops and animals into these models did not significantly alter the observed OR. These associations, though small, suggest an independent role for specific pesticides in respiratory symptoms of farmers.	American Journal of Respiratory & Critical Care Medicine	165	5	683-9	Self-reported exposure			Cohort (prospective)	Specific active ingredient	respiratory	self-reported	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
492	J. A. U. Hoppin, D. M.; London, S. J.; Lynch, C. F.; Alavanja, M. C.; Sandler, D. P.	Pesticides and adult respiratory outcomes in the agricultural health study	2006	In the 1700s, Bernardino Ramazzini was among the first to describe respiratory disease among agricultural workers. Since then, farmers continue to have higher rates of respiratory illnesses, even as changes occur in occupational and environmental exposures on farms. While grain and animal exposures have been well studied for their role in agricultural lung diseases, pesticide exposures have not. Using the Agricultural Health Study, a prospective cohort study of approximately 89,000 licensed pesticide applicators and their spouses in Iowa and North Carolina, we are currently assessing the association of pesticides with respiratory outcomes, including wheeze, adult asthma, farmer's lung, and chronic bronchitis. At enrollment (1993-1997), 19% of farmers and 22% of commercial pesticide applicators reported wheeze in the previous year. Using logistic regression models adjusted for age, state, smoking status, and body mass index, we evaluated the association of 40 individual pesticides with wheeze within these two groups separately. In both groups, we observed strong evidence of an association of organophosphates with wheeze. For farmers, the organophosphates chlorpyrifos, malathion, and parathion were positively associated with wheeze; for the commercial applicators, the organophosphates chlorpyrifos, dichlorvos, and phorate were positively associated with wheeze. Chlorpyrifos was strongly associated with wheeze in a dose-dependent manner in both groups; use of chlorpyrifos for at least 20 days per year had an odds ratio of 1.48 (95% confidence interval [CI] = 1.00-2.19) for farmers and 1.96 (95% CI = 1.05-3.66) for commercial applicators. Our wheeze results are consistent with recent animal models that support a role for organophosphates and respiratory outcomes.	Annals of the New York Academy of Sciences	1076	NA	343-54	Self-reported exposure			Cohort (prospective)	Specific active ingredient	respiratory	self-reported	USA	hic
493	J. Alguacil, T. Kauppinen, M. Porta, T. Partanen, N. Malats, M. Kogevinas, F. G. Benavides, J. Obiols, F. Bernal, J. Rifa and A. Carrato	Risk of pancreatic cancer and occupational exposures in Spain. PANKRAS II Study Group	2000	The objective of the study was to analyse the relationship between occupational exposures and risk of pancreatic cancer. Incident cases of pancreatic cancer and hospital controls were prospectively identified and interviewed during the hospital stay. Occupational history was obtained by direct interview with the patient, and was available for 164 (89%) of 185 pancreatic cancer cases, and 238 (90%) of 264 controls. Two industrial hygienists evaluated exposures to 22 suspected carcinogens previously associated with pancreatic cancer. Occupational exposures were also assessed using the Finnish job-exposure matrix (FINJEM). For each type of pesticide group, moderately increased odds ratios (OR) were apparent in the high-intensity category, highest for arsenical pesticides (OR=3.4; 95% CI 0.9-12.0), and 'other pesticides' (OR=3.17; 95% CI 1.1-9.2). ORs for aniline derivatives, and dyes and organic pigments, were also higher for high-intensity exposure, and increased when lagged and restricted to long duration of exposure. ORs above 3 were observed for the following agents evaluated by FINJEM: pesticides, benzo[a]pyrene, lead, volatile sulphur compounds, and sedentary work. Whilst generally negative, results lend moderate support to the hypothesis of an association between exposure to some pesticides and pancreatic cancer. Larger studies could address the potential for these compounds to modify the carcinogenic risk of other environmental exposures. Suggestive increases in risk from aniline derivatives, dyes and organic pigments, and benzo[a]pyrene may also deserve further attention.	Annals of Occupational Hygiene	44	5	391-403	Self-reported job history	Job exposure matrix		Case-control	Pesticides in general	cancer	doctor-diagnosed	Spain	hic
494	J. B. Wilk, J. L. Tobin, O. Suchowersky, H. A. Shill, C. Klein, G. F. Wooten, M. F. Lew, M. H. Mark, M. Guttman, R. L. Watts, C. Singer, J. H. Growdon, J. C. Latourelle, M. H. Saint-Hilaire, A. L. DeStefano, R. Prakash, S. Williamson, C. J. Berg, M. Sun, S. Goldwurm, G. Pezzoli, B. A. Racette, J. S. Perlmutter, A. Parsian, K. B. Baker, M. L. Giroux, I. Litvan, P. P. Pramstaller, G. Nicholson, D. J. Burn, P. F. Chinnery, P. Vieregge, J. T. Slevin, F. Cambi, M. E. MacDonald, J. F. Gusella, R. H. Myers and L. I. Golbe	Herbicide exposure modifies GSTP1 haplotype association to Parkinson onset age: the GenePD Study	2006	BACKGROUND: Polymorphisms in the glutathione S-transferase pi gene (GSTP1), encoding GSTP1-1, a detoxification enzyme, may increase the risk of Parkinson disease (PD) with exposure to pesticides. Using the GenePD Study sample of familial PD cases, we explored whether GSTP1 polymorphisms were associated with the age at onset of PD symptoms and whether that relation was modified by exposure to herbicides. METHODS: Seven single-nucleotide polymorphisms (SNPs) were genotyped and tested for association with PD onset age in men in three strata: no exposure to herbicides, residential exposure to herbicides, and occupational exposure to herbicides. Haplotypes were similarly evaluated in stratified analyses. RESULTS: Three SNPs were associated with PD onset age in the group of men occupationally exposed to herbicides. Three additional SNPs had significant trends for the association of PD onset age across the herbicide exposure groups. Haplotype results also provided evidence that the relation between GSTP1 and onset age is modified by herbicide exposure. One haplotype was associated with an approximately 8-years-earlier onset in the occupationally exposed group and a 2.8-years-later onset in the nonexposed group. CONCLUSIONS: Herbicide exposure may be an effect modifier of the relation between glutathione S-transferase pi gene polymorphisms and onset age in familial PD.	Neurology	67	12	112039	Self-reported exposure			Cross-sectional	Type of pesticide	neurological	doctor-diagnosed	AHIC	AHIC

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495	J. Blanco-Munoz, M. Lacasana, C. Aguilar-Garduno, M. Rodriguez-Barranco, S. Bassol, M. E. Cebrian, I. Lopez-Flores and I. Ruiz-Perez	Effect of exposure to p,p'-DDE on male hormone profile in Mexican flower growers	2012	OBJECTIVES: p,p'-Dichlorodiphenyldichloroethene (p,p'-DDE) acts as an androgen receptor antagonist, however data regarding its hormonal effects in men are limited. The objective of this study was to evaluate the association between serum levels of p,p'-DDE and reproductive hormone profile in Mexican male flower growers. METHODS: A longitudinal study was carried out in a population of men working in the production of flowers and ornamental plants in two Mexican states during July-October 2004 (rainy season) and December 2004-May 2005 (dry season). A questionnaire including information on socioeconomic characteristics, tobacco and alcohol use, presence of chronic and acute diseases, occupational history and anthropometry was used and blood and urine samples were obtained. Serum levels of p,p'-DDE were analysed by gas chromatography; FSH, LH, testosterone, oestradiol, inhibin B and prolactin levels were measured by enzymatic immunoassay. Urinary levels of dialkylphosphates (DAPs) were analysed by gas chromatography. Associations between serum levels of p,p'-DDE and male reproductive hormones (both transformed to their natural logarithm) were evaluated using multivariate generalised estimating equation (GEE) models. RESULTS: Median p,p'-DDE levels were 677.2 ng/g lipid (range 9.4-12 696.5) during the rainy season and 626.7 ng/g lipid (range 9.4-13 668.1) during the dry season. After adjusting for potential confounders (age, body mass index, state of residence and DAPs), p,p'-DDE levels were negatively associated with prolactin (beta=-0.04; 95% CI -0.07 to -0.008) and testosterone (beta=0.04; 95% CI -0.08 to 0.005) and positively with inhibin B (beta=0.11; 95% CI 0.02 to 0.21). CONCLUSION: These results indicate that p,p'-DDE can affect hypothalamic-pituitary-gonadal axis function in humans.	Occupational & Environmental Medicine	69	1	43231	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	endocrine/nutritional/metabolical	medical test result	Mexico	umic
496	J. Blanco-Munoz, M. Lacasana, I. Lopez-Flores, M. Rodriguez-Barranco, B. Gonzalez-Alzaga, S. Bassol, M. E. Cebrian, L. Lopez-Carrillo and C. Aguilar-Garduno	Association between organochlorine pesticide exposure and thyroid hormones in floriculture workers	2016	Several studies have suggested that exposure to DDT may be related to changes in thyroid hormone levels in animals and humans, even though results across studies are inconsistent. The aim of this study was to assess the association between exposure to p,p'-DDE (a stable metabolite of DDT) and serum levels of thyroid hormones in floriculture workers. A longitudinal study was conducted on 136 male subjects from the States of Mexico and Morelos, Mexico, who were occupationally exposed to pesticides, during agricultural periods of high (rainy season) and low (dry season) levels of pesticide application. Using a structured questionnaire, a survey was carried out on socio-demographic characteristics, anthropometry, clinical history, alcohol and tobacco consumption, residential chemical exposure, and occupational history. Blood and urine samples were collected to determine serum levels of TSH, total T3, total T4, and p,p'-DDE, and metabolites of organophosphate pesticides (OP), respectively. The analysis of the associations between p,p'-DDE levels and thyroid hormone profile adjusting by potential confounding variables including urinary OP metabolites was carried out using multivariate generalized estimating equation (GEE) models. Our results showed that the geometric means of p,p'-DDE levels were 6.17 ng/ml and 4.71 ng/ml in the rainy and dry seasons, respectively. We observed positive associations between the serum levels of p,p'-DDE and those of total T3 (beta=0.01, 95% CI: -0.009, 0.03), and total T4 (beta=0.08, 95% CI:0.03, 0.14) and negative but no significant changes in TSH in male floricultural workers, supporting the hypothesis that acts as thyroid disruptor in humans.	Environmental Research	150	NA	357-63	Biomonitoring (blood)	Self-reported job history		Cohort (prospective)	Specific active ingredient	endocrine/nutritional/metabolical	medical test result	Mexico	umic
497	J. Blanco-Munoz, M. M. Morales, M. Lacasana, C. Aguilar-Garduno, S. Bassol and M. E. Cebrian	Exposure to organophosphate pesticides and male hormone profile in floriculturist of the state of Morelos, Mexico	2010	BACKGROUND: Studies on experimental animals have found that organophosphate (OP) pesticides may act as endocrine disruptors; however, their effects on the human hormonal profile have not yet been adequately characterized. We evaluate the association between exposure to OP pesticides, measured through dialkyl phosphate (DAP) metabolites urinary levels, and the male hormone profile. METHODS: A cross-sectional study was performed in 104 floriculturists of Morelos, Mexico. A structured questionnaire was applied to get information on sociodemographic characteristics, anthropometry, clinical history, alcohol and tobacco consumption, and work history. DAP metabolites [dimethylphosphate (DMP), dimethylthiophosphate, dimethyldithiophosphate, diethylphosphate (DEP), diethylthiophosphate (DETP) and diethyldithiophosphate] were determined using gas-liquid chromatography. Serum levels of FSH, LH, prolactin, testosterone, inhibin B and estradiol were determined using enzyme-linked immunosorbent assay. Multiple linear regression was used to study the association between DAP metabolite levels and male hormonal profile. Data were adjusted by p,p' -dichlorodiphenyldichloroethene serum levels and other potential confounders. RESULTS: There was a negative association between inhibin B and urinary levels of DMP, DEP, DETP and total DAP metabolites. DEP levels were negatively associated with serum FSH concentrations, but marginally and positively associated with those of testosterone. DETP was marginally associated with lower LH serum levels. There were no other significant associations among OP metabolites and serum hormone levels. CONCLUSIONS: Inhibin B and FSH vary according to levels of DAP metabolites in men occupationally exposed to OP pesticides. These results suggest that OP pesticides could act as endocrine disruptors in humans; however, most hormonal values fell within the wide normal range and associations were small. There is, therefore, a need for further investigation to elucidate their biological and clinical relevance.	Human Reproduction	25	7	1787-95	Biomonitoring (blood)			Cross-sectional	Chemical class	endocrine/nutritional/metabolical	medical test result	Mexico	umic
498	J. Bukowski, C. Brown, L. R. Korn and L. W. Meyer	Prevalence of and potential risk factors for symptoms associated with insecticide use among animal groomers	1996	Pet groomers make numerous insecticide applications during the flea season, but few studies have examined their health complaints. The Pesticide Control Program of the New Jersey Department of Environmental Protection conducted a health and safety survey of this population. All licensed pet applicators in New Jersey were contacted, as were New Jersey veterinarians listed as pet-animal practitioners by the American Veterinary Medical Association. Approximately 36% of the respondents indicated that during the 1994 flea season, they had experience at least one of the 17 symptoms associated with insecticide application. Central nervous system symptoms (headache, dizziness, or confusion) and skin symptoms (skin rash or numbness/tingling) were reported most frequently. Logistic regression results suggest that applications per season, years as an applicator, certain hygiene variables, certain classes of products, and status of applicator (veterinary vs veterinary) are potentially important risk factors.	Journal of Occupational & Environmental Medicine	38	5	528-34	Job title			Cross-sectional	Type of pesticide	pesticide-related symptoms	self-reported	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
499	J. Butler-Dawson and P. S. Thorne	Determinants of pesticide exposure and neurobehavioral impact of subsistence farmers in the Gambia	2014	Pesticide use greatly impacts the health of agricultural communities, including both beneficial and detrimental impacts. There is increasing concern regarding the widespread use of pesticides and their potential impacts on public health. Acute high-level exposures to certain insecticides have well-known adverse neurobehavioral (NB) effects. Chronic exposures have more subtle effects which are harder to measure and evidence is limited on the NB aspects of low-level exposures to insecticides. We assessed levels of chronic pesticide exposure and effects on NB performance of subsistence farmers. NB tests were administered to rural residents in the Upper River Region of The Gambia. Participants (N=158, ages 18 - 40 years) completed eight NB tests to assess attention, memory, response speed, and coordination. Questionnaires were administered to participants on sociodemographic characteristics and agricultural and home pesticide use. Among participants who had ever directly used agricultural pesticides (N=77, 58%), practices that were potentially main determinants of pesticide exposure were duration and frequency of use, lack of personal protective equipment use (58%), mixing techniques (bare hands/leaves, 27%, and jerry can, 22%), application methods (hands, 40%, and hand-held sprayer, 23%), and hygiene practices (not bathing or changing clothes after use, 42%, and not washing hands before eating, 42%). These exposure determinants were weighted individually by six subject matter experts to create exposure scores that included frequency and duration of use to estimate exposure levels of participants. The average age of the studied population was 28 years and 48% of males and 63% of females had never been to school. Females had statistically significant higher exposure scores than males and certain ethnicity groups had statistically significant higher exposure scores. The results of such studies are critically important especially in developing countries where adverse health effects could be the greatest due to lack of protective measures and regulations.	American Journal of Tropical Medicine and Hygiene	91	5	353-354	Self-reported exposure			Cross-sectional	Pesticides in general	neurological	medical test result	Gambia	lic
500	J. C. Paiva, I. O. Cabral, B. M. Soares, C. M. Sombra, J. R. Ferreira, M. O. Moraes, B. C. Cavalcanti and C. Pessoa	Biomonitoring of rural workers exposed to a complex mixture of pesticides in the municipalities of Tiangua and Ubajara (Ceara state, Brazil): genotoxic and cytogenetic studies	2011	In recent years, the use of pesticides in agriculture has been steadily increasing, and associations between exposure to agricultural chemicals and DNA damage and cancer have been reported. Brazil is one of the world leaders in pesticide use; however, studies that evaluate the impact of pesticide exposure on cancer incidence and mortality are very scarce in the Brazilian population. The alkaline comet assay and the chromosome aberration (CA) test were used to evaluate primary DNA damage in the peripheral blood lymphocytes of workers exposed to a complex mixture of pesticides in two small rural communities in the municipalities of Tiangua and Ubajara, located in the western part of Ceara State (Northeast Brazil), which are among the largest agricultural areas of the state. The comet assay showed that the damage index and damage frequency observed in the exposed groups were significantly higher in relation to the controls (P < 0.05). On the other hand, no differences were detected regarding structural and numerical CAs in the communities evaluated. Additionally, the observed levels of DNA strand breaks and frequencies of CAs, stratified for exposure time, were not statistically different for individuals of either rural community. Our results suggest that the damages caused by pesticides in our study area were not great enough to induce permanent mutations or to interfere with mitotic apparatus formation; minimal pesticide damages could have undergone cellular repair, explaining the absence of structural and numerical CAs.	Environmental & Molecular Mutagenesis	52	6	492-501	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Brazil	umic
501	J. Carmona-Fonseca	Erythrocytic and plasmatic cholinesterases in workers with chronic controlled diseases and in users of medicines	2006	PROBLEM: Physiological values of cholinesterase are known in healthy population, but limited information on them is available in individuals with chronic, controlled diseases, either with or without medication. OBJECTIVES: To measure erythrocytic and plasmatic cholinesterase levels in active workers who met the following conditions: to be feeling well and active at their jobs at the time of the study; to suffer from some disease that was under control either with or without medication; not to have been exposed to pesticides based on cholinesterase inhibitors. METHODOLOGY: A survey was carried out among workers affiliated to the Social Security Institute in Antioquia, Colombia, to identify those suffering from some disease and who had it under control. Acetylcholinesterase and butyrylcholinesterase levels were determined using two techniques for the former and three for the latter. Surveyed workers belonged to two different parts of Antioquia, namely: the Aburra Valley and the Near East region. The study sample was made up by 827 persons. 19% of which informed to be suffering from some disease. RESULTS: Prevalence of disease in the Aburra Valley workers was 30% and in those from the Near East region, 9% (p = 0.0000000). The list of their diseases included 13 different ones, the most frequent of which were: hypertension (29%), "liver disease" (16%), anemia (10%), and arthritis (10%). Out of the 827 people, 127 (15%) were under some kind of medication at the moment of the study; of them, 85% were being treated with only one drug. Eight per cent were diseased and under medication (D+, M+), 74% were neither diseased nor under medication (D-, M-), 11 % were diseased but were not being treated (D+, M-), and 7% were not diseased but did use some medication (D-, M+). These four groups were stratified according to region and sex and compared as to cholinesterase levels. No significant differences were found. Comparison of enzymatic values among people with or without specific diseases also did not reveal any significant differences, except for anemia. CONCLUSION: Erythrocytic and plasmatic cholinesterase levels are similar in healthy workers and in those with chronic, controlled diseases, regardless of the use or not of medication.	Iatreia	19	1	14-28	Biomonitoring (blood)			Cross-sectional	Chemical class	NA	self-reported	Colombia	umic
502	J. Castillo-Cadena, L. E. Tenorio-Vieyra, A. I. Quintana-Carabia, M. M. Garc<U+221A><U+2260>a-Fabila, E. Ram<U+221A><U+2260>rez-San Juan and E. Madrigal-Bujaidar	Determination of DNA damage in floriculturists exposed to mixtures of pesticides	2006	The aim of the study was to determine possible DNA damage in floriculturists chronically exposed to pesticides. Leukocytes from 52 workers, 46 environmentally exposed, and 38 control individuals were evaluated with the comet assay. Serum from all individuals was also analyzed for pesticides using gas chromatography coupled to mass spectrometry. A statistically significant difference in DNA fragmentation in the pesticide exposed group compared to the other two groups (P < .001) was found. No differences between environmentally exposed and control individuals were detected. The statistical analysis showed no significant correlation between DNA damage and sex, age, drinking or smoking habits, as well as years of exposure. One or more pesticides were detected in 50% of the floriculturists, while in the rest of the individuals, a chemical related with the preparation of pesticides, such as additives, plasticizers, or solvents, was found. Our study shows that chronic exposure to pesticides produces DNA damage in floriculturists. It also suggests that this type of monitoring could be valuable in recommending preventive measures. Copyright <U+00AC><U+00A9> 2006 J. Castillo-Cadena et al.	Journal of Biomedicine and Biotechnology	2006	NA	NA	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Mexico	umic

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503	J. Clavel, D. Hemon, L. Mandereau, B. Delemotte, F. Severin and G. Flandrin	Farming, pesticide use and hairy-cell leukemia	1996	OBJECTIVES: This paper analyzes the role of farming and pesticide exposures in the occurrence of hairy-cell leukemia (HCL). METHODS: The study included 226 men with HCL and 425 matched hospital referents. Pesticide exposure was assessed by expert review of detailed interview data on occupational histories and agricultural activities and exposures. RESULTS: Altogether, 77 cases and 116 referents had farmed for at least six months, giving an odds ratio (OR) of 1.5 [95% confidence interval (95% CI) 1.0-2.2]. Forage growing was reported by 20.8% of the cases and 11.1% of the referents and was associated with HCL (OR 2.8, 95% CI 1.6-4.9), even among farmers who had never handled pesticides (OR 3.4, 95% CI 1.0-11.0). A significant association was found between HCL and pesticide use, the overall odds ratios for insecticide, fungicide, and herbicide use ranging from 1.5 to 2.4. Organophosphorus insecticides were the only agrochemicals with a positive association with HCL after other pesticide exposures, smoking, and forage growing were accounted for. A clear-cut negative interaction was found between smoking and exposure to organophosphorus insecticides. A multivariate analysis yielded odds ratio estimates of 2.8 (95% CI 1.4-5.6) for exposure to forage and 7.5 (95% CI 0.9-61.5) for nonsmokers exposed to organophosphorus insecticides. CONCLUSIONS: The present study argues for a role of organophosphorus insecticides in HCL among nonsmoking farmers and shows an unexpected association with forage growing. No evidence of an association with phenoxyacetic acids, triazines, or organochlorine insecticides was found.	Scandinavian Journal of Work, Environment & Health	22	4	285-93	Self-reported job history	Expert case-by-case assessment		Case-control	Chemical class	cancer	doctor-diagnosed	France	hic
504	J. Clavel, L. Mandereau, S. Cordier, C. Le Goaster, D. Hemon, F. Conso and G. Flandrin	Hairy cell leukaemia, occupation, and smoking	1995	The roles of farm practices, occupational exposures to organic solvents, and ionizing radiation in the risk of hairy cell leukaemia (HCL) were examined in a French hospital-based multicentre case-control study including 291 cases (229 men and 62 women) and 541 controls (425 men and 116 women). No positive association was observed with occupations involving exposure to organic solvents or with self-declared exposures to solvents, but a significant association with self-reported exposure to petrol or diesel was found for men (OR = 1.5 CI95% [1.0-2.1]). No association with ionizing radiation was detected. Agriculture employment gave an odds ratio of 1.7 (CI95% [1.1-2.4]) for men and 2.7 (CI95% [1.1-6.7]) for women. Among men, the association seems to affect farmers rather than agricultural workers. Self-declared exposure to pesticides or bovine cattle breeding was related to HCL risk in both genders. Finally, a significant negative association with smoking was observed in men, with an inverse exposure-risk relationship odds ratios of 0.6, 0.5 and 0.2, respectively, for cumulative consumptions of < 10, 10-23 and > or = 24 pack-years), contrasting with an odds ratios clearly > 1 in women.	British Journal of Haematology	91	1	154-61	Self-reported exposure			Case-control	Job title	cancer	doctor-diagnosed	France	hic
505	J. D. Brender, M. Felkner, L. Suarez, M. A. Canfield and J. P. Henry	Maternal pesticide exposure and neural tube defects in Mexican Americans	2010	PURPOSE: The relation between maternal pesticide exposures and neural tube defects (NTDs) in offspring was evaluated in 184 Mexican American case-women and 225 comparison women. METHODS: In-person interviews solicited information about environmental and occupational exposures to pesticides during the periconceptional period. RESULTS: With adjustment for maternal education, smoking, and folate intake, women who reported using pesticides in their homes or yards were two times more likely (95% confidence interval [CI], 1.2-3.1) to have NTD-affected pregnancies than women without these reported exposures. Case-women were also more likely to report living within 0.25 mile of cultivated fields than control-women (odds ratio [OR] 3.6; 95% CI, 1.7-7.6). As sources of pesticide exposure opportunities increased, risk of NTDs also increased. The adjusted ORs and 95% CIs for one, two, and three or more exposure sources were 1.2 (0.69-1.9), 2.3 (1.3-4.1) and 2.8 (1.2-6.3) respectively, and this positive trend was stronger for risk of anencephaly than for spina bifida. CONCLUSIONS: Self-reported pesticide exposures were associated with NTD risk in this study population, especially use of pesticides within the home and a periconceptional residence within 0.25 mile of cultivated fields.	Annals of Epidemiology	20	1	16-22	Self-reported exposure			Case-control	Pesticides in general	offspring	doctor-diagnosed	Mexico	umic
506	J. D. Ferreira, A. C. Couto, M. S. Pombo-de-Oliveira, S. Koifman and L. Brazilian Collaborative Study Group of Infant Acute	In utero pesticide exposure and leukemia in Brazilian children < 2 years of age	2013	BACKGROUND: An association between pesticide exposure and cancer has been suggested. Infant leukemia is a rare neoplasm and its association with maternal pesticide exposure has been poorly explored. OBJECTIVES: We investigated the association between pesticide exposure during pregnancy and leukemia in children < 2 years of age. METHODS: A hospital-based case-control study was carried out in 13 Brazilian states during 1999-2007. Mothers of 252 cases and those of 423 controls were interviewed. Information on pesticide exposures 3 months before pregnancy, throughout pregnancy, and during breastfeeding was obtained. Unconditional logistic regression was used to estimate adjusted odds ratios (aORs) for associations between pesticide exposures and leukemia. RESULTS: Associations with ever use of pesticides during pregnancy were observed for acute lymphoid leukemia (ALL) (aOR = 2.10; 95% CI: 1.14, 3.86) and acute myeloid leukemia (AML) (aOR = 5.01; 95% CI: 1.97, 12.7) in children 0-11 months of age, and with ALL (aOR = 1.88; 95% CI: 1.05, 5.23) at 12-23 months of age. According to reported maternal exposure to permethrin, higher risk estimates were verified for children 0-11 months of age (aOR = 2.47; 95% CI: 1.17, 5.25 for ALL; and aOR = 7.28; 95% CI: 2.60, 20.38 for AML). Maternal pesticide exposure related to agricultural activities showed an aOR of 5.25 (95% CI: 1.83, 15.08) for ALL, and an aOR of 7.56 (95% CI: 1.83, 31.23) for AML. CONCLUSIONS: These results support the hypothesis that pesticide exposure during pregnancy may be involved in the etiology of acute leukemia in children < 2 years of age.	Environmental Health Perspectives	121	2	269-75	Self-reported exposure			Case-control	Pesticides in general	offspring	doctor-diagnosed	Brazil	umic
507	J. D. H. Beard, J. A.; Richards, M.; Alavanja, M. C. R.; Blair, A.; Sandler, D. P.; Kamel, F.	Organophosphate insecticide use and self-reported incident depression among male private pesticide applicators in the agricultural health study	2012	Background: Organophosphate insecticide (OP) use has been positively associated with depression in several studies. No previous study has evaluated this relationship prospectively. Objectives: We aimed to evaluate the association between OP use and incident depression using data from male private pesticide applicators in the Agricultural Health Study (AHS), a prospective cohort study in Iowa and North Carolina. Methods: We used data on 22,063 male private pesticide applicators who did not report a physiciandiagnosis of depression at enrollment in the AHS (1993-1997) and who completed a follow-up telephone interview in 2003-2008. These applicators reported 928 new physician diagnoses of depression at follow-up. We collected information on ever use, cumulative lifetime days of use, and intensity-adjusted cumulative lifetime days of use of 10 OPs and on potential confounders via self-administered questionnaires at enrollment. We used log-binomial regression models to estimate adjusted risk ratios (RRs) and 95% confidence intervals (CIs). Results: After adjustment for age at enrollment, state of residence, and marital status, incident depression was not associated with ever use (RR = 1.05; 95% CI = 0.85-1.30) or cumulative lifetime days of use (ptrend = 0.74) of any OP. Incident depression was associated with ever use of dichlorvos (1.30; 1.07-1.58), diazinon (1.17; 1.01-1.35), or parathion (1.18; 0.99-1.41). Results suggested dose-response relationships between depression and using dichlorvos (ptrend = 0.06) or diazinon (ptrend = 0.08). Adjusting for additional covariates did not meaningfully change the observed associations. Conclusions: Our study supports an association between use of some OPs and incident depression.	Epidemiology	23	5	S475	Algorithm/model	Self-reported exposure		Cohort (prospective)	Specific active ingredient	mental disorders	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
508	J. D. H. Beard, J. A.; Richards, M.; Alavanja, M. C.; Blair, A.; Sandler, D. P.; Kamel, F.	Pesticide exposure and self-reported incident depression among wives in the Agricultural Health Study	2013	BACKGROUND: Depression in women is a public health problem. Studies have reported positive associations between pesticides and depression, but few studies were prospective or presented results for women separately. OBJECTIVES: We evaluated associations between pesticide exposure and incident depression among farmers' wives in the Agricultural Health Study, a prospective cohort study in Iowa and North Carolina. METHODS: We used data on 16,893 wives who did not report physician-diagnosed depression at enrollment (1993-1997) and who completed a follow-up telephone interview (2005-2010). Among these wives, 1054 reported physician diagnoses of depression at follow-up. We collected information on potential confounders and on ever use of any pesticide, 11 functional and chemical classes of pesticides, and 50 specific pesticides by wives and their husbands via self-administered questionnaires at enrollment. We used inverse probability weighting to adjust for potential confounders and to account for possible selection bias induced by the death or loss of 10,639 wives during follow-up. We used log-binomial regression models to estimate risk ratios and 95% confidence intervals. RESULTS: After weighting for age at enrollment, state of residence, education level, diabetes diagnosis, and drop out, wives' incident depression was positively associated with diagnosed pesticide poisoning, but was not associated with ever using any pesticide. Use of individual pesticides or functional or chemical classes of pesticides was generally not associated with wives' depression. Among wives who never used pesticides, husbands' ever use of individual pesticides or functional or chemical classes of pesticides was generally not associated with wives' incident depression. CONCLUSIONS: Our study adds further evidence that high level pesticide exposure, such as pesticide poisoning, is associated with increased risk of depression and sets a lower bound on the level of exposure related to depression, thereby providing reassurance that the moderate levels of pesticide exposure experienced by farmers' wives likely do not increase risk.	Environmental Research	126	NA	31-42	Self-reported exposure			Cohort (prospective)	Specific active ingredient	mental disorders	self-reported	USA	hic
509	J. D. Tucker, D. H. Moore, 2nd, M. J. Ramsey, P. Kato, R. G. Langlois, B. Burroughs, L. Long and V. F. Garry	Multi-endpoint biological monitoring of phosphine workers	2003	The pesticide phosphine (PH(3)) is a suspected carcinogen and a known clastogen which has been shown to produce chromosome damage in agricultural workers. To confirm and extend these results we evaluated 22 phosphine appliers and 26 controls matched for age and smoking status. Two independent methods were used to evaluate exposure: fluorescence in situ hybridization (FISH) with whole-chromosome paints of chromosomes 1, 2, and 4 labeled in a single color to quantify translocations in peripheral lymphocytes, and the glycophorin A (GPA) assay to quantify phenotypically mutant (NO or NN) erythrocytes. No differences in the frequency of translocations were found in the phosphine appliers compared to the controls, and no effect of cigarette smoking was observed. However, a significant increase in the frequency of translocations with age (P<0.0001) was seen. No effect of phosphine exposure or cigarette smoking was observed in the GPA assay. These results are in contrast to previous findings from this same population which showed an increase in chromosome aberrations among phosphine appliers. The results are most easily interpreted as supporting the effectiveness of the personal protective equipment that is now worn by the workers but which was not employed prior to and during the earlier studies.	Mutation Research	536	1	43295	Environmental air monitoring	Registers		Cross-sectional	Specific active ingredient	genetic (biomarkers)	medical test result	USA	hic
510	J. D. U. Beard, D. M.; Hoppin, J. A.; Richards, M.; Alavanja, M. C.; Blair, A.; Sandler, D. P.; Kamel, F.	Suicide and pesticide use among pesticide applicators and their spouses in the agricultural health study	2011	BACKGROUND: An association may exist between pesticide exposure and suicide. OBJECTIVE: We sought to evaluate the existence of an association between pesticide use and suicide using data from the Agricultural Health Study (AHS), a prospective cohort study of licensed pesticide applicators and their spouses in Iowa and North Carolina. METHODS: Via linkage to state mortality files and the National Death Index, we identified 110 suicides occurring between enrollment in the AHS (from 1993 to 1997) and 31 May 2009, among 81,998 cohort members contributing 1,092,943 person-years of follow-up. The average length of follow-up was 13.3 years. AHS participants provided data on pesticide use and potential confounders via self-administered questionnaires at enrollment. We evaluated several measures of pesticide use: use of any pesticide, ever use of 50 specific pesticides, cumulative lifetime days of use and intensity-adjusted cumulative lifetime days of use of 22 specific pesticides, and ever use of 10 functional and chemical classes of pesticides. We used Cox proportional hazards regression models to estimate adjusted hazard ratios and 95% confidence intervals. RESULTS: After adjusting for age at enrollment, sex, number of children in family, frequency of alcohol consumption during the past 12 months, and smoking status, we found no association between prior pesticide use and suicide in applicators and their spouses. Results were the same for applicators and spouses together or for applicators alone and were consistent across several measures of pesticide use. CONCLUSIONS: Our findings do not support an association between moderate pesticide use and suicide.	Environmental Health Perspectives	119	11	1610-5	Algorithm/model	Self-reported exposure		Cohort (prospective)	Specific active ingredient	other	doctor-diagnosed	USA	hic
511	J. D. U. Beard, D. M.; Hoppin, J. A.; Richards, M.; Alavanja, M. C.; Blair, A.; Sandler, D. P.; Kamel, F.	Pesticide exposure and depression among male private pesticide applicators in the agricultural health study	2014	BACKGROUND: Pesticide exposure may be positively associated with depression. Few previous studies have considered the episodic nature of depression or examined individual pesticides. OBJECTIVE: We evaluated associations between pesticide exposure and depression among male private pesticide applicators in the Agricultural Health Study. METHODS: We analyzed data for 10 pesticide classes and 50 specific pesticides used by 21,208 applicators enrolled in 1993-1997 who completed a follow-up telephone interview in 2005-2010. We divided applicators who reported a physician diagnosis of depression (n = 1,702; 8%) into those who reported a previous diagnosis of depression at enrollment but not follow-up (n = 474; 28%), at both enrollment and follow-up (n = 540; 32%), and at follow-up but not enrollment (n = 688; 40%) and used polytomous logistic regression to estimate odds ratios (ORs) and 95% CIs. We used inverse probability weighting to adjust for potential confounders and to account for the exclusion of 3,315 applicators with missing covariate data and 24,619 who did not complete the follow-up interview. RESULTS: After weighting for potential confounders, missing covariate data, and dropout, ever-use of two pesticide classes, fumigants and organochlorine insecticides, and seven individual pesticides-the fumigants aluminum phosphide and ethylene dibromide; the phenoxy herbicide (2,4,5-trichlorophenoxy)acetic acid (2,4,5-T); the organochlorine insecticide dieldrin; and the organophosphate insecticides diazinon, malathion, and parathion-were all positively associated with depression in each case group, with ORs between 1.1 and 1.9. CONCLUSIONS: Our study supports a positive association between pesticide exposure and depression, including associations with several specific pesticides.	Environmental Health Perspectives	122	9	984-91	Self-reported exposure			Cohort (prospective)	Specific active ingredient	mental disorders	self-reported	USA	hic

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512	J. da Silva, C. R. Moraes, V. D. Heuser, V. M. Andrade, F. R. Silva, K. Kvitko, V. Emmel, P. Rohr, D. L. Bordin, A. C. Andreazza, M. Salvador, J. A. Henriques and B. Erdtmann	Evaluation of genetic damage in a Brazilian population occupationally exposed to pesticides and its correlation with polymorphisms in metabolizing genes	2008	Cytogenetic damage in individuals occupationally exposed to pesticides has received the attention of investigators in several countries, but no definitive conclusions can yet be made. The present study aimed at assessing if prolonged exposure to complex mixtures of pesticides leads to an increase in cytogenetic damage. Vineyard workers exposed to pesticides in Caxias do Sul (Brazil) were evaluated using the micronucleus (MN) test in binucleated lymphocytes and the comet assay in peripheral leukocytes. In order to evaluate if genetically determined individual variations in xenobiotic metabolizing capacity could modify individual susceptibility to the possible genotoxic effects of pesticides, the subjects were genotyped for several genes: GSTT1, GSTM1, GSTP1, CYP1A1, CYP2E1 and PON. The study involved a total number of 173 men: 108 were agricultural workers exposed to pesticides and 65 were controls. The present study showed a high rate of MN and DNA damage in pesticide-exposed individuals (P <or= 0.001; Mann-Whitney U-test). In addition, some effects of genetic polymorphisms in PON in the modulation of MN results were observed in the exposed group, and an association between GSTM1, GSTT1 and CYP2E1 polymorphisms was suggested.	Mutagenesis	23	5	415-22	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Brazil	umic
513	J. de Cock, K. Westveer, D. Heederik, E. te Velde and R. van Kooij	Time to pregnancy and occupational exposure to pesticides in fruit growers in The Netherlands	1994	OBJECTIVES: Although pesticides are regularly used in agriculture, relatively little is known about possible adverse health effects, especially reproductive effects, due to occupational exposure. This explorative study investigates the relation between exposure of the fruit grower to pesticides and fecundability (probability of pregnancy) in a population of fruit growers. METHODS: The analysis is based on self reported data and includes 91 pregnancies during 1978-1990 of 43 couples. Cox' proportional hazards model was used to analyse time to pregnancy after correction for gravidity and consultation with a physician for fertility problems. RESULTS AND CONCLUSIONS: Application of pesticides solely by the owner was associated with a long time to pregnancy, resulting in a fecundability ratio of 0.46 (95% confidence interval (95% CI) 0.28-0.77). Similarly a low spraying velocity (< or = 1.5 hectares/h) resulted in a fecundability ratio of 0.47 (95% CI 0.29-0.76) and is associated with the use of older spraying techniques and tractors without a cabin. These factors were assumed to cause high exposure, which was confirmed by exposure measurements in the field. The effect of high exposure was mainly apparent if the couple had intended to become pregnant in the period from March-November (fecundability ratio 0.42, 95% CI 0.20-0.92). This is the period in which pesticides are applied. Out of the spraying season the effect of a high exposure was absent (fecundability ratio 0.82, 95% CI 0.33-2.02). In the high exposure group 28% of the pregnancies had been preceded by consulting a physician because of fertility problems, compared with 8% in the low exposure group. These findings indicate that an adverse effect of exposure to pesticides on fecundability is likely.	Occupational & Environmental Medicine	51	10	693-9	Self-reported exposure			Cohort (prospective)	Pesticides in general	reproductive	self-reported	Netherlands	hic
514	J. E. Burton, J. E. Michalek and A. J. Rahe	Serum dioxin, chloracne, and acne in veterans of Operation Ranch Hand	1998	The possible relationship between exposure to Agent Orange and its contaminant, 2,3,7,8-tetrachlorodibenzo-p-dioxin (dioxin), during the Vietnam War and chloracne was investigated. The index subjects were veterans of Operation Ranch Hand, the unit responsible for aerial herbicide spraying in Vietnam from 1962 to 1971. Other Air Force veterans who served in Southeast Asia during the same period, but who were not involved with spraying herbicides, served as comparisons. None of the Ranch Hand veterans were diagnosed with chloracne; therefore, we restricted our analyses to acne. We found no meaningful or consistent association between dioxin exposure and prevalence of acne without or with regard to anatomical location. These results suggested that exposure of Ranch Hand veterans to dioxin was insufficient for the production of chloracne or perhaps the exposure may have caused chloracne that resolved and was currently undetectable.	Archives of Environmental Health	53	3	199-204	Registers			Cohort (prospective)	Chemical class	dermatological	doctor-diagnosed	USA	hic
515	J. E. Compston, S. Vedi, A. B. Stephen, S. Bord, A. R. Lyons, S. J. Hodges and B. E. Scammell	Reduced bone formation after exposure to organophosphates	1999	Bone histomorphometric analysis in 24 agricultural workers with chronic organophosphate exposure showed significantly lower bone formation at tissue and cellular level than in healthy controls.	Lancet	354	9192	1791-2	Biomonitoring (blood)			Cross-sectional	Chemical class	muskuloskeletal	medical test result	UK	hic
516	J. E. Cornwall, M. L. Ford, T. S. Liyanage and D. Win Kyi Daw	Risk assessment and health effects of pesticides used in tobacco farming in Malaysia	1995	Pesticide poisoning is a global health problem to which tobacco farmers are at risk because of the need for frequent application of pesticide to this insect-prone crop. A cross-sectional, descriptive study of 103 tobacco workers from 50 family farm units in Kelantan, Malaysia, aimed to determine pesticides used, the factors influencing exposure of tobacco farmers to pesticides and the frequency of poisoning among tobacco farmers. Questionnaire, observation and focus group discussions were used to collect data. The organophosphate (OP) methamidophos, WHO Toxicity Class 1B Hazardous, was used on 96% of farms and was always applied using knapsack sprayers. Twenty-two of 48 knapsack sprayers observed in use were leaking. Training for farmers in pesticide use was minimal, storage and labelling of pesticide containers did not comply with WHO standards, and observed use of protective clothing was significantly less than that reported by farm workers. One-third of workers had two or more symptoms consistent with pesticide toxicity. It was concluded that an improvement in worker education was necessary.	Health Policy and Planning	10	4	431-437	Self-reported exposure	Expert case-by-case assessment		Cross-sectional	Pesticides in general	NA	self-reported	Malaysia	umic
517	J. E. Hardos, L. W. Whitehead, I. Han, D. K. Ott and D. K. Waller	Depression Prevalence and Exposure to Organophosphate Esters in Aircraft Maintenance Workers	2016	INTRODUCTION: Previous studies found that aircraft maintenance workers may be exposed to organophosphates in hydraulic fluid and engine oil. Studies have also illustrated a link between long-term low-level organophosphate pesticide exposure and depression. METHODS: A questionnaire containing the Patient Health Questionnaire 8 depression screener was e-mailed to 52,080 aircraft maintenance workers (with N = 4801 complete responses) in a cross-sectional study to determine prevalence and severity of depression and descriptions of their occupational exposures. RESULTS: There was no significant difference between reported depression prevalence and severity in similar exposure groups in which aircraft maintenance workers were exposed or may have been exposed to organophosphate esters compared to similar exposure groups in which they were not exposed. However, a dichotomous measure of the prevalence of depression was significantly associated with self-reported exposure levels from low (OR: 1.21) to moderate (OR: 1.68) to high exposure (OR: 2.70) and with each exposure route including contact (OR: 1.68), inhalation (OR: 2.52), and ingestion (OR: 2.55). A self-reported four-level measure of depression severity was also associated with a self-reported four-level measure of exposure. DISCUSSION: Based on self-reported exposures and outcomes, an association is observed between organophosphate exposure and depression; however, we cannot assume that the associations we observed are causal because some workers may have been more likely to report exposure to organophosphate esters and also more likely to report depression. Future studies should consider using a larger sample size, better methods for characterizing crew chief exposures, and bioassays to measure dose rather than exposure. Hardos JE, Whitehead LW, Han I, Ott DK, Waller DK. Depression prevalence and exposure to organophosphate esters in aircraft maintenance workers. Aerosp Med Hum Perform. 2016; 87(8):712-717.	Aerospace Medicine & Human Performance	87	8	712-7	Self-reported exposure			Cross-sectional	Chemical class	mental disorders	self-reported	USA	hic

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518	J. E. Michalek, A. J. Rahe and C. A. Boyle	Paternal dioxin, preterm birth, intrauterine growth retardation, and infant death	1998	We studied paternal exposure to Agent Orange and its dioxin contaminant (2,3,7,8-tetrachlorodibenzo-p-dioxin) and preterm birth, intrauterine growth retardation, or infant death in veterans of Operation Ranch Hand, the unit responsible for spraying herbicides during the Vietnam war. A Comparison group of Air Force veterans who served in Southeast Asia during the same time period and who were not occupationally exposed to herbicides was included. We studied children conceived during or after the father's service in Southeast Asia and based exposure on paternal dioxin measured in 1987 or 1992 extrapolated to the time of conception of the child. We assigned each child to one of four exposure categories: Comparison and three Ranch Hand categories (Background, Low, High). Children in the High (relative risk = 1.3) and Background (relative risk = 1.4) categories were at increased risk of preterm birth. The risk of intrauterine growth retardation was not increased in any exposure category. The risk of infant death was increased in all Ranch Hand children, with the greatest increases in the High (relative risk = 4.5) and Background (relative risk = 3.2) categories. These patterns indicate that the increases in the relative risk of preterm birth and infant death may not be related to paternal dioxin level.	Epidemiology	9	2	161-7	Algorithm/model	Biomonitoring (blood)		Cohort (prospective)	Specific active ingredient	offspring	doctor-diagnosed	USA	hic
519	J. E. Michalek, D. H. Barrett, R. D. Morris and W. G. Jackson, Jr.	Serum dioxin and psychological functioning in U.S. Air Force veterans of the Vietnam War	2003	Using the Minnesota Multiphasic Personality Inventory and the Millon Clinical Multiaxial Inventory, we assessed the psychological functioning of U.S. Air Force veterans exposed to Agent Orange and its contaminant, 2,3,7,8-tetrachlodibenzo-p-dioxin (dioxin), during the Vietnam War. Index subjects were veterans of Operation Ranch Hand (N = 1,109). Comparisons (N = 1,493) were U.S. Air Force veterans not involved with spraying herbicides. We found few consistent psychological abnormalities associated with serum dioxin levels. Ranch Hand veterans with higher dioxin levels showed some difficulties in anxiety, somatization, depression, and a denial of psychological factors. However, those with background levels also showed indications of emotional distress, primarily in emotional numbing and lability; a guarded, suspicious, and withdrawn style of relating to others; and unusual thoughts or behaviors.	Military Medicine	168	2	153-9	Biomonitoring (blood)			Cohort (prospective)	Chemical class	mental disorders	doctor-diagnosed	USA	hic
520	J. E. Michalek, F. Z. Akhtar and J. L. Kiel	Serum dioxin, insulin, fasting glucose, and sex hormone-binding globulin in veterans of Operation Ranch Hand	1999	We studied insulin, fasting glucose, and sex hormone-binding globulin (SHBG) in Air Force veterans exposed to Agent Orange and its contaminant, 2,3,7,8-tetrachlorodibenzo-p-dioxin (dioxin), during the Vietnam War. The index subjects were veterans of Operation Ranch Hand, the unit responsible for aerial herbicide spraying in Vietnam from 1962-1971. Other Air Force veterans who served in Southeast Asia during the same period but were not involved with spraying herbicides served as comparisons. We assigned each Ranch Hand veteran based on his dioxin level to one of three exposure categories, named background, low, and high. Among nondiabetic veterans, we found the mean of the logarithm of insulin significantly increased in the high dioxin category. Additionally, in nondiabetic veterans the relation between SHBG and insulin interacted significantly with dioxin category on the log scale within strata defined by age and percent body fat. Among young (age, < or = 53 yr), lean (percent body fat, < or = 25%) nondiabetic veterans in the high category, the slope relating the logarithm of SHBG and the logarithm of insulin was significantly decreased. These findings suggest a compensatory metabolic relationship between dioxin and insulin regulation.	Journal of Clinical Endocrinology & Metabolism	84	5	1540-3	Biomonitoring (blood)			Cohort (prospective)	Chemical class	endocrine/nutritional/metabolical	medical test result	USA	hic
521	J. E. Michalek, F. Z. Akhtar, J. C. Arezzo, D. H. Garabrant and J. W. Albers	Serum dioxin and peripheral neuropathy in veterans of Operation Ranch Hand	2001	We studied whether exposure to Agent Orange and its contaminant, 2,3,7,8-tetrachlorodibenzo-p-dioxin (dioxin), during the Vietnam War is related to peripheral neuropathy. The index subjects were veterans of Operation Ranch Hand, the unit responsible for aerial herbicide spraying in Vietnam from 1962 to 1971. We report peripheral nerve function assessed in 1982, 1985, 1987, 1992 and 1997, nerve conduction velocities measured in 1982, and vibrotactile thresholds of the great toes measured in 1992 and 1997. We assigned each Ranch Hand veteran to one of three exposure categories named "background", "low" and "high", based on his serum dioxin level. Other than the bilateral vibrotactile abnormalities, we consistently found a statistically significant increased risk of all indices of peripheral neuropathy among Ranch Hand veterans in the high exposure category in 1997, and a statistically significant increased risk of diagnosed peripheral neuropathy, incorporating bilateral vibrotactile abnormalities of the great toes, in the high category in 1992. Restricting to the enlisted veterans did not alter these results. Cautious interpretation of these results is appropriate until the relationship between pre-clinical diabetes mellitus and peripheral neuropathy is further evaluated in future examinations.	Neurotoxicology	22	4	479-90	Biomonitoring (blood)			Cohort (prospective)	Chemical class	neurological	doctor-diagnosed	USA	hic
522	J. E. Michalek, N. S. Ketchum and I. J. Check	Serum dioxin and immunologic response in veterans of Operation Ranch Hand	1999	The authors studied immune response and exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin (dioxin) among veterans of Operation Ranch Hand, the US Air Force unit responsible for the aerial spraying of herbicides in Vietnam from 1962 to 1971. A comparison group of Air Force veterans who served in Southeast Asia but were not involved in spraying herbicides was included. The authors studied delayed-type hypersensitivity skin test responses to Candida albicans, mumps, Trichophyton, and a bacterial antigen made from lysed Staphylococcus aureus. Lymphocyte measurements included total lymphocyte counts; T-cell (CD3, CD4, CD5, and CD8), B-cell (CD20), and NK-cell (CD16 and CD56) subsets; and expression of the activation antigen CD25 on CD3 T cells. The authors quantitated the serum concentrations of immunoglobulin (Ig)A, IgG, and IgM; examined sera for the presence of monoclonal immunoglobulins (M proteins); and looked for a broad range of autoantibodies (rheumatoid factor, antinuclear antibody, smooth muscle autoantibody, mitochondrial autoantibody, parietal cell autoantibody, and thyroid microsomal autoantibodies). They measured the level of dioxin in 1987 or 1992, extrapolated the result to the time of service in Vietnam, and assigned each veteran to one of four exposure categories: Comparison and three Ranch Hand groups (Background, Low, or High). Overall, the authors found no evidence of a consistent relation between dioxin exposure category and immune system alteration.	American Journal of Epidemiology	149	11	1038-46	Biomonitoring (blood)			Cohort (prospective)	Chemical class	immunological	medical test result	USA	hic
523	J. E. Michalek, N. S. Ketchum and M. P. Longnecker	Serum dioxin and hepatic abnormalities in veterans of Operation Ranch Hand	2001	PURPOSE: We studied hepatic abnormalities and indices of hepatic function in relation to exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin (dioxin) in veterans of Operation Ranch Hand, the Air Force unit responsible for the aerial spraying of herbicides in Vietnam from 1962 to 1971.	NA	NA	NA	NA	Biomonitoring (blood)			Cohort (prospective)	Chemical class	genitourinary	medical test result	USA	hic

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524	J. E. Michalek, N. S. Ketchum and R. C. Tripathi	Diabetes mellitus and 2,3,7,8-tetrachlorodibenzo-p-dioxin elimination in veterans of Operation Ranch Hand	2003	Using multivariate statistical models, no significant relationship was found between the rate of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) elimination and the occurrence or time to onset of diabetes in 343 veterans of Operation Ranch Hand, the unit responsible for the aerial spraying of Agent Orange and other TCDD-contaminated herbicides during the Vietnam War. Without adjustment for age, body mass index, family history of diabetes, and smoking history, the time to onset of diabetes decreased and the risk of diabetes increased with a diminished elimination rate. However, after adjustment, diabetes time to onset and occurrence were not significantly associated with TCDD elimination. Analyses of covariance found no significant difference between the average elimination rates of diabetic and nondiabetic veterans, without or with adjustment for risk factors. To our knowledge, this is the only study to date to examine TCDD elimination and diabetes.	Journal of Toxicology & Environmental Health Part A	66	3	211-21	Registers			Cohort (prospective)	Chemical class	endocrine/nutritional/metabolical	doctor-diagnosed	USA	hic
525	J. F. Acquavella, E. Delzell, H. Cheng, C. F. Lynch and G. Johnson	Mortality and cancer incidence among alachlor manufacturing workers 1968-99	2004	BACKGROUND: Alachlor is the active ingredient in pre-emergent herbicide formulations that have been used widely on corn, soybeans, and other crops. It has been found to cause nasal, stomach, and thyroid tumours in rodent feeding studies at levels that are much higher than likely human exposures. AIMS: To evaluate mortality rates from 1968 to 1999 and cancer incidence rates from 1969 to 1999 for alachlor manufacturing workers at a plant in Muscatine, Iowa. METHODS: Worker mortality and cancer incidence rates were compared to corresponding rates for the Iowa state general population. Analyses addressed potential intensity and duration of exposure. RESULTS: For workers with any period of high alachlor exposure, mortality from all causes combined was lower than expected (42 observed deaths, SMR 64, 95% CI 46 to 86) and cancer mortality was slightly lower than expected (13 observed deaths, SMR 79, 95% CI 42 to 136). Cancer incidence for workers with potential high exposure was similar to that for Iowa residents, both overall (29 observed cases, SIR 123, 95% CI 82 to 177) and for workers exposed for five or more years and with at least 15 years since first exposure (eight observed cases, SIR 113, 95% CI 49 to 224). There were no cases of nasal, stomach, or thyroid cancer. CONCLUSIONS: There were no cancers of the types found in toxicology studies and no discernible relation between cancer incidence for any site and years of alachlor exposure or time since first exposure. Despite the small size of this population, the findings are important because these workers had chronic exposure potential during extended manufacturing campaigns, while use in agriculture is typically limited to a few days or weeks each year.	Occupational & Environmental Medicine	61	8	680-5	Expert case-by-case assessment	Self-reported job history		Cohort (prospective)	Specific active ingredient	mortality (all cause)	doctor-diagnosed	USA	hic
526	J. F. Acquavella, S. G. Riordan, M. Anne, C. F. Lynch, J. J. Collins, B. K. Ireland and W. F. Heydens	Evaluation of mortality and cancer incidence among alachlor manufacturing workers	1996	Alachlor is the active ingredient in a family of preemergence herbicides. We assessed mortality rates from 1968 to 1993 and cancer incidence rates from 1969 to 1993 for manufacturing workers with potential alachlor exposure. For workers judged to have high alachlor exposure, mortality from all causes combined was lower than expected [23 observed, standardized mortality ratio (SMR) = 0.7, 95% CI, 0.4-1.0], cancer mortality was similar to expected (6 observed, SMR = 0.7, 95% CI, 0.3-1.6), and there were no cancer deaths among workers with 5 or more years high exposure and 15 or more years since first exposure (2.3 expected, SMR = 0, 95% CI, 0-1.6). Cancer incidence for workers with high exposure potential was similar to the state rate [18 observed, standardized incidence ratio (SIR) = 1.2, 95% CI, 0.7-2.0], especially for workers exposed for 5 or more years and with at least 15 years since first exposure (4 observed, SIR = 1.0, 95% CI, 0.3-2.7). The most common cancer for these latter workers was colorectal cancer (2 observed, SIR 3.9, 95% CI, 0.5-14.2 among workers). Despite the limitations of this study with respect to small size and exposure estimating, the findings are useful for evaluating potential alachlor-related health risks because past manufacturing exposures greatly exceeded those characteristic of agricultural operations. These findings suggest no appreciable effect of alachlor exposure on worker mortality or cancer incidence rates during the study period.	Environmental Health Perspectives	104	7	728-33	Expert case-by-case assessment	Self-reported job history		Cohort (prospective)	Specific active ingredient	mortality (all cause)	doctor-diagnosed	USA	hic
527	J. F. E. Lebov, L. S.; Richardson, D.; Hogan, S. L.; Hoppin, J. A.; Sandler, D. P.	Pesticide use and risk of end-stage renal disease among licensed pesticide applicators in the Agricultural Health Study	2016	OBJECTIVES: Experimental studies suggest a relationship between pesticide exposure and renal impairment, but epidemiological evidence is limited. We evaluated the association between exposure to 39 specific pesticides and end-stage renal disease (ESRD) incidence in the Agricultural Health Study, a prospective cohort study of licensed pesticide applicators in Iowa and North Carolina. METHODS: Via linkage to the US Renal Data System, we identified 320 ESRD cases diagnosed between enrolment (1993-1997) and December 2011 among 55 580 male licensed pesticide applicators. Participants provided information on use of pesticides via self-administered questionnaires. Lifetime pesticide use was defined as the product of duration and frequency of use and then modified by an intensity factor to account for differences in pesticide application practices. Cox proportional hazards models, adjusted for age and state, were used to estimate associations between ESRD and: (1) ordinal categories of intensity-weighted lifetime use of 39 pesticides, (2) poisoning and high-level pesticide exposures and (3) pesticide exposure resulting in a medical visit or hospitalisation. RESULTS: Positive exposure-response trends were observed for the herbicides alachlor, atrazine, metolachlor, paraquat, and pendimethalin, and the insecticide permethrin. More than one medical visit due to pesticide use (HR=2.13; 95% CI 1.17 to 3.89) and hospitalisation due to pesticide use (HR=3.05; 95% CI 1.67 to 5.58) were significantly associated with ESRD. CONCLUSIONS: Our findings support an association between ESRD and chronic exposure to specific pesticides, and suggest pesticide exposures resulting in medical visits may increase the risk of ESRD. CLINICAL TRIAL REGISTRATION: Clinicaltrials.gov NCT00352924.	Occupational & Environmental Medicine	73	1	43171	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	genitourinary	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
528	J. F. Lebov, L. S. Engel, D. Richardson, S. L. Hogan, D. P. Sandler and J. A. Hoppin	Pesticide exposure and end-stage renal disease risk among wives of pesticide applicators in the Agricultural Health Study	2015	BACKGROUND: Pesticide exposure has been found to cause renal damage and dysfunction in experimental studies, but epidemiological research on the renal effects of chronic low-level pesticide exposure is limited. We investigated the relationships between end-stage renal disease (ESRD) among wives of licensed pesticide applicators (N=31,142) in the Agricultural Health Study (AHS) and (1) personal pesticide use, (2) exposure to the husband's pesticide use, and (3) other pesticide-associated farming and household activities. METHODS: AHS participants reported pesticide exposure via self-administered questionnaires at enrollment (1993-1997). ESRD cases were identified via linkage to the United States Renal Data System. Associations between ESRD and pesticide exposures were estimated with Cox proportional hazard regression models controlling for age at enrollment. Models of associations with farming and household factors were additionally adjusted for personal use of pesticides. RESULTS: We identified 98 ESRD cases diagnosed between enrollment and 31 December 2011. Although women who ever applied pesticides (56% of cohort) were less likely than those who did not apply to develop ESRD (Hazard Ratio (HR): 0.42; 95% CI: 0.28, 0.64), among women who did apply pesticides, the rate of ESRD was significantly elevated among those who reported the highest (vs. lowest) cumulative general pesticide use (HR: 4.22; 95% CI: 1.26, 14.20). Among wives who never applied pesticides, ESRD was associated with husbands' ever use of paraquat (HR=1.99; 95% CI: 1.14, 3.47) and butylate (HR=1.71; 95% CI: 1.00, 2.95), with a positive exposure-response pattern for husband's cumulative use of these pesticides. CONCLUSIONS: ESRD may be associated with direct and/or indirect exposure to pesticides among farm women. Future studies should evaluate indirect exposure risk among other rural populations.	Environmental Research	143	NA	198-210	Self-reported exposure			Cohort (prospective)	Specific active ingredient	genitourinary	doctor-diagnosed	USA	hic
529	J. F. Shelton and I. Hertz-Picciotto	The effect of maternal occupational pesticide exposure on cognitive and adaptive function in the charge study	2010	Pesticide exposure during pregnancy at levels sub-toxic to the mother may have subtle effects on adaptive behavior and cognitive function of the child. Mothers of 922 children enrolled in the Childhood Autism Risk from Genetics and the Environment (CHARGE) study were surveyed regarding pesticide exposures prior to conception and throughout breastfeeding. We examined the effect of maternal occupational exposure on the composite scores for the Vineland Adaptive Behavioral Scale and Mullen Scales of Early Learning among typically functioning children (N = 275), autistic children (N = 331), children with ASD (N = 147), and with developmental delay (N = 141). In multivariate linear regression models, we found an average 10.87 (SE 5.39) point decrease in cognitive function among typically functioning children of occupationally exposed mothers, controlling for maternal education, insurance payment type, child's race/ethnicity, and maternal birthplace. Scores on adaptive behavior were unaffected by maternal occupational exposure, and similarly for the cognitive function scores among children diagnosed with autism, autism spectrum disorder, or developmental delay. This and other findings suggest that gestational exposure to pesticides may induce adverse cognitive effects, and may increase the risk of developmental delay.	American Journal of Epidemiology	171	NA	S99	Self-reported exposure			Cross-sectional	Pesticides in general	offspring	medical test result	USA	hic
530	J. F. Viel and B. Challier	Bladder cancer among French farmers: does exposure to pesticides in vineyards play a part?	1995	OBJECTIVE: To appraise the potential contribution of pesticides sprayed on vineyards to the genesis of bladder cancer among agricultural workers. METHODS: A pesticide exposure index (PEI), based on labour time and the proportion of agricultural land used as vineyards, was constructed for 89 French geographical units (departements). The standardised mortality ratios (SMRs) for bladder cancer, as well as tobacco consumption and economic status of male farmers and farm labourers aged 35-74 in the same areas were estimated for the period 1984-6. Models were fitted to the geographical data with Poisson regressions and extra-Poisson models with geographically structured and unstructured random effects. RESULTS: Mortality from bladder cancer among farmers was lower (but not significantly so) than within the overall population (SMR 0.96, 95% confidence interval (95% CI) 0.85-1.08), but there was a significant link with exposure to pesticides in vineyards by univariate analysis (relative risk (RR) 1.17, 95% CI 1.10-1.24) and by multivariate analysis (RR 1.14, 95% CI 1.07-1.22). CONCLUSION: These results add some evidence to the view that pesticides in vineyards cause mortality from bladder cancer among farmers, and could explain the French south-north gradient in bladder cancer, as vineyards are mainly located in Southern France.	Occupational & Environmental Medicine	52	9	587-92	Index	Algorithm/model		Cohort (prospective)	Pesticides in general	cancer	doctor-diagnosed	France	hic
531	J. F. Viel and S. T. Richardson	Lymphoma, multiple myeloma and leukaemia among French farmers in relation to pesticide exposure	1993	Lymphoma, multiple myeloma and leukaemia mortality among French male farmers and farm laborers (1984-1986) has been studied geographically. In each geographical area (89 "departements") exposure to pesticides in arable land has been characterized by an index taking into account different practices in the treatment of various crops as well as an estimate of the time per farmer spent cultivating each crop in 1970. The farmers population as a whole presented an increased mortality for multiple myeloma (SMR = 1.59, 95% CI = 1.32-1.89) and leukaemia (SMR = 1.33, 95% CI = 1.19-1.49) but not for lymphoma (SMR = 1.09, 95%, CI = 0.94-1.26). Using Poisson regression, leukaemia mortality appeared significantly linked to the pesticide exposure index (P = 0.04), after adjustment of farmers' economic status and a linear geographical gradient, whereas no significant relationship was found for lymphoma or multiple myeloma. This result reinforces a similar link reported from a previous French geographical study conducted at a smaller scale within a region.	Social Science & Medicine	37	6	771-7	Index	Algorithm/model		Cohort (prospective)	Pesticides in general	cancer	doctor-diagnosed	France	hic
532	J. F. Viel, B. Challier, A. Pitard and D. Pobel	Brain cancer mortality among French farmers: the vineyard pesticide hypothesis	1998	In this study, the authors assessed the contribution of vineyard pesticides to brain cancer mortality among agricultural workers. A pesticide exposure index (PEI) in vineyards was calculated for 89 French geographical units (departements). The authors estimated standardized mortality ratios among male farmers and farm laborers aged 35-74 y for the years 1984-1986. Poisson regression models, which were fitted to the ecological data, included random effects. Mortality from brain cancer among farmers was significantly higher than mortality for the overall population (standardized mortality ratio = 1.25, p < .001). Univariate analysis revealed a significant link with pesticide exposure in vineyards (relative risk = 1.10; 95% confidence interval = 1.03, 1.18), as did multivariate analysis (relative risk = 1.11; 95% confidence interval = 1.03, 1.19). These results corraborate the evidence that pesticides in vineyards contribute to mortality from brain cancer among farmers.	Archives of Environmental Health	53	1	65-70	Algorithm/model	Index		Cohort (prospective)	Pesticides in general	cancer	doctor-diagnosed	France	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
533	J. G.-M. Castillo-Cadena, A. L.; Hernandez-Caballero, N.; Ramirez-San Juan, E.; Alvarez-Gonzalez, I.; Madrigal-Bujaidar, E.	Immunotoxic damage in floriculturists exposed to pesticide mixtures	2013	The aim of the present work was to determine if the use of pesticide mixtures produced alterations in immunotoxicity biomarkers. The study was undertaken in three groups: the first group consisted of 38 floriculturists, the second comprised 38 vendors of the local market, and the last comprised 33 non-exposed persons from another locality. The determinations included haematocrit, mean cellular volume, hemoglobin, number of erythrocytes and leukocytes, immunoglobulins (IgA, IgG, IgM, and IgE), percentage of T-lymphocytes, and mitotic index from lymphocyte cultures with and without phytohaemagglutinin (PHA). The obtained results indicated the following: (i) in the level of the studied immunoglobulins, the results were within the reference values; (ii) there was a reduction in the amount of T-lymphocytes in the floriculturists in comparison with the determined in the other two groups; (iii) there was a decrease in the mitotic index of PHA-stimulated lymphocyte cultures of floriculturists and vendors in relation to the value of the control group; (iv) there was an increase in the mitotic index of unstimulated lymphocytes of floriculturists compared with the lymphocytes of the other two groups; and (v) there was no correlation between the results and the personal characteristics of the studied individuals. Our results established an immunotoxic effect in the floriculturists exposed to pesticides.	Journal of Environmental Science & Health - Part B: Pesticides, Food Contaminants, & Agricultural Wastes	48	1	12298	Job title			Cohort (prospective)	Job title	immunological	medical test result	Mexico	umic
534	J. Gallois, D. Pottier, M. Houssin, J. Le Goff and V. Andre	DNA adduct variations in non-smoking crop farmers: potential relationship with occupational exposure to pesticides?	2011	Genotoxic impact of the occupational exposure was measured in farmers from Normandy, France. White blood cell DNA-adduct levels were measured for 116 non-smoking French crop farmers, using the (32)P-postlabelling method. A single blood sample was collected per farmer, at a randomised period of the year. Significantly higher bulky DNA-adduct levels were observed for samples collected from April to July, compared with samples collected during the other months. Agricultural practices were not significantly different between these two groups of farmers, but interestingly, the mean and the median duration without exposure to pesticides were significantly shorter for farmers sampled between April and July. These data, obtained in a homogeneous population of farmers, indicate a genotoxic impact for a sub-group, with a potential association with the use of pesticides. From the rest of the group, this study also gives for the first time additional information on the background fluctuations of this biomarker over the year.	Environmental Toxicology & Pharmacology	32	1	43109	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	France	hic
535	J. Gomes, O. L. Lloyd and D. M. Revitt	The influence of personal protection, environmental hygiene and exposure to pesticides on the health of immigrant farm workers in a desert country	1999	OBJECTIVES: Farm workers in developing countries tend not to use protective measures while handling pesticides. This study investigates the use of personal protection equipment and the practice of safety and hygiene procedures in the handling of pesticides in agriculture. METHODS: Through a multi-stage sampling technique, one-fifth of the farms in a region were selected and all the farm workers at these farms were included in the study. A comparison population matching in age, socio-economic status and stay in the region was selected. A specifically designed questionnaire was used to collect information on the use of protective measures and the practice of safety and hygiene during work and on the disposal of empty pesticide containers. Blood pressure and erythrocyte acetylcholinesterase (AChE) activity were measured in the exposed and the unexposed populations. RESULTS: Protective equipment was worn by a minority of farm workers - gloves, by 35%; work coveralls, by 36%; a scarf to cover the nose and mouth, by 39%; and shoes at work, by 79%. With regard to personal hygiene measures, 83% of the workers changed clothes after work and the same proportion took a shower after work; 63% and 46% drank and ate while at work respectively; and 11% used articles of domestic use in the preparation of pesticides on the farm. Most of the farm workers (96%) were asked to prepare pesticides for spraying by the foreman and 61% were asked to spray the pesticides on the crops. AChE activity was highly significantly depleted in the exposed population as compared with the unexposed population. CONCLUSIONS: AChE depletion was found to be negatively associated with the use of gloves, of work coveralls, and of a scarf to cover the nose and mouth and with the implementation of safety and hygiene procedures on the farm. AChE depletion was positively associated with the frequency of pesticide spraying.	International Archives of Occupational & Environmental Health	72	1	14732	Job title			Cross-sectional	Job title	neurological	medical test result	UAE	hic
536	J. Gomes, O. Lloyd, M. D. Revitt and M. Basha	Morbidity among farm workers in a desert country in relation to long-term exposure to pesticides	1998	OBJECTIVES: Farm workers chronically exposed to low levels of pesticides seldom show signs and symptoms of clinical significance. This study investigates subclinical morbidity patterns among male farm workers in a desert country. METHODS: Migrant-established farm workers (N=226) were compared with referents (N=226) and with new farm workers (N=92) who had just entered the country to work on farms. Acetylcholinesterase activity was measured, the aiming test and digit symbol test were applied, and a morbidity profile was collected with a questionnaire. RESULTS: The erythrocyte acetylcholinesterase activity and hemoglobin-adjusted erythrocyte acetylcholinesterase activity were significantly depleted in the established farm workers. The results of the aiming and digit symbol tests were also significantly lower for the established farm workers. For the morbidity profile, irritated conjunctiva (47.3%), watery eyes (52.2%), blurred vision (63.3%), dizziness (55.2%), headache (63.7%), muscular pain (61.1%), and weakness (76.6%) were reported by established farm workers in statistically significantly higher numbers than by the referents and new farm workers. CONCLUSIONS: Morbidity patterns, such as the health complaints and objective parameters suggested in this study, would be suitable as criteria for identifying farm workers most at risk from pesticide toxicity and as criteria for initiating measures to control and reduce exposure.	Scandinavian Journal of Work, Environment & Health	24	3	213-9	Job title			Cross-sectional	Job title	morbidity	self-reported	UAE	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
537	J. H. Yiin, A. M. Ruder, P. A. Stewart, M. A. Waters, T. Carreon, M. A. Butler, G. M. Calvert, K. E. Davis King, P. A. Schulte, J. S. Mandel, R. F. Morton, D. J. Reding, K. D. Rosenman and G. Brain Cancer Collaborative Study	The Upper Midwest Health Study: a case-control study of pesticide applicators and risk of glioma	2012	BACKGROUND: An excess incidence of brain cancer in farmers has been noted in several studies. The National Institute for Occupational Safety and Health developed the Upper Midwest Health Study (UMHS) as a case-control study of intracranial gliomas and pesticide uses among rural residents. Previous studies of UMHS participants, using "ever-never" exposure to farm pesticides and analyzing men and women separately, found no positive association of farm pesticide exposure and glioma risks. The primary objective was to determine if quantitatively estimated exposure of pesticide applicators was associated with an increased risk of glioma in male and female participants. METHODS: The study included 798 histologically confirmed primary intracranial glioma cases (45% with proxy respondents) and 1,175 population-based controls, all adult (age 18-80) non-metropolitan residents of Iowa, Michigan, Minnesota, and Wisconsin. The analyses used quantitatively estimated exposure from questionnaire responses evaluated by an experienced industrial hygienist with 25 years of work on farm pesticide analyses. Odds ratios (ORs) and 95% confidence intervals (CIs) using unconditional logistic regression modeling were calculated adjusting for frequency-matching variables (10-year age group and sex), and for age and education (a surrogate for socioeconomic status). Analyses were separately conducted with or without proxy respondents. RESULTS: No significant positive associations with glioma were observed with cumulative years or estimated lifetime cumulative exposure of farm pesticide use. There was, a significant inverse association for phenoxy pesticide used on the farm (OR 0.96 per 10g-years of cumulative exposure, CI 0.93-0.99). No significant findings were observed when proxy respondents were excluded. Non-farm occupational applicators of any pesticide had decreased glioma risk: OR 0.72, CI 0.52-0.99. Similarly, house and garden pesticide applicators had a decreased risk of glioma: OR 0.79, CI 0.66-0.93, with statistically significant inverse associations for use of 2,4-D, arsenates, organophosphates, and phenoxys. CONCLUSIONS: These results are consistent with our previous findings for UMHS of reported farm pesticide exposure and support a lack of positive association between pesticides and glioma.	Environmental Health: A Global Access Science Source	11	NA	39	Expert case-by-case assessment			Case-control	Chemical class	cancer	doctor-diagnosed	USA	hic
538	J. Hu, Y. Mao and K. White	Renal cell carcinoma and occupational exposure to chemicals in Canada	2002	This study assesses the effect of occupational exposure to specific chemicals on the risk of renal cell carcinoma in Canada. Mailed questionnaires were used to obtain data on 1279 (691 male and 588 female) newly diagnosed, histologically confirmed renal cell carcinoma cases and 5370 population controls in eight Canadian provinces, between 1994 and 1997. Data were collected on socio-economic status, smoking habit, alcohol use, diet, residential and occupational histories, and years of exposure to any of 17 chemicals. Odds ratios (ORs) and 95% confidence intervals (CIs) were derived using unconditional logistic regression. The study found an increased risk of renal cell carcinoma in males only, which was associated with occupational exposure to benzene; benzidine; coal tar, soot, pitch, creosote or asphalt; herbicides; mineral, cutting or lubricating oil; mustard gas; pesticides; and vinyl chloride. Compared with no exposure to the specific chemical, the adjusted ORs were 1.8 (95% CI = 1.2-2.6), 2.1 (1.3-3.6), 1.4 (1.1-1.8), 1.6 (1.3-2.0), 1.3 (1.1-1.7), 4.6 (1.7-12.5), 1.8 (1.4-2.3) and 2.0 (1.2-3.3), respectively; an elevated risk was also associated with exposure to cadmium salts and isopropyl oil. The risk of renal cell carcinoma increased with duration of exposure to benzene, benzidine, cadmium, herbicides and vinyl chloride. Very few females were exposed to specific chemicals in this study; further research is needed to clarify the association between occupational exposure to chemicals and renal cell carcinoma in females.	Occupational Medicine (Oxford)	52	3	157-64	Self-reported exposure			NA	Type of pesticide	cancer	doctor-diagnosed	Canada	hic
539	J. Huang, K. Aoyama, A. Ueda and T. Matsushita	Respiratory effects and skin allergy in workers exposed to tetrachloroisophthalonitrile	1995	NA	Bulletin of Environmental Contamination & Toxicology	55	2	320-4	Environmental air monitoring			Cross-sectional	Specific active ingredient	respiratory	medical test result	Japan	hic
540	J. J. A. Ryan, Z.; Carrier, G.	Sex ratios of children of Russian pesticide producers exposed to dioxin	2002	We investigated the sex ratio of children of pesticide workers who produced the biocide trichlorophenol and the herbicide 2,4,5-trichlorophenoxy acetic acid from 1961 to 1988 in the city of Ufa, Bashkortostan, Russia. We measured exposure of the two related cohorts to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and other dioxins by analyzing 84 blood samples, which produced median TCDD toxic equivalents blood lipid values of 240 ng/kg, which are more than 30 times higher than background or normal exposure from the region. The sex ratio (fraction male) of the combined cohort of 227 children from 150 male and 48 female workers was 0.40, significantly lower (z-test for proportions = 3.21; $p < 0.001$) than those for the city of Ufa (0.512) and elsewhere worldwide. When we analyzed the sex ratio of the children according to maternal or paternal exposure, we observed a decrease in the number of boys (ratio 0.38) for fathers and a normal number (ratio 0.51) for the mothers. Human exposure of these pesticide producers to high levels of dioxins is associated with the birth of more girls, but only for paternal exposures.	Environmental Health Perspectives	110	11	A699-701	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	offspring	medical test result	Russia	umic
541	J. J. Collins, K. Bodner, L. L. Aylward, M. Wilken and C. M. Bodnar	Mortality rates among trichlorophenol workers with exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin	2009	The authors examined 1,615 workers exposed to dioxins in trichlorophenol production in Midland, Michigan, to determine if there were increased mortality rates from exposure. Historical dioxin levels were estimated by a serum survey of workers. Vital status was followed from 1942 to 2003, and cause-specific death rates and trends with exposure were evaluated. All cancers combined (standardized mortality ratio (SMR) = 1.0, 95% confidence interval (CI): 0.8, 1.1), lung cancers (SMR = 0.7, 95% CI: 0.5, 0.9), and nonmalignant respiratory disease (SMR = 0.8, 95% CI: 0.6, 1.0) were at or below expected levels. Observed deaths for leukemia (SMR = 1.9, 95% CI: 1.0, 3.2), non-Hodgkin lymphoma (SMR = 1.3, 95% CI: 0.6, 2.5), diabetes (SMR = 1.1, 95% CI: 0.6, 1.8), and ischemic heart disease (SMR = 1.1, 95% CI: 0.9, 1.2) were slightly greater than expected. No trend was observed with exposure for these causes of death. However, for 4 deaths of soft tissue sarcoma (SMR = 4.1, 95% CI: 1.1, 10.5), the mortality rates increased with exposure. The small number of deaths and the uncertainty in both diagnosis and nosology coding make interpretation of this finding tenuous. With the exception of soft tissue sarcoma, the authors found little evidence of increased disease risk from exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin.	American Journal of Epidemiology	170	4	501-6	Biomonitoring (blood)	Algorithm/model		Cohort (prospective)	Specific active ingredient	mortality (all cause)	doctor-diagnosed	USA	hic
542	J. J. Collins, K. Bodner, L. L. Aylward, M. Wilken, G. Swaen, R. Budinsky, C. Rowlands and C. M. Bodnar	Mortality rates among workers exposed to dioxins in the manufacture of pentachlorophenol	2009	OBJECTIVE: We sought to determine if workers exposed to dioxins in pentachlorophenol (PCP) manufacturing were at increased risk of death from specific causes.	Journal of Occupational & Environmental Medicine	51	10	NA	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	mortality (all cause)	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
543	J. Jurewicz, W. Hanke, T. Makowiec-Dabrowska and W. Sobala	Exposure to pesticides and heavy work in greenhouses during pregnancy: does it effect birth weight?	2005	OBJECTIVES: Work in greenhouses is performed in warm microclimate during the most time of the year, involves usually moderately intense or heavy work. The working conditions in greenhouses might involve also indirect exposure to pesticides resulting from contact with pesticide-treated flowers and vegetables. The aim of the study was to investigate whether the work in greenhouse during pregnancy adversely influenced infant birth weight and, if so, which of the two main potential hazards typical for such environment (heavy physical work or exposure to pesticides) played the major role in this process. METHODS: The list of 14 major greenhouses (each above 5 ha) growing vegetables (cucumbers and tomatoes) was obtained from the Polish Chamber of Horticulture. Between January 2001 and December 2003, 460 women at the age below 45 years, married or who lived with a partner and who had been working for a period of at least 2 years in greenhouses in Poland were asked to participate in the project. We classified pregnancies of women working in, and out of, greenhouses on the basis of energy expenditure during mother's work into three groups: A (200-700 kcal/shift); B (701-1000 kcal/shift); and C (1001-1200 kcal/shift). Information about application of pesticides in 1997-2001 was received from persons responsible for chemical protection in each examined greenhouse. Trade names of pesticides, names and amounts of the active ingredients, type of cultivation and its area were abstracted from pesticide application registers run by each greenhouse operator. Pesticides were classified as reproductive and developmental (RD) toxins according to Pan American Pesticide Database classification. RESULTS: The mean birth weight of infants whose mothers worked in greenhouse during pregnancy (work expenditure >1000 kcal/shift) was 177 g lower than that of those whose mothers worked out of greenhouse (light work <700 kcal/shift) (p = 0.05). Mothers who during work in greenhouse were potentially exposed to RD pesticides, delivered infants with birth weight lower by about 70 g. than infants' mothers not working at places where pesticides RD were applied, but these findings were not statistically significant. CONCLUSION: Our results indicate that infants of mothers performing heavy work inside greenhouse during pregnancy had lower mean birth weight than infants of mothers working out of greenhouse. No similar effects of current exposure to pesticides was observed.	International Archives of Occupational & Environmental Health	78	5	418-26	Registers			Cohort (retrospective)	Specific active ingredient	offspring	medical test result	Poland	hic
544	J. K. H. Waggoner, P. K.; Kullman, G. J.; Umbach, D. M.; Kamel, F.; Beane Freeman, L. E.; Alavanja, M. C.; Sandler, D. P.; Hoppin, J. A.	Pesticide use and fatal injury among farmers in the Agricultural Health Study	2013	PURPOSE: To assess whether pesticide use practices were associated with injury mortality among 51,035 male farmers from NC and IA enrolled in the Agricultural Health Study. METHODS: We used Cox proportional hazards models adjusted for age and state to estimate fatal injury risk associated with self-reported use of 49 specific pesticides, personal protective equipment, specific types of farm machinery, and other farm factors collected 1-15 years preceding death. Cause-specific mortality was obtained through linkage to mortality registries. RESULTS: We observed 338 injury fatalities over 727,543 person-years of follow-up (1993-2008). Fatal injuries increased with days/year of pesticide application, with the highest risk among those with 60+ days of pesticide application annually [hazard ratio (HR) = 1.87; 95% confidence interval (CI) = 1.10, 3.18]. Chemical-resistant glove use was associated with decreased risk (HR = 0.73; 95% CI = 0.58, 0.93), but adjusting for glove use did not substantially change estimates for individual pesticides or pesticide use overall. Herbicides were associated with fatal injury, even after adjusting for operating farm equipment, which was independently associated with fatal injury. Ever use of five of 18 herbicides (2,4,5-T, paraquat, alachlor, metribuzin, and butylate) were associated with elevated risk. In addition, 2,4-D and cyanazine were associated with fatal injury in exposure-response analyses. There was no evidence of confounding of these results by other herbicides. CONCLUSION: The association between application of pesticides, particularly certain herbicides, and fatal injuries among farmers should be interpreted cautiously but deserves further evaluation, with particular focus on understanding timing of pesticide use and fatal injury.	International Archives of Occupational & Environmental Health	86	2	177-87	Self-reported exposure			Cohort (prospective)	Specific active ingredient	offspring	doctor-diagnosed	USA	hic
545	J. Kim, D. H. Shin and W. J. Lee	Suicidal ideation and occupational pesticide exposure among male farmers	2013	Background: The occupation of farming has been reported to be associated with a high suicide rate, and suicidal ideation is an important risk factor for suicide. The objective of this study was to explore the association between occupational pesticide exposure or poisoning history and suicidal ideation among male farmers in South Korea. Methods: Through a nationwide sampling survey, a total of 1958 male farmers were interviewed in 2011 in South Korea. Detailed occupational pesticide exposure and pesticide poisoning information were obtained from face-to-face interviews. Suicidal ideation was defined as whether they had thought of harming themselves or trying to take their own lives over the preceding year. Logistic regression analyses were conducted to examine the effect of pesticide poisoning on suicidal ideation. Results: Among all farmers, 8.7% (n=92) reported suicidal ideation in 2010. After controlling for potential confounders, lifetime hospitalization due to pesticide poisoning showed a 2.48-fold increase in risk (95% CI: 1.26, 4.91). Those with multiple poisonings showed more significant associations with suicidal ideation (OR=2.33 for once, OR=3.02 for more than once). Moderate- or severe-symptom severity of acute pesticide poisoning cases (OR=2.23; 95% CI: 1.21-4.11) also showed increased risks of suicidal ideation than the milder classes did. However, no significant association was identified with cumulative lifetime pesticide application and suicidal ideation. Conclusions: Our findings suggest that risk of suicidal ideation is related to occupational pesticide poisoning among male farmers. <U+00AC><U+00A9> 2013 Elsevier Inc. All rights reserved.	Environmental Research	NA	NA	NA	Self-reported exposure			Cross-sectional	Pesticides in general	other	doctor-diagnosed	Korea	hic
546	J. Kim, Y. Ko and W. J. Lee	Depressive symptoms and severity of acute occupational pesticide poisoning among male farmers	2013	OBJECTIVES: Limited evidence suggests the association between severity of acute occupational pesticide poisoning and depressive symptoms in farmers. The aim of this study was to investigate the association between occupational pesticide exposure and depressive symptoms among male farmers in South Korea. METHODS: A nationwide sampling survey of male farmers was conducted in South Korea. A total of 1958 male farmers were interviewed in 2011. Severity of occupational pesticide poisoning was evaluated according to symptoms, types of treatment and number of pesticide poisonings per individual. Depressive symptoms were assessed using the Geriatric Depression Scale. A survey logistic regression model was used to estimate the multivariate OR and 95% CIs. RESULTS: Among total farmers, 10.4% (n=197) reported depressive symptoms. After controlling for potential confounders, occupational pesticide poisoning in the previous year was positively associated with the risk of depressive symptoms (OR=1.61; 95% CI 1.10 to 2.34). Cases of more severe pesticide poisoning, such as moderate- or severe-symptom cases (OR=2.81; 95% CI 1.71 to 4.63), outpatient or hospitalisation cases (OR=2.52; 95% CI 1.15 to 5.53), and multiple poisoning cases (OR=1.82; 95% CI 1.19 to 2.76) showed higher risks of depressive symptoms than did milder cases. Among the pesticides causing the poisonings, paraquat dichloride was found to be a significant predictor of depressive symptoms. No significant association was found with cumulative lifetime pesticide application and depressive symptoms. CONCLUSIONS: Our findings suggest that the risk of depression appears to be related to the severity of symptoms of poisoning, type of care received and the number of previous episodes of acute poisonings.	Occupational & Environmental Medicine	70	5	303-9	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	Korea	hic

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547	J. L. Baelum, P.; Doekes, G.; Sigsgaard, T.	Health effects of selected microbiological control agents. A 3-year follow-up study	2012	INTRODUCTION AND OBJECTIVES: Microbiological control agents (MBCA) are widely used in greenhouses, replacing chemical pesticides. The presented study aims to describe health effects of exposure to three types commonly used: Bacillus thuringiensis, Verticillium lecanii, and Trichoderma harzenianum covering seven different products in greenhouse workers with emphasis on sensitization and respiratory effects. METHODS: 579 persons aged 17-67 years culturing ornamental flowers were included. They were followed for three years with annual examinations including interview about exposure and symptoms, lung function, including bronchial (histamine) challenge test, and blood samples. Direct and indirect exposure for each person and year was estimated by information from respondents and employers. IgE in serum against the 7 products of MCBA was analyzed using an enzyme immunoassay technique. RESULTS: 65%, 40%, and 78% were exposed to B. thuringiensis, V. lecanii, and T. harzenianum, respectively, while 6, 3 and 3% were handling the products. IgE against B. thuringiensis was seen in 53% of the samples and with prevalence rate ratios among exposed increasing from 1.20 (CI95%:1.01-1.42) to 1.43 (CI95%:1.09-1.87) over the 3-year period. There was no relation between exposure to any MBCA and neither prevalence nor incidence of respiratory symptoms and there was no effect on lung function or bronchial responsiveness. CONCLUSIONS: Use of B. thuringiensis in greenhouses may give rise to sensitization while no effect on the occurrence of respiratory symptoms or lung function was observed. The persons had a relatively long exposure. Therefore, a healthy worker effect may have influenced the results.	Annals of Agricultural & Environmental Medicine	19	4	631-6	Self-reported exposure			Cohort (prospective)	Specific active ingredient	pesticide-related symptoms	medical test result	Denmark	hic
548	J. L. H. Rinsky, J. A.; Blair, A.; Kamel, F.; He, K.; Beane Freeman, L. E.; Chen, H.	Agricultural exposures and stroke mortality in the agricultural health study	2012	Although farmers have reduced rates of stroke compared to the general public, certain exposures common to farming could still be associated with stroke. Few studies have examined these occupational risk factors. We analyzed data from 51,603 male pesticide applicators (mostly farmers) enrolled in the Agricultural Health Study (1993-1997). Vital status was obtained through 2008 and stroke mortality was defined by underlying or contributing cause of death on the death certificate (ICD-9 codes 430-438, and ICD-10 codes I60-I69). Information about exposure to crops, pesticides, and animals, as well as potential confounders was self-reported at baseline. Cox proportional hazards models with time from age at enrollment to age at death or censoring were used to estimate hazard ratios (HR) adjusted for state, smoking, and alcohol consumption. Median follow-up time was 13.7 years/participant, during which 390 stroke deaths occurred. Associations between stroke mortality and established risk factors (e.g., smoking, BMI, drinking) were in the expected direction and magnitude. Overall, use of 50 specific pesticides was not associated with stroke mortality. However, stroke mortality was inversely associated with handling hay, grain, or silage (HR: 0.68; 95% confidence interval (CI): 0.53, 0.86). Although, this association may be a result of a healthy worker effect where people engaging in these activities were at lower risk of stroke, the possibility of a protective role of inflammation-related processes associated with grain exposures may also explain this finding. Future studies should focus on stroke incidence to better evaluate these risk factors.	American Journal of Epidemiology	175	NA	S118	Self-reported exposure			Cohort (prospective)	Specific active ingredient	circulatory	doctor-diagnosed	USA	hic
549	J. L. H. Zhu, N. H.; Andersen, A. M.; Olsen, J.	Occupational exposure to pesticides and pregnancy outcomes in gardeners and farmers: a study within the Danish National Birth Cohort	2006	OBJECTIVE: We conducted a follow-up study to examine whether exposure to pesticides during pregnancy had an adverse effect on pregnancy outcomes among Danish gardeners and farmers. METHODS: Using data from the National Birth Cohort in Denmark, we identified 226 pregnancies of gardeners and 214 pregnancies of farmers during 1997 through 2003. Work activities and exposure to pesticides were reported in an interview (around 16 weeks of gestation). Totally, 62,164 other workers in the cohort served as a reference group. Pregnancy outcomes were obtained by linkage to the national registers. Cox regression was applied to analyze late fetal loss and congenital malformations, and logistic regression was used to analyze preterm birth and small for gestational age. RESULTS: There were no significant differences in the studied pregnancy outcomes between gardeners or farmers and all other workers, except for an increased risk of very preterm birth for gardeners and a favorable birth weight for farmers. With the exception of biologic approach used in gardening, neither work activities nor exposure to pesticides showed a significant increased risk of adverse birth outcomes among gardeners or farmers. CONCLUSIONS: Our data suggest little effect of occupational exposures to pesticides on pregnancy outcomes among gardeners or farmers in Denmark. The results may not apply to other countries.	Journal of Occupational & Environmental Medicine	48	4	347-52	Self-reported exposure			NA	Pesticides in general	reproductive	doctor-diagnosed	Denmark	hic
550	J. L. Lu	Comparison of pesticide exposure and physical examination, neurological assessment, and laboratory findings between full-time and part-time vegetable farmers in the Philippines	2009	Objectives: This study aimed to compare the work practices and health effects of pesticide exposure between full-time and part-time vegetable farmers. Methods: Data was gathered via structured personal interview using a 9-page questionnaire, physical examination, and blood extraction for complete blood count and serum creatinine. Results: Pyrethroid was the pesticide type most used by both groups. The risk for full-time farmers was related to both the amount of exposure and the type of pesticide. There were more full-time farmers who complained of falling ill because of work. This difference was statistically significant (P = 0.05). The level of those seeking medical attention was also significantly different between the two groups (P = 0.01). In assessing the individual components of the neurologic examination, 5.22% of full-time and 8.63% of part-time farmers had abnormal cranial nerve function, and 22 (5.7%) and 9 (6.47%) had abnormal motor strength. All farmers tested for reflexes, meningeals, and autonomics from both groups were normal. Based on hematologic examination, full-time farmers had higher mean values for creatinine, white blood cell, red blood cell, hemoglobin, and hematocrit. Activity of cholinesterase enzymes in blood can be utilized as a biomarker for the effect of organophosphates; of the 232 blood cholinesterase results, 94 (40%) were abnormal. Conclusion: The study showed certain differences between full-time and part-time farmers in terms of farming practices and health-related problems. Education on safe pesticide use and handling and better health monitoring of the farmers are recommended. <U+00AC><U+00A9> 2009 The Japanese Society for Hygiene.	Environmental Health and Preventive Medicine	14	6	345-352	Biomonitoring (blood)	Self-reported exposure		Cross-sectional	Chemical class	pesticide-related symptoms	medical test result	Philippines	lmic

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551	J. L. Lu	Risk factors to pesticide exposure and associated health symptoms among cut-flower farmers	2005	The study looked into the risk factors associated with pesticide exposure among cut-flower farmers. A survey questionnaire was given to 102 respondents in Barangay Bahong in La Trinidad, the center of cut-flower production in the Philippines. Results showed that 32% were symptomatic or had experienced pesticide-related illnesses since their first use of pesticides. The majority of the pesticides used by the farmers were Categories Ib and II which are moderately or highly hazardous chemicals. Individuals with signs and symptoms most often centered on the eye, ear, nose and throat (EENT) (44 respondents reporting these symptoms) followed by general and neuralgic (16 respondents) and the integumentary (14 respondents). The most common general signs and symptoms manifested were weakness followed by fatigue and muscle pain then by chills and fever. The most common EENT manifestations were eye itchiness and blurring of vision. For neurological signs and symptoms, dizziness followed by headache was reported. Logistic regression showed that illnesses for the past 12 months were associated with certain risk factors such as farm use of pesticides, exposure to pesticide while applying it, respiratory inhalation of pesticide vapours and mists (p = 0.05). Moreover, those who re-entered a recently sprayed area were 20 times more likely to get ill during the past 12 months than those who did not. Those who used pesticide-contaminated pieces of fabric to wipe sweat off their faces were 2% more likely to get ill, and those who had spills on their bodies while applying pesticide were 26 times more likely to get ill. The study suggested that the risk factors to pesticide exposure should be considered in policy formulations for the cut-flower farmers in the country.	International Journal of Environmental Health Research	15	3	161-9	Self-reported exposure			Cross-sectional	Type of pesticide	NA	self-reported	Philippines	lmic
552	J. L. Lu	Acute pesticide poisoning among cut-flower farmers	2007	The study reported here looked at adverse health effects associated with pesticide exposure among cut-flower farmers in La Trinidad, Philippines. Survey questionnaires and detailed physical and laboratory examinations were administered to 114 and 102 respondents, respectively, to determine pesticide exposure, work and safety practices, individual and family illnesses, and cholinesterase levels. Results showed that pesticide application was the activity most frequently associated with pesticide exposure, and entry was mostly ocular and dermal. Involvement of the skin was noted, with 21 percent of farmers having integumentary abnormalities. Upon physical examination, 90 respondents, or 88.2 percent of those examined, were found to have abnormal peak expiratory flow rate (PEFR). Abnormal temperature was found in 81.3 percent, and the next most frequent finding was abnormal general-survey results, at 75.5 percent. In 51 percent, cholinesterase levels were below the mean value of 0.7 delta pH/hour. (The unit of measure A pH/hour refers to the change in cholinesterase activity as measured by the difference between the initial pH and the final pH when acetylcholine solution has been added to the red blood cell for 1 1/2 hours. A decrease in cholinesterase activity will produce a low delta pH/hour level) In 25.5 percent, a more than 10 percent depression in the level of RBC cholinesterase was found. Certain hematological parameters were also abnormal, namely hemoglobin, hematocrit, and eosinophil count. Using Pearson's r, the author found that factors strongly associated with illness due to pesticides include use of a contaminated piece of fabric to wipe off sweat (p = .01) and reuse of pesticide containers to store water (p = .01), Recycling of containers poses great health hazards and risks of contamination, and the current recommendation is that used containers should be buried. There was a moderate relationship between illness and average number of years of pesticide use (p = .05), and between illness and re-entering a recently sprayed area (p = .05). Those with motor scale scores of < or = 15--normal values--were less likely to be sick. The greatest adverse effect in those exposed was an abnormal cholinesterase level, a finding that confirms results from earlier studies on the effect of pesticides on the body.	Journal of Environmental Health	70	2	38-43	Environmental air monitoring			Cross-sectional	Type of pesticide	pesticide-related symptoms	medical test result	Philippines	lmic
553	J. L. Lu	Effects of agricultural work practices and pesticide use on occupational health of farmers	2016	Aims The target site is Benguet, Philippines which is the largest vegetable producer in the Philippines. There are about 27.5 thousand farms covering 30 thousand hectares of agricultural land in Benguet. The province is known as the 'salad bowl' of the Philippines as its major crops are tubers, roots and bulbs, and leafy vegetables, stems and flowers. This is a study conducted among 534 farmers in six municipalities in an agricultural area engaged in vegetable industry. It assessed the pesticide exposure and work practices of farmers, and identified physical and neurological health status of the farmers. Methods Survey questionnaires look into pesticide exposures and work practices of the farmers. Physical health assessment was conducted by medical doctors from Baguio. Laboratory examination of blood was also done. Results Majority were males (53.4%), married (80.5%) with a mean age of 47 years old. 40.9% who underwent the physical examination were diagnosed to have abnormal assessment results. Analyses indicated that pesticide use and risk factors were found to have association at p = 0.05 with easy fatigability, weight loss, loss of appetite, cerebellar function, creatinine levels, haemoglobin, mean corpuscular volume, mean corpuscular haemoglobin count, and platelet count. Conclusion. These results underscore the need to improve protection measures so as to reduce the exposure of the population and environment to pesticides.	Occupational and Environmental Medicine	73	NA	A195-A196	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	Philippines	lmic
554	J. Lindsay, R. Hebert and K. Rockwood	The Canadian Study of Health and Aging: risk factors for vascular dementia	1997	BACKGROUND AND PURPOSE: The Canadian Study of Health and Aging (CSHA) was conducted in communities and institutions in 10 Canadian provinces. One objective of the study was to study risk factors for vascular dementia (VaD). METHODS: This was a population-based case-control study. It included 129 patients clinically diagnosed with VaD with duration of symptoms no more than 3 years and 535 control subjects, frequency matched by age group, study center, and residence in community or institution, who were clinically confirmed to be cognitively normal. Odds ratios (ORs) were calculated using unconditional logistic regression for potential risk factors for VaD. RESULTS: Risk of VaD was associated with history of arterial hypertension (OR, 2.08; 95% confidence interval, 1.29 to 3.35). Other significantly elevated ORs were seen for history of alcohol abuse (2.45), history of heart condition (1.71), use of aspirin (3.10), and occupational exposure to pesticides and herbicides (2.60), as well as liquid plastic or rubber (2.59). The OR for less than 6 years of education compared with 10 or more years was 4.02. CONCLUSIONS: The study confirmed some previously reported risk factors for VaD, such as history of heart disease. Higher levels of education seemed to lower the risk or delay onset of symptoms of VaD. Use of aspirin may be a predictor of survival rather than a risk factor. The occupational associations, particularly with pesticides and fertilizers, need further study.	Stroke	28	3	526-30	Self-reported exposure			Case-control	Pesticides in general	circulatory	doctor-diagnosed	Canada	hic

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555	J. Londhe, R. Kodgule, S. Juvekar, S. Madas, A. Agrawal and S. Salvi	Prevalence of chronic obstructive pulmonary disease (COPD) amongst farmers in rural India	2015	Background: An estimated 263 million people are engaged in farming in India. Use of pesticides has increased in recent years to improve crop yield. We aimed to study the prevalence of COPD among farmers in rural India and to study whether farmers using pesticide sprays have a higher disease burden. Methods: All male and female resident farmers above the age of 25yrs from 4 randomly selected villages of rural India were invited to participate. A pre-tested questionnaire were administered to obtain information about use of pesticides and other exposures such as smoking history and biomass exposure, using a mobile phone device. Post bronchodilator spirometry was performed to determine the prevalence of COPD (FEV1/FVC < 70%). Results: 938 participants (Mean age: 45.3 <U+00AC><U+00B1> 13.2; M: 53.4%) completed the questionnaire and performed acceptable spirometry. The prevalence of COPD among farmers was 4.9% (M:6.2%, F: 3.4%). Farmers using pesticide sprays had a greater odds of having small airways obstruction on spirometry (FEF25-75% < 65%); 45.2% vs 32.5% (OR: 1.71 (CI: 1.27-2.29) p <0.0001). However, there was no difference in the prevalence of COPD between pesticide users and non-users (5.4% vs 3.9%; p=0.34). Although 67% of the farmers who had COPD never smoked, smoking was associated with a greater risk of COPD (OR: 7.65 (CI: 3.9 - 15.0) p<0.0001). Conclusion: Two thirds of farmers who have COPD in rural India are never smokers, although smoking increased the risk further by 7 fold. Farmers using pesticides have greater prevalence of small airways obstruction.	European Respiratory Journal	46	NA	NA	Self-reported exposure			Cross-sectional	Pesticides in general	respiratory	medical test result	India	lmic
556	J. M. Crawford, J. A. Hoppin, M. C. Alavanja, A. Blair, D. P. Sandler and F. Kamel	Hearing loss among licensed pesticide applicators in the agricultural health study	2008	OBJECTIVE: We evaluated self-reported hearing loss and pesticide exposure in licensed private pesticide applicators enrolled in the Agricultural Health Study in 1993 to 1997 in Iowa and North Carolina. METHODS: Among 14,229 white male applicators in 1999 to 2003, 4926 reported hearing loss (35%). Logistic regression was performed with adjustment for state, age, and noise, solvents, and metals. We classified pesticides by lifetime days of use. RESULTS: Compared with no exposure, the odds ratio (95% confidence interval) for the highest quartile of exposure was 1.19 (1.04 to 1.35) for insecticides and 1.17 (1.03 to 1.31) for organophosphate insecticides. Odds of hearing loss were elevated for high pesticide exposure events (1.38, 1.25 to 1.54), pesticide-related doctor visits (1.38, 1.17 to 1.62) or hospitalization (1.81, 1.25 to 2.62), and diagnosed pesticide poisoning (1.75, 1.36 to 2.26). CONCLUSIONS: Although control for exposure to noise or other neurotoxicants was limited, this study extends previous reports suggesting that organophosphate exposure increases risk of hearing loss.	Journal of Occupational & Environmental Medicine	50	7	817-26	Self-reported exposure			Cross-sectional	Chemical class	other	self-reported	USA	hic
557	J. M. Gorell, C. C. Johnson, B. A. Rybicki, E. L. Peterson and R. J. Richardson	The risk of Parkinson's disease with exposure to pesticides, farming, well water, and rural living	1998	We assessed exposure to pesticides, farming, well water use, and rural living as risk factors for Parkinson's disease (PD) in a population-based case-control study consisting of men and women > or = 50 years of age who had primary medical care at Henry Ford Health System in metropolitan Detroit. Enrolled PD patients (n = 144) and control subjects (n = 464) were frequency-matched for age, race, and sex. When adjusted for these variables and smoking status, there was a significant association of occupational exposure to herbicides (odds ratio [OR], 4.10; 95% CI, 1.37, 12.24) and insecticides (OR, 3.55; 95% CI, 1.75, 7.18) with PD, but no relation was found with fungicide exposure. Farming as an occupation was significantly associated with PD (OR, 2.79; 95% CI, 1.03, 7.55), but there was no increased risk of the disease with rural or farm residence or well water use. The association of occupational exposure to herbicides or insecticides with PD remained after adjustment for farming. The association of farming with PD was maintained after adjustment for occupational herbicide exposure and was of borderline significance after adjustment for occupational insecticide exposure. These results suggest that PD is associated with occupational exposure to herbicides and insecticides and to farming and that the risk of farming cannot be accounted for by pesticide exposure alone.	Neurology	50	5	1346-50	Self-reported exposure			Case-control	Type of pesticide	neurological	doctor-diagnosed	USA	hic
558	J. M. Mazurek and P. K. Henneberger	Lifetime allergic rhinitis prevalence among US primary farm operators: findings from the 2011 Farm and Ranch Safety survey	2017	PURPOSE: Allergic rhinitis is associated with decreased quality of life, and reduced workplace performance and productivity. This study investigated the prevalence of lifetime allergic rhinitis and factors associated with allergic rhinitis among US primary farm operators. METHODS: The 2011 Farm and Ranch Safety Survey data collected from 11,210 active farm operators were analyzed. Survey respondents were determined to have lifetime allergic rhinitis based on a "yes" response to the question: "Have you ever been told by a doctor, nurse, or other health professional that you had hay fever, seasonal allergies, or allergic rhinitis?" Data were weighted to produce nationally representative estimates. RESULTS: An estimated 30.8% of the 2.1 million active farm operators had lifetime allergic rhinitis in 2011. The allergic rhinitis prevalence varied by demographic and farm characteristics. Farm operators with allergic rhinitis were 1.38 (95% CI 1.22-1.56) times more likely to be exposed to pesticides compared with operators with no allergic rhinitis. The association with pesticide exposure for allergic rhinitis and current asthma, and allergic rhinitis alone was statistically significant and greater than that for current asthma alone. CONCLUSION: Certain groups of farm operators may be at increased risk of allergic rhinitis. Studies should further investigate the association of allergic rhinitis with specific pesticide exposure.	International Archives of Occupational & Environmental Health	90	6	507-515	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	USA	hic
559	J. M. Morahan and R. Pamphlett	Amyotrophic lateral sclerosis and exposure to environmental toxins: an Australian case-control study	2006	It has been suggested that environmental toxins could be risk factors for sporadic amyotrophic lateral sclerosis (SALS). We therefore analysed epidemiological data on 179 SALS cases and 179 age-, ethnicity- and sex-matched controls in Australia using self-reporting questionnaires. SALS was associated with solvent/chemical exposure (OR = 1.92, 95% CI: 1.26-2.93), overall herbicide/pesticide exposure (OR = 1.57, 95% CI: 1.03-2.41) and industrial herbicide/pesticide exposure (OR = 5.58, 95% CI: 2.07-15.06). Exposure to herbicides/pesticides showed a dose-response effect. All positive findings were more statistically significant in males. These findings support those from northern hemisphere studies, indicating that environmental toxins can be risk factors for SALS.	Neuroepidemiology	27	3	130-5	Self-reported exposure			Case-control	Type of pesticide	neurological	doctor-diagnosed	Australia	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
560	J. M. R. Dominguez, A. E. Morano, G. Castano-Vinyals, B. Perez-Gomez, T. Dierssen-Sotos, R. Peiro, J. J. Jimenez-Moleon, R. Capelo, A. Tardon, J. A. Garrido, M. Kogevinas and J. Alguacil	Occupational exposure and prostate cancer in the multicase-control study in Spain (MCC-Spain)	2016	Background In Spain, prostate cancer is the third cause of mortality from cancer in men, after lung and colorectal cancers. Age, family history and race are common risk factors. Several environmental and occupational factors have been investigated, including pesticides and endocrine disruptors, but results are inconsistent. We have previously shown an association of prostate cancer risk with shift work. We evaluate here which occupations and agents are associated with a high risk for prostate cancer within the framework of the MCC-Spain. Methods We included 1111 incident cases of prostate cancer and 1489 population controls recruited from 7 Spanish regions from September 2008 to December 2012. Occupational history was collected for all subjects, and occupations were coded according to the Spanish National Classification of Occupations 1994 (CNO-94). The Spanish Job Exposure Matrix (MatEmESp) was applied to assess occupational exposures to different agents. Unconditional logistic regression was applied, adjusting for age, education and region, showing Odds Ratios and 95% Confidence Intervals (OR; CI). Results Construction building managers (OR = 2.0; 1.1-3.8), cleaning personnel (OR = 2.1; 1.1-4.0), farmers (OR = 3.0; 1.1-8.1) were associated with an increase risk in prostate cancer. An association has been observed for exposure to inorganic dust, specifically to silica dust (OR = 1.3; 1.1-1.7), insecticides (OR = 1.4; 1.1-1.8), and ultraviolet radiations (OR = 1.3; 1.1-1.6). Analysis on intensity and duration of the exposure to certain agents as well as associations with extension of the disease will be presented. Conclusions Occupational exposures may play a role in the development of prostate cancer.	Occupational and Environmental Medicine	73	NA	A135	Self-reported job history	Job exposure matrix		Case-control	Job title	cancer	doctor-diagnosed	Spain	hic
561	J. M. Ramlow, N. W. Spadacene, S. R. Hoag, B. A. Stafford, J. B. Cartmill and P. J. Lerner	Mortality in a cohort of pentachlorophenol manufacturing workers, 1940-1989	1996	Mortality in a cohort of 770 workers with potential pentachlorophenol (PCP) exposure was evaluated from 1940 through 1989. The study cohort is a subset of a larger cohort of workers with potential exposure to higher chlorinated dioxins. Total mortality and cancer mortality in the PCP cohort were slightly lower than expected in comparison to the U.S. white male population. There were 229 total deaths with 242.5 expected (SMR = 94, 95% confidence interval 83-108), and 50 cancer deaths with 52.6 expected (SMR = 95, 95% confidence interval 71-125). In comparison with unexposed employees, the risk ratio for total mortality was 1.03 (95% confidence interval 0.90-1.17), and the risk ratio for all cancer mortality was 0.95 (95% confidence interval 0.71-1.26). In most cause of death categories of a priori interest no deaths were observed in the cohort. A small excess of other and unspecified lymphopoietic cancer deaths was observed but did not appear to be related to exposure. Excesses of deaths due to cancer of the kidney, gastric and duodenal ulcer, cirrhosis of the liver, and all accidents were observed in comparison with the U.S. white male population and with unexposed employees. These were associated with increasing estimated cumulative PCP exposure after lagging exposures by 5 and 15 years. Despite the limited size and the generally favorable total mortality experience of the cohort, it was concluded that cohort members may have incurred increased risk of death due to some specific causes. The risks could not, however, be attributed conclusively to PCP exposure and may have been associated with other occupational and nonoccupational factors. Additional mortality surveillance of this cohort will be performed.	American Journal of Industrial Medicine	30	2	180-94	Registers			Cohort (prospective)	Specific active ingredient	mortality (all cause)	doctor-diagnosed	USA	hic
562	J. M. Wright and J. Keller-Byrne	Environmental determinants of Parkinson's disease	2005	Increasing toxicologic and epidemiologic evidence suggests that pesticides and other environmental exposures are associated with idiopathic Parkinson's disease. Using a case-control study, the authors examined the impact of farming, pesticide use, rural residence, and well water use (including critical periods of childhood exposure) on the risk of Parkinson's disease. After adjustment for confounding, > or = 40 years of well-water exposure (compared to no well water use) was associated with an increased risk of Parkinson's disease (OR = 7.1; 95% CI: 2.3-22.1). The authors found an increased risk of Parkinson's disease (OR = 2.1; 95% CI: 0.7-6.4) for well water use during the first 20 years of life (compared with <20 years of exposure) and saw some suggestion of an exposure-response relationship with increasing childhood exposure. Farming and pesticide use (occupational or residential) was not associated with Parkinson's disease but exposure assessment limitations warrant further investigation.	Archives of Environmental & Occupational Health	60	1	11902	Self-reported exposure			Case-control	Pesticides in general	neurological	doctor-diagnosed	USA	hic
563	J. N. Agopian, J. M.; Gac, A. C.; Lecluse, Y.; Briand, M.; Grenot, P.; Gauduchon, P.; Ruminy, P.; Lebailly, P.; Nadel, B.; Roulland, S.	Agricultural pesticide exposure and the molecular connection to lymphomagenesis	2009	The t(14;18) translocation constitutes the initiating event of a causative cascade leading to follicular lymphoma (FL). t(14;18) translocations are present in blood from healthy individuals, but there is a trend of increased prevalence in farmers exposed to pesticides, a group recently associated with higher risk of t(14;18)(+) non-Hodgkin's lymphoma development. A direct connection between agricultural pesticide use, t(14;18) in blood, and malignant progression, however, has not yet been demonstrated. We followed t(14;18) clonal evolution over 9 yr in a cohort of farmers exposed to pesticides. We show that exposed individuals bear particularly high t(14;18) frequencies in blood because of a dramatic clonal expansion of activated t(14;18)(+) B cells. We further demonstrate that such t(14;18)(+) clones recapitulate the hallmark features of developmentally blocked FL cells, with some displaying aberrant activation-induced cytidine deaminase activity linked to malignant progression. Collectively, our data establish that expanded t(14;18)(+) clones constitute bona fide precursors at various stages of FL development, and provide a molecular connection between agricultural pesticide exposure, t(14;18) frequency in blood, and clonal progression.	Journal of Experimental Medicine	206	7	1473-83	Self-reported exposure			Cohort (prospective)	Pesticides in general	cancer	doctor-diagnosed	France	hic
564	J. N. K. Hofmann, M. C.; De Roos, A. J.; Fenske, R. A.; Furlong, C. E.; van Belle, G.; Checkoway, H.	Occupational determinants of serum cholinesterase inhibition among organophosphate-exposed agricultural pesticide handlers in Washington State	2010	OBJECTIVE: To identify potential risk factors for serum cholinesterase (BuChE) inhibition among agricultural pesticide handlers exposed to organophosphate (OP) and N-methyl-carbamate (CB) insecticides. METHODS: We conducted a longitudinal study among 154 agricultural pesticide handlers who participated in the Washington State cholinesterase monitoring program in 2006 and 2007. BuChE inhibition was analysed in relation to reported exposures before and after adjustment for potential confounders using linear regression. ORs estimating the risk of BuChE depression (>20% from baseline) were also calculated for selected exposures based on unconditional logistic regression analyses. RESULTS: An overall decrease in mean BuChE activity was observed among study participants at the time of follow-up testing during the OP/CB spray season relative to pre-season baseline levels (mean decrease of 5.6%, p<0.001). Score for estimated cumulative exposure to OP/CB insecticides in the past 30 days was a significant predictor of BuChE inhibition (beta=-1.74, p<0.001). Several specific work practices and workplace conditions were associated with greater BuChE inhibition, including mixing/loading pesticides and cleaning spray equipment. Factors that were protective against BuChE inhibition included full-face respirator use, wearing chemical-resistant boots and storing personal protective equipment in a locker at work. CONCLUSIONS: Despite existing regulations, agricultural pesticide handlers continue to be exposed to OP/CB insecticides at levels resulting in BuChE inhibition. These findings suggest that modifying certain work practices could potentially reduce BuChE inhibition. Replication from other studies will be valuable.	Occupational & Environmental Medicine	67	6	375-86	Self-reported exposure			Cohort (prospective)	Pesticides in general	cancer	doctor-diagnosed	USA	hic

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565	J. N. K. Hofmann, M. C.; Furlong, C. E.; De Roos, A. J.; Farin, F. M.; Fenske, R. A.; van Belle, G.; Checkoway, H.	Serum cholinesterase inhibition in relation to paraoxonase-1 (PON1) status among organophosphate-exposed agricultural pesticide handlers	2009	BACKGROUND: Animal studies have demonstrated that low paraoxonase-1 (PON1) status (i.e., low catalytic efficiency and/or low plasma PON1 activity) is associated with neurotoxic effects after exposure to several organophosphate (OP) insecticides. However, few human studies have investigated associations between PON1 status and intermediate end points, such as serum cholinesterase [butyrylcholinesterase (BuChE)] inhibition, among OP-exposed individuals. OBJECTIVES: We evaluated the relation between plasma PON1 status and BuChE inhibition among OP-exposed agricultural pesticide handlers. METHODS: Agricultural pesticide handlers in Washington State were recruited during the 2006 and 2007 spray seasons when they were seen for follow-up ChE testing by collaborating medical providers as part of a statewide monitoring program. Blood samples were collected from 163 participants and tested for PON1 status based on plasma PON1 activity [arylesterase (AREase)] and PON1 Q192R genotype. We evaluated percent change in BuChE activity from baseline level in relation to PON1 status. RESULTS: We observed significantly greater BuChE inhibition among QQ homozygotes relative to RR homozygotes (p = 0.036). Lower levels of plasma PON1 activity were significantly associated with greater BuChE inhibition (p = 0.004). These associations remained after adjustment for year, days since baseline test, age, and OP exposure in the last 30 days. CONCLUSIONS: We found that both low PON1 catalytic efficiency (i.e., the Q192 alloform) and low plasma PON1 activity were associated with BuChE inhibition among OP-exposed agricultural pesticide handlers. Corroborative findings from future studies with prospective collection of blood samples for PON1 testing, more sensitive markers of OP-related effects, and larger sample sizes are needed.	Environmental Health Perspectives	117	9	1402-8	Self-reported exposure			Cohort (prospective)	Chemical class	genetic (biomarkers)	medical test result	USA	hic
566	J. N. Poynter, M. Richardson, M. Roesler, C. K. Blair, B. Hirsch, P. Nguyen, A. Cioc, J. R. Cerhan and E. Warlick	Chemical exposures and risk of acute myeloid leukemia and myelodysplastic syndromes in a population-based study	2016	Background Myelodysplastic syndromes (MDS) are a group of clonal hematologic disorders that result in ineffective hematopoiesis. Individuals with MDS have a high risk of progressing to leukemia, with approximately 30% expected to develop acute myeloid leukemia (AML). Benzene exposure is one of the few well-established risk factors for AML, and recent studies suggest it is also a risk factor for MDS. Exposure to other occupational and residential chemicals has been inconsistently associated with hematologic malignancies. In this analysis, we evaluated occupational and residential chemical exposures as risk factors for AML and MDS using population-based data. Methods AML and MDS cases were identified by rapid case ascertainment through the Minnesota Cancer Surveillance System (MCSS). Centralized pathology and cytogenetics reviews were conducted to confirm diagnosis and classify by subtypes. Controls were identified through the Minnesota State driver's license/identification card list. Chemical exposures were measured by selfreport and included occupational and residential exposure to a variety of chemicals. Unconditional logistic regression with adjustment for age, sex, previous cancer treatment, income, and farm or rural residence was used to calculate crude and adjusted odds ratios (ORs) and 95% confidence intervals (CI). Smoking, obesity and physical activity were considered as potential confounders but did not change effect estimates by 10% or more. Results We included 265 MDS cases, 420 AML cases, and 1388 controls in this analysis. As expected, we observed significant associations between benzene and both MDS and AML (OR = 1.77, 95% CI 1.17, 2.67 and OR = 2.03, 95% CI 1.45, 2.83, respectively). Exposure to vinyl chlorides was associated with MDS (OR = 2.25, 95% CI 1.32, 3.81) but not with AML (OR = 1.36, 95% CI 0.83, 2.21). Exposure to fertilizers (OR = 1.70, 95% CI 1.11, 2.59), soot (OR = 2.64, 95% CI 1.59, 4.39), creosote (OR = 1.95, 95% CI 1.08, 3.51), inks, dyes and tanning solutions (OR = 1.63, 95% 1.02, 2.60), and coal dust (2.64, 95% CI 1.30, 5.39) were associated with AML, while no association was seen between any of these exposures and MDS (range ORs = 0.78-1.25). No significant associations were observed for occupational pesticide exposures in either group. Discussion These data confirm the importance of benzene as a risk factor for myeloid malignancy and provide risk estimates in a population-based sample. A number of other significant associations with occupational and residential chemicals were observed for AML; however, all exposures were reported by only a small percentage of cases (<U+201A><U+00E2><U+00A7>10%). While chemical exposures play a clear role in the etiology of myeloid malignancy, these exposures do not account for the majority of cases.	Cancer Research	76	14	NA	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	USA	hic
567	J. O. A. Delancey, M. C.; Coble, J.; Blair, A.; Hoppin, J. A.; Austin, H. D.; Beane Freeman, L. E.	Occupational exposure to metribuzin and the incidence of cancer in the Agricultural Health Study	2009	PURPOSE: Little is known about the potential carcinogenicity of the triazinone herbicide metribuzin. We evaluated the association between metribuzin use and cancer risk in the Agricultural Health Study, a prospective cohort study of licensed pesticide applicators in Iowa and North Carolina. METHODS: Applicators (N=23,072) provided information on metribuzin use on a self-administered questionnaire at enrollment (1993-1997). Among metribuzin users (n=8,504), there were 554 incident cancer cases. We used multivariable Poisson regression to evaluate potential associations between metribuzin use and cancer incidence by using two quantitative exposure metrics, lifetime days and intensity-weighted lifetime days. RESULTS: Using intensity-weighted lifetime days, the rate ratio (RR) and 95% confidence interval (CI) for the highest exposed tertile for lymphohematopoietic malignancies were 2.09 (95% CI: 0.99-4.29), p trend=0.02 and 2.42 (95% CI: 0.82-7.19), p trend=0.08 for leukemia. For non-Hodgkin lymphoma, the RR was 2.64 (95% CI: 0.76-9.11), p trend=0.13 for lifetime days and 2.52 (95% CI: 0.66-9.59), p trend=0.13 for intensity-weighted lifetime days. Patterns of association were similar for both exposure metrics, but associations were generally weaker than for intensity-weighted days. CONCLUSIONS: The results from this study suggest a potential association between metribuzin use and certain lymphohematopoietic malignancies; however, having not been observed previously, caution should be used in interpretation.	Annals of Epidemiology	19	6	388-95	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
568	J. O. Esechie and O. O. Ibitayo	Pesticide use and related health problems among greenhouse workers in Batinah Coastal Region of Oman	2011	Pesticide practices and the health problems associated with pesticide exposure among 74 greenhouse workers in the Batinah Coastal Region of Oman were investigated. The workers were mostly migrant workers from India (37.8%), Bangladesh (28.4%), Nepal (14.9%), Sri Lanka (8.1%) and Pakistan (5.4%). Majority of the workers (44%) had some primary education, were between 31 and 40 years of age (50%), were married (85.1%) and had been applying pesticides for over 10 years (32.4%). Occupational and phytosanitary practices among the pesticide workers were poor, as most of the workers (59.5%) did not wash their hands after pesticide application, many (43.2%) did not shower and some (20.3%) did not change their clothes. Their methods of handling of partly used pesticides were questionable, with 81.1% storing them in other rooms in the house and 14.9% storing them in their bedrooms. Personal protective equipment (PPE) such as nose mask, overall and eye goggles were hardly used during pesticide application. Some of the reported health symptoms due to pesticide exposure were skin irritation (70.3%), burning sensation (39.2%), headache (33.8%), vomiting (29.7%) and salivation (21.6%). It was suggested that a provision be included in the Pesticide Laws of Oman that makes it mandatory for greenhouse owners to provide their workers with PPE. Also, regular training programs should be organized for the greenhouse pesticide workers to improve their ability to handle hazardous chemicals.	Journal of Forensic & Legal Medicine	18	5	198-203	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	Oman	hic

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569	J. P. Fryzek, D. H. Garabrant, S. D. Harlow, R. K. Severson, B. W. Gillespie, M. Schenk and D. Schottenfeld	A case-control study of self-reported exposures to pesticides and pancreas cancer in southeastern Michigan	1997	A case-control study of pancreas cancer in residents, aged 30-79 years, of 18 counties in southeastern Michigan was conducted to investigate the risks of exposure to DDT and related materials in the general population. Sixty-six people with cytologically diagnosed pancreas cancer were identified using 7 participating hospitals in metropolitan Detroit and Ann Arbor. One hundred and thirty-one controls were frequency-matched to the cases on age, sex, ethicity and county of residence by random-digit dialing. All study participants were administered a questionnaire to assess life-time exposure to pesticides from both environmental and occupational sources, family history of cancer, past medical history, smoking history and demographic information. A statistically significant increased risk was found for self-reported exposure to ethylan (1,1-dichloro-2,2-bis(4-methoxyphenyl) ethane). Increased odds ratios were observed for self-reported exposures to chloropropylate and DDT, as well as for the summary group of organochlorine pesticides which included all of these materials, though these associations were not significant.	International Journal of Cancer	72	1	22828	Self-reported exposure			Case-control	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
570	J. P. Galanaud, A. Elbaz, J. Clavel, J. S. Vidal, J. R. Correze, A. Alperovitch and C. Tzourio	Cigarette smoking and Parkinson's disease: a case-control study in a population characterized by a high prevalence of pesticide exposure	2005	Epidemiological studies have been consistent in showing that cigarette smoking is inversely associated with Parkinson's disease (PD), whereas pesticide use is positively associated with PD. However, the relationship between PD and cigarette smoking remains poorly understood. Our objective was to study the relationship between cigarette smoking and PD in a population characterized by a high prevalence of pesticide exposure. This case-control study was carried out among subjects enrolled in the Mutualite Sociale Agricole, the French health insurance organization for workers connected to the agricultural world. We included 247 cases and 676 controls matched on age, sex, and region of residency. Information on smoking was obtained through in-person interviews. Pesticide exposure was assessed using a case-by-case expert evaluation procedure. We found an inverse relationship between ever cigarette smoking and PD (odds ratio [OR] = 0.6; 95% confidence interval [CI] = 0.4-0.9). The strength of this association increased with the number of pack-years. This relationship was present even when smoking was considered as long as 40 years before PD onset. An inverse association was also present among subjects professionally exposed to pesticides (OR = 0.5; 95% CI = 0.3-0.8) and was independent of the duration of exposure among men. We confirm the inverse association between cigarette smoking and PD in a population characterized by a high prevalence of professional pesticide exposure. The relationship between PD and cigarette smoking was not significantly modified or confounded by exposure to pesticides.	Movement Disorders	20	2	181-9	Expert case-by-case assessment			Case-control	Pesticides in general	neurological	doctor-diagnosed	France	hic
571	J. P. Guo, E.; Kyyronen, P.; Lindbohm, M. L.; Heikkila, P.; Kauppinen, T.	Testicular cancer, occupation and exposure to chemical agents among Finnish men in 1971-1995	2005	OBJECTIVE: To find associations between testicular cancer, occupation and chemical exposure. METHODS: A cohort of all economically active Finnish men born between 1906 and 1945 was followed-up for 19.7 million person-years during 1971-1995. Incident cases of testicular cancer (n=387) were identified in a record linkage with the Finnish Cancer Registry. The Census occupations in 1970 were converted to chemical exposures with a job-exposure matrix (FINJEM). Cumulative exposure (CE) was calculated as the product of prevalence, level, and duration of the exposure. Standardised incidence ratio (SIR) was calculated for each of the 393 occupations, and for CE categories of the 43 chemical agents, using average male population as reference. Relative risks (RR) comparing various CE-categories with unexposed ones were defined for selected agents by Poisson regression analysis. RESULTS: Elevated SIRs were observed among railway traffic supervisors (5.8, 95% CI 1.6-14.7), programmers (4.3, 1.4-9.9), university teachers (4.1, 1.3-9.5) and electrical engineers (3.9, 1.1-10.1). A significant exposure-response trend (mainly contributed by seminoma) was observed for pesticides, textile dust, aliphatic and alicyclic hydrocarbons, and some other organic solvents. CONCLUSIONS: Risk of testicular cancer increased only in four occupations. Pesticides, textile dust, and some organic solvents may be related to an excess risk of seminoma.	Cancer Causes & Control	16	2	97-103	Job exposure matrix			Cohort (prospective)	Type of pesticide	cancer	doctor-diagnosed	Finland	hic
572	J. P. Hubble, T. Cao, R. E. Hassanein, J. S. Neuberger and W. C. Koller	Risk factors for Parkinson's disease	1993	Parkinson's disease (PD) has been associated with rural living, well-water consumption, and pesticide exposure; however, the individual risk contribution of these variables has not been established. We examined social and medical histories of predominantly rural populations to determine relative risk factors for PD. Patients and controls were surveyed regarding residency, occupation, medical history, and social and dietary habits. An initial multiple logistic regression model was confounded by excessive variable colinearity. Principal factor analysis yielded three factors: rural living (including years of rural residency and ground-water use), pesticide use, and male lifestyle (male gender, head trauma, male-dominated occupations). Other variables did not load in factor analysis and were entered separately, with the three factor scores, in a second multiple logistic regression model. Significant predictors of PD emerged (in order of strength): pesticide use, family history of neurologic disease, and history of depression. The predicted probability of PD was 92.3% (odds ratio = 12.0) with all three predictors positive. Pesticide use (distinguishable from rural living) can be considered a risk factor for the development of PD, with family history of neurologic disease and history of depression serving as weaker predictors of PD.	Neurology	43	9	1693-7	Self-reported exposure			Case-control	Pesticides in general	neurological	doctor-diagnosed	USA	hic
573	J. Pajic, D. Jovicic and A. P. S. Milovanovic	Cytogenetic surveillance of persons occupationally exposed to genotoxic chemicals	2017	Human genotoxic exposures can occur environmentally, occupationally, or medicinally. The aim of this study was to assess cytogenetic damage (chromosomal aberrations and micronuclei) in persons exposed to chemical agents in medical, agricultural, and industrial occupations. The results showed influences of age, gender, occurrence, and duration of exposure on the extent of cytogenetic damage, but no influence of smoking. Persons exposed to pesticides were allocated significantly higher values of most examined parameters. Among all tested parameters, logistic regression analysis marked tMN, CB, and iCB as the best predictors with high discrimination accuracy of separation between exposed and unexposed persons. The obtained data encourage us to consider certain cytogenetic parameters as valuable markers for preventive medical screening as the extent of cytogenetic damage reflects cumulative exposure events and possible health consequences related to chronic occupational genotoxic exposure.	Archives of Environmental and Occupational Health	NA	NA	43109	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Serbia	umic

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574	J. R. Beach, A. Spurgeon, R. Stephens, T. Heafield, I. A. Calvert, L. S. Levy and J. M. Harrington	Abnormalities on neurological examination among sheep farmers exposed to organophosphorous pesticides	1996	OBJECTIVES: Organophosphates are effective pesticides which are frequently used in several agricultural settings. Although their acute effects are well characterised, it remains unclear whether long term exposure can damage the human nervous system. This study sought to investigate their long term effects by comparing abnormalities on neurological examination between groups of workers exposed to organophosphates and an unexposed group. METHODS: 146 exposed sheep farmers and 143 unexposed quarry workers were recruited into a cross sectional study of symptoms and neuropsychological effects of long term exposure to organophosphates in sheep dip. From a symptom questionnaire given immediately after dipping the 10 most symptomatic and 10 least symptomatic farmers were selected. Several months later each of these, along with 10 of the unexposed quarry workers, underwent a standardised neurological examination similar to that which might be used in clinical practice, at at time as remote as possible from recent exposure to organophosphates so as to exclude any acute effects. RESULTS: All 30 selected subjects agreed to participate. The components of the examination which showed a significant difference were two point discrimination on the dorsum of the hand (symptomatic farmers 22 mm; asymptomatic farmers 13 mm; quarry workers 8 mm) and the dorsum of the foot (symptomatic farmers 34 mm; asymptomatic farmers 10 mm; quarry workers 11 mm), and mean calf circumference (symptomatic farmers 35.0 cm; asymptomatic farmers 36.3 cm; quarry workers 38.6 cm). Overall the prevalence of neurological abnormalities was low. CONCLUSIONS: The differences in neurological examination detected between groups were subtle and their clinical significance was unclear. However, they do suggest evidence of an adverse neurological effect from exposure to organophosphates. Further, larger scale studies will be required before it is possible to confirm or refute the differences detected.	Occupational & Environmental Medicine	53	8	520-5	Job title			Cross-sectional	Job title	neurological	self-reported	UK	hic
575	J. Rooney, F. D'Ovidio, A. E. Visser, R. Vermeulen, G. Logroscino, J. Veldink, E. Beghi, L. Van Den Berg, A. Chio and O. Hardiman	Euro-MOTOR: A multi-centre populationbased case-control study of pesticides exposure as risk factor for Amyotrophic Lateral Sclerosis	2017	Background and aims: Long-term exposure to pesticides has been proposed as a risk factor for neurodegenerative disorders including Amyotrophic Lateral Sclerosis (ALS), however research has been complicated by difficulty in assessing historical exposures. Methods: Incident ALS cases and matched controls were recruited over 4 years in Ireland, Italy and the Netherlands. Trained investigators carried out structured interviews of participants to gather details of lifetime occupational history. Job-Exposure-Matrices (JEM) were applied to occupational data to characterize risk of exposure to pesticides. Logistic regression models adjusting for age, gender, education and cohort were used to determine the association between pesticide exposure and ALS risk. Results: 1,557 patients and 2,922 controls were included. We found increased odds ratios (ORs) for ALS with any history of exposure to any pesticides (OR 1.34; 95%CI: 1.09-1.63), and to herbicides (OR 1.35; 95% CI: 1.06-1.71), insecticides (OR 1.31; 95% CI: 1.07-1.62) and fungicides (OR 1.38; 95% CI: 1.11-1.70) separately. These findings were robust to sensitivity analyses, and were unchanged after correction for physical activity, smoking and alcohol consumption. Conclusion: Our findings provide new evidence for an association between pesticide exposure and ALS in European populations. Further work is ongoing to identify any population specific differences and dose-response relationships.	European Journal of Neurology	24	NA	634	Job exposure matrix			Case-control	Type of pesticide	neurological	doctor-diagnosed	Ireland/Italy/Netherlands	AHIC
576	J. Rothlein, D. Rohlman, M. Lasarev, J. Phillips, J. Muniz and L. McCauley	Organophosphate pesticide exposure and neurobehavioral performance in agricultural and non-agricultural Hispanic workers	2006	Our understanding of the health risks of farmworkers exposed to pesticides in their work and home environments is rapidly increasing, although studies designed to examine the possible neurobehavioral effects of low-level chronic pesticide exposure are limited. We measured dialkyl phosphate urinary metabolite levels, collected environmental dust samples from a subset of homes, obtained information on work practices, and conducted neurobehavioral tests on a sample of farmworkers in Oregon. Significant correlations between urinary methyl metabolite levels and total methyl organophosphate (azinphos-methyl, phosmet, malathion) house dust levels were observed. We found the neurobehavioral performance of Hispanic immigrant farmworkers to be lower than that observed in a nonagricultural Hispanic immigrant population, and within the sample of agricultural workers there was a positive correlation between urinary organophosphate metabolite levels and poorer performance on some neurobehavioral tests. These findings add to an increasing body of evidence of the association between low levels of pesticide exposure and deficits in neurobehavioral performance.	Environmental Health Perspectives	114	5	691-6	Biomonitoring (urine)			Cross-sectional	Chemical class	neurological	medical test result	USA	hic
577	J. Runkle, J. Flocks, J. Economos, J. A. Tovar-Aguilar and L. McCauley	Occupational risks and pregnancy and infant health outcomes in Florida farmworkers	2014	The agricultural industry has some of the highest incidence rates and numbers of occupational injuries and illnesses in the United States. Injuries and illnesses in agriculture result from accidents, falls, excessive heat, repetitive motion and adverse pesticide exposure. Women working in agriculture are exposed to the same hazards and risks as their male counterparts, but can face additional adverse impacts on their reproductive health. Yet, few occupational risk assessment studies have considered the reproductive health of female farmworkers. The objective of this community-based participatory research study was to conduct a retrospective, cross-sectional survey to collect information on workplace conditions and behaviors and maternal, pregnancy and infant health outcomes among a sample of female nursery and fernery farmworkers in Central Florida. Survey results showed that nursery workers were more likely to report health symptoms during their pregnancy than fernery workers. We also observed a self-reported increased risk of respiratory illness in the first year of life for infants whose mothers worked in ferneries. Our findings confirm that agricultural work presents potential reproductive hazards for women of childbearing age.	International Journal of Environmental Research & Public Health [Electronic Resource]	11	8	7820-40	Self-reported exposure			Cross-sectional	Pesticides in general	reproductive	self-reported	USA	hic

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578	J. S. Beard, T.; Morgan, G.; Berry, G.; Brooks, L.; McMichael, A.	Health impacts of pesticide exposure in a cohort of outdoor workers	2003	We compared mortality of 1,999 outdoor staff working as part of an insecticide application program during 1935-1996 with that of 1,984 outdoor workers not occupationally exposed to insecticides, and with the Australian population. Surviving subjects also completed a morbidity questionnaire. Mortality was significantly higher in both exposed and control subjects compared with the Australian population. The major cause was mortality from smoking-related diseases. Mortality was also significantly increased in exposed subjects for a number of conditions that do not appear to be the result of smoking patterns. Compared with the general Australian population, mortality over the total study period was increased for asthma [standardized mortality ratio (SMR) = 3.45; 95% confidence interval (CI), 1.39-7.10] and for diabetes (SMR = 3.57; 95% CI, 1.16-8.32 for subjects working < 5 years). Mortality from pancreatic cancer was more frequent in subjects exposed to 1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane (SMR = 5.27; 95% CI, 1.09-15.40 for subjects working < 3 years). Compared with the control population, mortality from leukemia was increased in subjects working with more modern chemicals (standardized incidence ratio = 20.90; 95% CI, 1.54-284.41 for myeloid leukemia in the highest exposure group). There was also an increase in self-reported chronic illness and asthma, and lower neuropsychologic functioning scores among surviving exposed subjects when compared with controls. Diabetes was reported more commonly by subjects reporting occupational use of herbicides. These findings lend weight to other studies suggesting an association between adverse health effects and exposure to pesticides.	Environmental Health Perspectives	111	5	724-30	Job title			Cohort (prospective)	Job title	mortality (all cause)	doctor-diagnosed	Australia	hic
579	J. S. Graves, T. Chitnis, B. Weinstock-Guttman, J. Rubin, A. S. Zelikovitch, B. Nourbakhsh, T. Simmons, M. Waltz, T. C. Casper, E. Waubant and C. Network of Pediatric Multiple Sclerosis	Maternal and Perinatal Exposures Are Associated With Risk for Pediatric-Onset Multiple Sclerosis	2017	OBJECTIVE: To determine if prenatal, pregnancy, or postpartum-related environmental factors are associated with multiple sclerosis (MS) risk in children. METHODS: This is a case-control study of children with MS or clinically isolated syndrome and healthy controls enrolled at 16 clinics participating in the US Network of Pediatric MS Centers. Parents completed a comprehensive environmental questionnaire, including the capture of pregnancy and perinatal factors. Case status was confirmed by a panel of 3 pediatric MS specialists. Multivariable logistic regression analyses were used to determine association of these environmental factors with case status, adjusting for age, sex, race, ethnicity, US birth region, and socioeconomic status. RESULTS: Questionnaire responses were available for 265 eligible cases (median age 15.7 years, 62% girls) and 412 healthy controls (median age 14.6, 54% girls). In the primary multivariable analysis, maternal illness during pregnancy was associated with 2.3-fold increase in odds to have MS (95% confidence interval [CI] 1.20-4.21, P = .01) and cesarean delivery with 60% reduction (95% CI 0.20-0.82, P = .01). In a model adjusted for these variables, maternal age and BMI, tobacco smoke exposure, and breastfeeding were not associated with odds to have MS. In the secondary analyses, after adjustment for age, sex, race, ethnicity, and socioeconomic status, having a father who worked in a gardening-related occupation (odds ratio [OR] 2.18, 95% CI 1.14-4.16, P = .02) or any use in household of pesticide-related products (OR 1.73, 95% CI 1.06-2.81, P = .03) were both associated with increased odds to have pediatric MS. CONCLUSION: Cesarean delivery and maternal health during pregnancy may influence risk for pediatric-onset MS. We report a new possible association of pesticide-related environmental exposures with pediatric MS that warrants further investigation and replication.	Pediatrics	139	4	NA	Self-reported job history			Case-control	Job title	neurological	doctor-diagnosed	USA	hic
580	J. S. Okonya and J. Kroschel	A Cross-Sectional Study of Pesticide Use and Knowledge of Smallholder Potato Farmers in Uganda	2015	In response to increased pest and disease problems, potato farmers use pesticides, which could raise environmental and health concerns. This study sought to promote proper and safe pesticide-handling practices by providing data needed to guide pesticide regulation policy and training for extension staff and farmers. A household survey was conducted in three major potato-growing agroecological zones of Uganda. Two hundred and four potato farmers were interviewed about the type and source of pesticides they use in potato cultivation, the frequency of applications, the use of protective clothing, and cases of pesticide poisoning. The types of pesticides used in potato were fungicides (72%), insecticides (62%), and herbicides (3%). Overall, use of personal protective equipment was low, that is, gumboots (73%), gloves (7%), face masks (16%), and long sleeve shirts (42%). Forty-three percent of farmers who applied pesticides reported having experienced skin itching, 25% skin burning sensation, 43% coughing, 60% a runny nose, 27% teary eyes, and 42% dizziness. An IPM approach involving only moderately to slightly hazardous pesticides when pest and disease incidence has reached economic injury levels and by considering all safety measures during application and storage would be environmentally recommendable and result in reduced health risks.	BioMed Research International	2015	NA	759049	Self-reported exposure			Cross-sectional	Type of pesticide	NA	self-reported	Uganda	lic
581	J. S. Vidal, M. Vidailhet, P. Derkinderen, T. D. de Gaillarbois, C. Tzourio and A. Alperovitch	Risk factors for progressive supranuclear palsy: a case-control study in France	2009	BACKGROUND: The risk factors of progressive supranuclear palsy (PSP), a rare but severe Parkinsonian syndrome, are poorly known. OBJECTIVE: To study the risk factors of PSP in a case control study among French patients. METHOD: The study was conducted between April 2000 and December 2003. Cases were in- or outpatients of five large hospitals and fulfilled the Golbe criteria. Controls were relatives of patients from the same hospitals, free of Parkinsonian syndrome and dementia, and matched to cases for age, gender and living area. Data on demographic characteristics, occupation history, diet habits, anti-inflammatory drugs use, alcohol consumption, smoking habits, gardening and leisure activities, and exposure to pesticides were collected through a face-to-face questionnaire. A conditional logistic regression was used to analyse matched data and estimate OR. RESULTS: 79 cases and 79 controls were included. Only a few comparisons were significant. Cases reached a lower education attainment than controls (odds ratio (OR) = 2.6 (1.3 to 5.3), p = 0.01). Analysis of diet habits did not show any major difference although cases ate meat or poultry more frequently. Conversely, controls ate fruits more frequently than did cases. No association was found between PSP and occupation, use of pesticides, gardening, alcohol consumption, smoking habits and anti-inflammatory agent use. CONCLUSION: In this case-control study, we did not find any strong environmental risk factors for PSP.	Journal of Neurology, Neurosurgery & Psychiatry	80	11	1271-4	Self-reported exposure			Case-control	Pesticides in general	neurological	doctor-diagnosed	France	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
582	J. S<U+221A><U+00B0>nchez-Alarc<U+221A><U+2265>n, Y. P<U+221A><U+00A9>rez-Zempoalteca, M. Mili<U+0192><U+00E1>, J. M. R. Montiel-Gonz<U+221A><U+00B0>lez, R. A. Valencia-S<U+221A><U+00B0>nchez and R. Valencia-Quintana	Analysis of micronucleus and nuclear abnormalities in mucosa buccal cells of agricultural workers exposed to pesticide mixtures in Tlaxcala state, Mexico	2016	Introduction: Tlaxcala is a land of agriculture, which is why agricultural pest control is essential, and the most effective method is to use chemicals. However, they represent a significant source of occupational and non-occupational exposure to potentially toxic agents. Objectives: The aim of this study was to evaluate the geno- and cyto-toxic effects of pesticides in exfoliated buccal cells of workers occupationally exposed in Tlaxcala, Mexico. Materials and methods: The micronucleus assay in exfoliated buccal cells is a useful and minimally invasive method for monitoring genetic damage in humans. The study compared 32 agricultural workers in the rural community of Tlaxcala, Mexico, with 30 nonexposed individuals. All of the individuals signed an informed consent form and filled in a detailed questionnaire enquiring into possible confounding factors (age, gender, smoking and drinking habits, vaccination, medication, X-ray examinations and diet). In the case of the affected group, years of exposure and protective measures used were also recorded. Buccal epithelium cell samples were collected during the day. The subjects rinsed their mouth with water before sampling, buccal cell samples were obtained by gently scraping the roof of the mouth. The slides were stained by the Feulgen reaction technique. 3000 epithelial cells of each individual were evaluated to determine MN, KR, KL, and BN frequencies. In order to compare differences among the exposed and non-exposed, Welch's unequal variances t-test was applied. Results: The study revealed that the frequency of MN and the nuclear anomalies (KR, and BN), increased significantly in the exposed group. No significant effect on genetic damage was observed as a result of age, smoking, and alcohol consumption. Conclusions: This study provided valuable data for establishing the possible risk to human health associated with pesticide exposure.	Toxicology Letters	259	NA	S213	Self-reported exposure			Case-control	Pesticides in general	genetic (biomarkers)	medical test result	Mexico	umic
583	J. Sanyal, D. P. Chakraborty, B. Sarkar, T. K. Banerjee, S. C. Mukherjee, B. C. Ray and V. R. Rao	Environmental and familial risk factors of Parkinsons disease: case-control study	2010	BACKGROUND: While the cause of Parkinson's disease (PD) remains unknown, evidence suggests certain environmental factors, such as well water drinking, herbicides, pesticides exposure and neurotoxins, may trigger the chain of oxidative reactions culminating in the death of dopaminergic neurons in substantia nigra to cause Parkinsonism. To investigate the possible impact of environmental risk factors for idiopathic PD, a case-control study was performed in the Eastern India. METHODS: During the period from January 1st, 2006 and December 10th, 2009, 175 PD patients (140 men, 35 women) and 350 non-Parkinson age-sex matched controls were included in the study. Subjects were given a structured neurological examination and completed an administered questionnaire which elicited detailed information on demographic data, pesticides, herbicides family history, occupation, dietary and smoking habits. RESULTS: The multivariate analysis revealed that family history of PD, pesticide exposure, exposure to toxins other than pesticides and herbicides, rural living and previous history of depression were associated with increased risk of PD, whereas, smoking appeared to be a protective factor. Well water drinking for at least five years, though a significant risk factor on univariate analysis (OR = 4.5, 95% CI = 2.1-9.9), could not be proved significant in multivariate analysis. Head trauma, vegetarian dietary habit, occupation involving physical exertion and exposure to domestic pets were not as significant risk factors. CONCLUSION: Results of our study support the hypothesis of multifactorial etiology of PD with environmental factors acting on a genetically susceptible host.	Canadian Journal of Neurological Sciences	37	5	637-42	Self-reported exposure			Case-control	Type of pesticide	neurological	doctor-diagnosed	India	lmic
584	J. Shaham, Z. Kaufman, R. Gurvich and Z. Levi	Frequency of sister-chromatid exchange among greenhouse farmers exposed to pesticides	2001	Sister-chromatid exchange (SCE) was measured in peripheral lymphocytes of 104 greenhouse farmers exposed to pesticides and 44 unexposed workers. The results of SCEs are expressed in two variables: (a) mean number of SCEs per chromosome and, (b) proportion of high frequency cells (cells with more than eight SCEs). A high correlation was found between these two variables. The adjusted means of both SCEs variables were significantly higher among the farmers compared with the unexposed group (P < 0.01). Adjustment was made for smoking, age, education, and origin. The adjusted means of both SCE variables, were significantly elevated (P < 0.05) among the farmers who prepared and applied more than 70% of the pesticides by themselves compared with those who prepared and applied less than 70% of the pesticides by themselves. Both SCEs variables were also significantly elevated (P < 0.05) among farmers who were involved in more than 7.4 sprays per year compared with those with 7.4 or less sprays per year (P < 0.05). We found a tendency towards elevation of the two variables of SCEs among those who did not use protective measures while preparing the pesticides. Evaluation of the influence of years of exposure on the frequency of SCEs showed that the two variables of SCEs were higher among those farmers who were exposed to pesticides for more than 21 years than among those with less than 21 years of exposure. The variables that had the most influence on the elevation of SCEs were self-preparation of the pesticide mixtures and the number of sprayings per year. Because the farmers used a mixture of almost 24 different chemical classes it was impossible to attribute exposure to a specific pesticide or group of pesticides to single farmers. Our finding of a significant increase of SCEs frequency in peripheral lymphocytes in greenhouse farmers indicates a potential cytogenetic hazard due to pesticides exposure.	Mutation Research	491	1	71-80	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	NA	NA
585	J. T. Efird, E. A. Holly, S. Preston-Martin, B. A. Mueller, F. Lubin, G. Filippini, R. Peris-Bonet, M. McCredie, S. Cordier, A. Arslan and P. M. Bracci	Farm-related exposures and childhood brain tumours in seven countries: results from the SEARCH International Brain Tumour Study	2003	A total of 1218 cases of childhood brain tumours (CBT) and 2223 control subjects from the general population were included in a population-based case-control study conducted in nine centres in seven countries. Mothers were asked about farm- or agriculture-related exposures. Significantly elevated odds ratios (OR) for CBT were associated with children's personal and maternal prenatal exposure while living on a farm with pigs (child OR = 1.7, mother OR = 2.3), horses (child OR = 1.6, mother OR = 1.8), dogs (child OR = 1.5, mother OR = 1.5) and cats (child OR = 1.5, mother OR = 1.7). Children who were exposed to pigs, horses and cats combined, while living on a farm, had a threefold elevated OR for CBT. Increased ORs for primitive neuroectodermal tumours (PNET) were associated with children's farm exposure to dogs (OR = 1.9) and cats (OR = 2.2), and maternal farm exposure to pigs (OR = 4.2). The OR for CBT was elevated (OR = 2.3) for children of mothers who had preconception/prenatal farm- or agriculture-related employment involving potential contact with animals, relative to no farm- or agriculture-related employment. In particular, increased ORs for CBT were observed for children of mothers who were employed as general farmers (OR = 4.1) or general farm workers (OR = 3.8). During the 5 years preceding the index child's birth, maternal exposures were related to CBT, relative to no maternal exposure to agricultural chemicals or animal products: fertilisers (OR = 1.8), pesticides (OR = 2.0), animal manure (OR = 2.0) and unprocessed wool (OR = 3.0). Our findings suggest that various farm-related exposures are positively associated with CBT and warrant further investigation into the public health importance of these associations.	Paediatric and Perinatal Epidemiology	17	2	201-11	Self-reported exposure			NA	Type of pesticide	offspring	doctor-diagnosed	AHIC	AHIC

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
586	J. Tikkanen and O. P. Heinonen	Risk factors for hypoplastic left heart syndrome	1994	A case-control study was performed in Finland to investigate the etiology of the lethal heart malformation, hypoplastic left heart syndrome (HLHS). The cases represented all verified HLHS (n = 34) in Finland during 1982-1983, and controls (n = 756) were randomly selected from all babies born during the same period. Both case and control mothers were interviewed by midwives approximately 3 mo after delivery. Maternal upper respiratory infection during the first trimester of pregnancy was a significant risk factor for HLHS (OR = 2.5, CI95 = 1.2-5.4). Maternal exposures at work to factors such as disinfectants, pesticides, dyes, lacquers or paints, and anesthetic gases were rare and failed to indicate any risk for HLHS. Maternal use of deodorants or hairsprays during the first trimester of pregnancy was not a significant risk factor for HLHS (OR = 1.8, CI95 = 0.9-3.6). The risk of HLHS was not associated with seasonal variation, maternal smoking, alcohol or coffee consumption, or use of acetosalicylic acid. Because the study material is limited in size, the power of this investigation is weak for testing the teratogenicity of specific chemicals on the risk of HLHS. Thus, conclusions from the negative findings of this study should be drawn very carefully.	Teratology	50	2	112-7	Self-reported exposure			Case-control	Pesticides in general	circulatory	doctor-diagnosed	Finland	hic
587	J. U. Hoppin, D.; Long, S.; London, S.; Henneberger, P. K.; Blair, A.; Beane Freeman, L.; Sandler, D. P.	Pesticides are associated with allergic and non-allergic wheeze among male farmers	2015	Rationale: Farmers are at high risk for respiratory symptoms that may predict future adverse respiratory outcomes. While hays, grains, and animals are believed to be the primary causes of respiratory symptoms among farmers, evidence is growing that pesticides may also contribute. Our previous work suggested that allergic and non-allergic asthma were associated with exposure to specific pesticides. Methods: We used data from the 2005-2010 interview of the Agricultural Health Study (AHS), a prospective study of farmers and their spouses in North Carolina and Iowa, to evaluate recent pesticide use and two types of wheeze (allergic and non-allergic) among men in the cohort. We used polytomous regression models adjusted for age, BMI, state, smoking, and current asthma, as well as overall frequency of pesticide application and driving diesel tractors to evaluate 80 specific chemicals reported by > 1% of the 22,134 men who completed the interview. Exposure to individual pesticides were characterized both as dichotomous (current use in the past year- yes/no) and categories of days/year used. Allergic wheeze was defined as reporting both wheeze and current allergy symptoms (n=1310, 6%), while non-allergic wheeze was defined as reporting wheeze but not current allergy symptoms (n=3939, 18%); those without wheeze (76%) served as the referent group. Results: In models evaluating current pesticide use, 21 pesticides were significantly (p<0.05) associated with non-allergic wheeze (2 negative, 19 positive) and 17 pesticides were significantly associated with allergic wheeze (1 negative, 16 positive); ten pesticides were significantly associated with both. Seven pesticides (carbaryl, zeta-cypermethrin, dimethoate, 2,4-D, simazine, fenoxaprop-p-ethyl, and pyraclostrobin) had significantly different odds ratios for allergic and non-allergic wheeze, with all but fenoxaprop-p-ethyl being elevated for allergic wheeze. Associations with wheeze differed by chemical class with some types of herbicides (e.g., acetic acid herbicides) being more likely to be associated with wheeze than other types of herbicides. We saw evidence of a positive exposure response relationship for a number of chemicals. Conclusion: Because some of the pesticides that our analysis suggested might contribute to wheeze among farmers are widely used in residential settings (permethrin, carbaryl, 2,4-D, glyphosate), future studies should explore the potential respiratory health consequences of these chemicals in residential users.	American Journal of Respiratory and Critical Care Medicine	191	NA	NA	Self-reported exposure			Cohort (prospective)	Specific active ingredient	respiratory	self-reported	USA	hic
588	J. Vena, P. Boffetta, H. Becher, T. Benn, H. B. Bueno-de-Mesquita, D. Coggon, D. Colin, D. Flesch-Janys, L. Green, T. Kauppinen, M. Littorin, E. Lynge, J. D. Mathews, M. Neuberger, N. Pearce, A. C. Pesatori, R. Saracci, K. Steenland and M. Kogevinas	Exposure to dioxin and nonneoplastic mortality in the expanded IARC international cohort study of phenoxy herbicide and chlorophenol production workers and sprayers	1998	The authors studied noncancer mortality among phenoxyacid herbicide and chlorophenol production workers and sprayers included in an international study comprising 36 cohorts from 12 countries followed from 1939 to 1992. Exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin or higher chlorinated dioxins (TCDD/HCD) was discerned from job records and company questionnaires with validation by biologic and environmental measures. Standard mortality ratio analyses suggested a moderate healthy worker effect for all circulatory diseases, especially ischemic heart disease, among both those exposed and those not exposed to TCDD/HCD. In Poisson regression analyses, exposure to TCDD/HCD was not associated with increased mortality from cerebrovascular disease. However, an increased risk for circulatory disease, especially ischemic heart disease (rate ratio [RR] 1.67, 95% confidence interval [CI] 1.23-2.26) and possibly diabetes (RR 2.25, 95% CI 0.53-9.50), was present among TCDD/HCD-exposed workers. Risks tended to be higher 10 to 19 years after first exposure and for those exposed for a duration of 10 to 19 years. Mortality from suicide was comparable to that for the general population for all workers exposed to herbicides or chlorophenols and was associated with short latency and duration of exposure. More refined investigations of the ischemic heart disease and TCDD/HCD exposure association are warranted.	Environmental Health Perspectives	106	NA	645-53	Expert case-by-case assessment	Biomonitoring (blood)		Cohort (prospective)	Chemical class	mortality (all cause)	doctor-diagnosed	AHIC	AHIC
589	J. W. Albers, D. H. Garabrant, S. Schweitzer, R. P. Garrison, R. J. Richardson and S. Berent	Absence of sensory neuropathy among workers with occupational exposure to chlorpyrifos	2004	Several studies have reported the occurrence of sensory neuropathy with exposure to chlorpyrifos and other organophosphorus insecticides, at levels not associated with overt toxicity. We evaluated 113 chemical workers, including 53 of 66 (80%) eligible chlorpyrifos workers and 60 of 74 (81%) randomly selected referent workers, to identify evidence of sensory neuropathy or subclinical neuropathy. Compared to referents, chlorpyrifos subjects had significantly longer duration of work in chlorpyrifos-exposed areas (9.72 vs. 0.01 years; P < 0.0001), greater cumulative chlorpyrifos exposure (64.16 vs. 0.69 mg/m(3). day; P < 0.0001), higher urine 3,5,6-trichloro-2-pyridinol (TCP) excretion (108.6 vs. 4.3 microg/g creatinine; P < 0.0001), and lower plasma butyrylcholinesterase (BuChE) activity (7281 vs. 8176 mIU/ml; P = 0.003). Despite exposures among chlorpyrifos subjects to levels at which well-described physiological effects on B-esterases exist, the frequency of symptoms or signs of neuropathy did not differ significantly between groups, and the only 2 subjects fulfilling criteria for confirmed neuropathy were both in the referent group. Mean nerve conduction study results were comparable to established control values and did not differ significantly between groups. We found no evidence of sensory neuropathy or isolated peripheral abnormalities among subjects with long-term chlorpyrifos exposure at levels known to be associated with the manufacturing process.	Muscle & Nerve	29	5	677-86	Biomonitoring (urine)	Expert case-by-case assessment		Cross-sectional	Specific active ingredient	neurological	medical test result	USA	hic
590	J. W. B. Albers, S.; Garabrant, D. H.; Giordani, B.; Schweitzer, S. J.; Garrison, R. P.; Richardson, R. J.	The effects of occupational exposure to chlorpyrifos on the neurologic examination of central nervous system function: a prospective cohort study	2004	Questions persist about adverse effects such as impaired cognition and attention, incoordination, spasticity, or parkinsonism from chronic, low-level exposures to organophosphate (OP) compounds. In a prospective cohort study, we evaluated chlorpyrifos-manufacturing workers and a referent group on 2 occasions, 1 year apart, to determine whether occupational exposure to chlorpyrifos produced clinically evident central nervous system (CNS) dysfunction. Chlorpyrifos subjects had significantly higher TCP excretion and lower average BuChE activity than referents in a range in which physiological effects on B-esterases exist. Few subjects had neurologic symptoms or signs, and there were no significant group differences in terms of signs at baseline or second examinations. Chronic chlorpyrifos exposure produced no clinical evidence of cortical, pyramidal tract, extrapyramidal, or other CNS dysfunction among chlorpyrifos subjects compared with referents, either at baseline or after 1 year of additional chlorpyrifos exposure.	Journal of Occupational & Environmental Medicine	46	4	367-78	Environmental air monitoring			Cohort (prospective)	Specific active ingredient	neurological	medical test result	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
591	J. W. Dich, K.	Prostate cancer in pesticide applicators in Swedish agriculture	1998	BACKGROUND: The use of chemicals in agriculture has been associated with elevated risks of prostate cancer. The aim of this study was to analyze prostate cancer risk in a cohort of 20,025 pesticide applicators in agriculture licensed between 1965-1976. METHODS: The cohort was followed up in the Swedish Cancer Register from date of licence until death of December 31, 1991. The mean follow-up time was 21.3 years. RESULTS: We found a statistically significant increased risk of prostate cancer with 401 cases observed compared to 355 expected, with a standardized incidence ratio (SIR) of 1.13 (95% confidence interval: 1.02-1.24). There were 7 cases among those born in 1935 or later, and the SIR was 2.03 (0.82-4.19). For those born earlier than 1935 the SIR was 1.12 (1.01-1.24). CONCLUSIONS: These findings of a statistically significant increased risk of prostate cancer, together with recent results from other studies, imply a relationship between agrochemicals or other risk factors in the environment of farmers and prostate cancer.	Prostate	34	2	100-12	Job title			Cohort (prospective)	Pesticides in general	cancer	doctor-diagnosed	Sweden	hic
592	J. W. Edwards and B. G. Priestly	Effect of occupational exposure to aldrin on urinary D-glucaric acid, plasma dieldrin, and lymphocyte sister chromatid exchange	1994	The effects of exposure to the chlorinated cyclodiene termiticide aldrin was evaluated in pest control workers potentially exposed to this material. Sister chromatid exchange (SCE) frequencies were not elevated in workers handling aldrin. This is consistent with the fact that chlorinated cyclodienes are not genotoxic. Plasma dieldrin concentrations (up to 250 ng/ml) confirmed exposure in workers actively performing termiticide treatments and in maintenance and store workers, when compared with unexposed control workers (median concentration, 4.8 ng/ml). Urinary D-glucaric acid (DGA), an index of hepatic enzyme activity, was elevated in pesticide-exposed groups but urinary DGA was poorly correlated with plasma dieldrin level. This indicates that concurrent exposures of these groups to other pesticides may have influenced mixed-function oxidase metabolic activity.	International Archives of Occupational & Environmental Health	66	4	229-34	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	genetic (biomarkers)	medical test result	Australia	hic
593	J. W. G. Albers, D. H.; Mattsson, J. L.; Burns, C. J.; Cohen, S. S.; Sima, C.; Garrison, R. P.; Richardson, R. J.; Berent, S.	Dose-effect analyses of occupational chlorpyrifos exposure and peripheral nerve electrophysiology	2007	We performed nerve conduction studies (NCSs) on 113 chemical workers, many of whom had occupational exposure to the organophosphorus insecticide chlorpyrifos (O,O-diethyl-O-[3,5,6-trichloro-2-pyridyl]-phosphorothioate), to identify dose effects of subclinical neuropathy. In this masked longitudinal study, we estimated historic and interim chlorpyrifos exposures and measured excretion of 3,5,6 trichloro-2-pyridinol (TCP), a chlorpyrifos metabolite. TCP excretion among exposed workers suggested an estimated daily chlorpyrifos exposure averaging about 576-627 microg/day and indicated levels approximately 30% (range 0-250%) of the internal dose received by a typical subject exposed during a working day at the threshold limit value of 200 microg/m3. We modeled NCS results using linear mixed models with repeated measures. Although we found no consistent associations between interim chlorpyrifos exposure and NCS results, we identified several significant associations involving historic chlorpyrifos exposure. Most associations, however, reflected effects at low-exposure levels (< 20 mg/m3 x days) without further effects as exposure increased over a 10-fold range (20-220 mg/m3 x days). This suggested small differences among subjects with low or no chlorpyrifos exposure, rather than a dose-related deterioration among subjects with higher exposures. Two NCS results demonstrating apparent subclinical adverse dose effects showed significant but unexplained interaction with education level. The overall results provide little support for the hypothesis that chronic chlorpyrifos exposures at levels in the range associated with appreciable inhibition of B-esterases produce adverse dose effects on peripheral nerve electrophysiology suggestive of subclinical neuropathy.	Toxicological Sciences	97	1	196-204	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	neurological	medical test result	USA	hic
594	J. W. G. Albers, D. H.; Schweitzer, S. J.; Garrison, R. P.; Richardson, R. J.; Berent, S.	The effects of occupational exposure to chlorpyrifos on the peripheral nervous system: a prospective cohort study	2004	AIMS: To determine whether chronic occupational exposure to chlorpyrifos at levels associated with various aspects of manufacturing produced a clinically evident or subclinical peripheral neuropathy. METHODS: Clinical and quantitative nerve conduction study (NCS) examinations were performed on two occasions on chlorpyrifos manufacturing workers who had measurable chlorpyrifos exposure and a referent group. Baseline evaluations were performed on 53 of 66 eligible chlorpyrifos subjects and on 60 of 74 eligible referent subjects; one-year evaluations were completed on 111 of the 113 subjects evaluated at baseline. RESULTS: Chlorpyrifos and referent groups differed significantly in measures of 3,5,6 trichloro-2-pyridinol excretion and plasma butyrylcholinesterase (BuChE) activity, indicating substantially higher exposures among chlorpyrifos subjects. Few subjects had clinically important neurological symptoms or signs. NCS results were comparable to control values, and there were no significant group differences in NCS results at baseline, one year, or change over one year. No chlorpyrifos subject fulfilled conventional criteria for confirmed peripheral neuropathy at baseline or one-year examinations. The odds ratios for developing any diagnosable level of peripheral neuropathy among the chlorpyrifos subjects was not increased at baseline or at one year compared to referents at baseline. Mixed regression models used to evaluate subclinical group-by-time interactions showed numerous significant NCS differences attributable to near-nerve temperature differences among all subjects between the baseline and one-year examinations, but only a few disparate effects related to group. CONCLUSIONS: Chronic chlorpyrifos exposure during the manufacturing process sufficient to produce biological effects on BuChE activity was not associated with clinically evident or subclinical peripheral neuropathy at baseline or with measurable deterioration among chlorpyrifos subjects compared to referents after one year of additional exposure.	Occupational & Environmental Medicine	61	3	201-11	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	neurological	medical test result	USA	hic
595	J. W. van der Gulden, J. J. Kolk and A. L. Verbeek	Work environment and prostate cancer risk	1995	A case-referent study of 345 prostate cancer cases and 1,346 referents was carried out in the Netherlands to investigate the relationship between work environment and prostate cancer risk. Cases were selected from the Cancer Registry of the Comprehensive Cancer Centre IKO. Referents (men diagnosed with benign prostate hyperplasia) were recruited with assistance of the pathology laboratories in the IKO region. Questionnaires were mailed to all subjects to obtain information on their work history and occupational exposure. Moreover, workers in farming (n = 323), and in metal work and maintenance (n = 340), were requested to complete short supplements to the questionnaire inquiring in more detail into specific types of exposure. Significantly elevated risks were found for work in food manufacturing and for bookkeepers. Significantly elevated odds ratios (OR) were also observed for jobs held between 1960 and 1970 in administration, in storage, or as farm laborer. In addition, a statistically significant excess risk was found for subjects who reported frequent occupational exposure to cadmium. Cases who worked in farming applied pesticides during significant more days per year than the referents did. A nonsignificantly elevated OR was found for maintenance of tractors and agricultural machinery. Among metal workers, mechanics, and repairmen, nonsignificantly increased ORs were observed with regard to the use of acids, solvents, iron, and steel, and for welding and maintenance of machinery.	Prostate	27	5	250-7	Self-reported job history			Case-control	Pesticides in general	cancer	doctor-diagnosed	Netherlands	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
596	J. W.-V. Tinggaard, C.; Husby, S.; Christiansen, L.; Skakkeb<U+221A><U+00B6>k, N. E.; Jensen, T. K.; Grandjean, P.; Main, K. M.; Andersen, H. R.	Prenatal pesticide exposure and PON1 genotype associated with adolescent body fat distribution evaluated by dual X-ray absorptiometry (DXA)	2016	Many modern pesticides have endocrine disrupting abilities and early-life exposure may affect growth and disease risk later in life. Previously, we reported associations between prenatal pesticide exposure and higher childhood body fat content measured by anthropometry. The associations were affected by child PON1 Q192R genotype. We aimed to study whether prenatal pesticide exposure was still associated with body fat content and distribution in the children at puberty and the potential impact of both maternal and child PON1 Q192R genotype. In this prospective cohort study of 247 children born by occupationally exposed or unexposed women (greenhouse workers and controls) two follow-up examinations (age 10-15 and 11-16 years) including simple anthropometry, skinfold measurements, pubertal staging and blood sampling were performed. Total and regional fat% was determined by dual X-ray absorptiometry (DXA) at age 10-15. Prenatal pesticide exposure was associated with increased total, android, and gynoid fat% (DXA) at age 10-15 years after adjustment for sex, socioeconomic status, and puberty (all <U+0152><U+2264> = 0.5 standard deviation score (SDS) p < 0.05). Stratified by sex, the associations were significant in girls (total fat: <U+0152><U+2264> = 0.7 SDS, android-gynoid ratio: <U+0152><U+2264> = 0.1, both p < 0.05), but not in boys. Carrying the R-allele (child or mother, separately, or both) augmented the differences between exposed and unexposed children (total fat: <U+0152><U+2264> = 1.0 SDS, <U+0152><U+2264> = 0.8 SDS, p < 0.05, respectively, and <U+0152><U+2264> = 1.2 SDS, p < 0.01). No exposure-related differences were found if either the child or mother had the QQ wild-type. At age 11-16, exposed children tended to have a higher total fat% estimated by skinfolds than unexposed children (p = 0.06). No significant associations between prenatal exposure and body mass index or waist circumference were found. Prenatal pesticide exposure was associated with higher adolescent body fat content, including android fat deposition, independent of puberty. Girls appeared more susceptible than boys. Furthermore, the association depended on maternal and child PON1 Q192R genotype.	Andrology	NA	NA	NA	Job title			Cohort (prospective)	Job title	offspring	medical test result	Denmark	hic
597	J. Wang, Y. Zhu, X. Cai, J. Yu, X. Yang and J. Cheng	Abnormal glucose regulation in pyrethroid pesticide factory workers	2011	The purpose of this study was to investigate associations between pyrethroids occupational exposures, and risk of abnormal glucose regulation. Data from total of 3080 subjects in two pesticide factories were used. This was a population-based case-controlled study in China. In total, 18.3% of subjects with impaired glucose regulation (IGR) and 6.5% of subjects with diabetes, and the prevalence of abnormal glucose regulation was 24.8%, 86 subjects had known type 2 diabetes and 114 had newly diagnosed diabetes. The prevalence of subjects with abnormal glucose regulation increased from 21.3% in the controls to 29.3% in the exposures (chi2 = 33.182, P < 0.001). Multivariate logistic regression was used to control potential confounders and calculate odd ratios as the estimate of effect. An indication of increased risk for abnormal glucose regulation was noted for exposure to pyrethroids (OR = 1.482, 95%CI = 1.238-1.774). Abnormal glucose regulation is common in subjects exposed to pyrethroids. The present investigation indicates the adverse health effects of pyrethroids are underestimated.	Chemosphere	82	7	1080-2	EAM not reported			Case-control	NA	endocrine/nutritional/metabolical	medical test result	China	umic
598	J. X. Xu, Y. Hoshida, W. I. Yang, H. Inohara, T. Kubo, G. E. Kim, J. H. Yoon, S. Kojya, N. Bandoh, Y. Harabuchi, K. Tsutsumi, I. Koizuka, X. S. Jia, M. Kirihata, H. Tsukuma and K. Aozasa	Life-style and environmental factors in the development of nasal NK/T-cell lymphoma: a case-control study in East Asia	2007	Cases of nasal NK/T-cell lymphoma (NKTCL) occur occasionally in Asian and Latin American countries but rarely in Western countries. The etiological role of life-style and environmental factors in nasal NKTCL was investigated. Five university hospitals in Japan and one each in Korea and China participated in this study; a total of 88 cases and 305 hospital controls were accrued during 2000-2005. The odds ratio (OR) of NKTCL obtained after adjustments of age, sex and country was 4.15 (95% confidence interval (CI), 1.74-9.87) for farmers, 2.81 (CI, 1.49-5.29) for producers of crops, 4.01 (CI, 1.99-8.09) for pesticide users, 11.65 (CI, 1.17-115.82) for residents near garbage burning plants, 2.95 (CI, 1.25-6.95) for former drinkers, and 0.49 (CI, 0.23-1.04) for current smokers. The ORs for crop producers, who minimized their exposure to pesticides by using gloves and glasses, and sprinkling downwind at the time of pesticide use, were 3.30 (95% CI, 1.28-8.54), 1.18 (95% CI, 0.11-12.13) and 2.20 (95% CI, 0.88-5.53), respectively, which were lower than those for producers who did not take these precautions. Exposure to pesticides and chemical solvents could be causative of NKTCL. Taken together, life-style and environmental factors might be risk factors for NKTCL.	International Journal of Cancer	120	2	406-10	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Japan/China/Korea	SHIC
599	K. A. R. Sumon, A.; Ter Horst, M. M.; Van den Brink, P. J.; Haque, M. M.; Rashid, H.	Risk assessment of pesticides used in rice-prawn concurrent systems in Bangladesh	2016	The objectives of the current study were to determine the occupational health hazards posed by the application of pesticides in rice-prawn concurrent systems of south-west Bangladesh and to assess their potential risks for the aquatic ecosystems that support the culture of freshwater prawns (Macrobrachium rosenbergii). Information on pesticide use in rice-prawn farming was collected through structured interviews with 38 farm owners held between January and May of 2012. The risks of the pesticide use to human health were assessed through structured interviews. The TOXSWA model was used to calculate pesticide exposure (peak and time-weighted average concentrations) in surface waters of rice-prawn systems for different spray drift scenarios and a simple first tier risk assessment based on threshold concentrations derived from single species toxicity tests were used to assess the ecological risk in the form of risk quotients. The PERPEST model was used to refine the ecological risks when the first tier assessment indicated a possible risk. Eleven synthetic insecticides and one fungicide (sulphur) were recorded as part of this investigation. The most commonly reported pesticide was sulphur (used by 29% of the interviewed farmers), followed by thiamethoxam, chlorantraniliprole, and phenthoate (21%). A large portion of the interviewed farmers described negative health symptoms after pesticide applications, including vomiting (51%), headache (18%) and eye irritation (12%). The results of the first tier risk assessment indicated that chlorpyrifos, cypermethrin, alpha-cypermethrin, and malathion may pose a high to moderate acute and chronic risks for invertebrates and fish in all evaluated spray drift scenarios. The higher tier assessment using the PERPEST model confirmed the high risk of cypermethrin, alpha-cypermethrin, and chlorpyrifos for insects and macro- and micro-crustaceans thus indicating that these pesticides may have severe adverse consequences for the prawn production yields.	Science of the Total Environment	568	NA	498-506	Self-reported exposure			Cross-sectional	Type of pesticide	pesticide-related symptoms	self-reported	Bangladesh	lmic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
600	K. Applebaum, J. Waggoner, J. Hoppin, L. Beane-Freeman and D. Sandler	Pesticides, solvents, and chronic kidney disease mortality in the agricultural health study	2012	Background: Environmental risk factors for chronic kidney disease (CKD) have not been widely studied. Pesticides and solvents have been associated with nephrotoxicity in animals, but epidemiologic studies are limited. Objective: Investigate the relationship of CKD mortality with pesticide and solvent use, in the Agricultural Health Study (AHS). Methods: At enrollment (1993-1997), pesticide applicators in North Carolina and Iowa completed selfadministered questionnaires on lifetime solvent use, pesticide use, and medical factors. Cause of death was determined from state mortality registries through 2008. Cox proportional hazards regression was used to estimate mortality rate ratios (MRRs) and 95% confidence intervals (CIs). We restricted analysis to 51,401 male pesticide applicators and 299 CKD cases with complete information on age, state, education, smoking, and diabetes, collected at enrollment. Sub-analyses evaluated diabetes and hypertension as confounders in approximately 40% who responded in subsequent questionnaires. Results: There was no relationship between CKD mortality and duration or frequency (days/year) of pesticide application or ever use by types of pesticides (e.g., herbicides, insecticides, fumigants, fungicides). Mortality was elevated among subjects who reported seeing a doctor 3+ times as a result of using pesticides (MRR=3.31, 95% CI (1.22, 8.96)). Ever use of solvents was associated with a 74% increased mortality rate (95% CI 1.02, 2.96). Conclusions: While solvent use was associated with CKD mortality, there was no relationship with overall pesticide use, except perhaps for acute exposures that led applicators to seek medical care. Future studies should assess CKD incidence to better assess potential renal risks associated with agricultural exposures.	Epidemiology	23	5	S798	Self-reported exposure			Cross-sectional	Type of pesticide	mortality (all cause)	doctor-diagnosed	USA	hic
601	K. Atreya	Probabilistic assessment of acute health symptoms related to pesticide use under intensified Nepalese agriculture	2008	Agriculture intensification has pushed farmers to use pesticides for maintaining agricultural productivity and to increase income. However, pesticide use has a significant negative impact on farmers' health. In Nepal, uses of pesticides have been already documented in agriculturally intensified areas, however, little is known on health impacts. Weekly interviews were conducted during 2005 to assess the emerging pesticide problems, estimate the magnitude of pesticide-related acute illness, and identify associated risk factors. The study showed that very few farmers have adopted safety gear during pesticide spraying. The safety measures regression shows that warm temperature and drinking habits significantly reduced adoption of safety gear, whereas, integrated pest management (IPM) training and farm experience increased its adoption. The dose-response analyses showed that use of insecticides or fungicides, spray duration and mixing pesticides significantly affect farmer's health, which could be reduced either by educating farmers, increasing the use of safety gear, or reducing mixtures applications.	International Journal of Environmental Health Research	18	3	187-208	Self-reported exposure			Cross-sectional	Type of pesticide	pesticide-related symptoms	self-reported	Nepal	lic
602	K. Atreya, B. K. Sitaula, H. Overgaard, R. M. Bajracharya and S. Sharma	Knowledge, attitude and practices of pesticide use and acetylcholinesteras e depression among farm workers in Nepal	2012	Assessing erythrocyte acetylcholinesterase (AChE) activity in farm workers across agricultural seasons can be used to monitor risks of pesticide exposure. We surveyed a total of 403 households in Nepal and adopted the Test-mate ChE Cholinesterase Test System to monitor AChE activity across season on the 127 individuals of the sampled households. The study aims to (i) document knowledge and practices of pesticide use among farmers and (ii) present the relationship between farmers' reported acute health symptoms and erythrocyte acetylcholinesterase depression. We found low levels of pesticide use hygiene and high levels of individuals' knowledge on the local environmental impacts of pesticide use. Safety measures taken against potential risks of pesticides exposure were inadequate. Exposure to organophosphates significantly reduced AChE activity across season, but was not sufficient enough to claim clinical symptoms whereas exposure to the pyrethroid insecticides and fungicides were sufficient enough to claim acute symptoms of poisoning.	International Journal of Environmental Health Research	22	5	401-15	Self-reported exposure			Cross-sectional	Chemical class	pesticide-related symptoms	self-reported	Nepal	lic
603	K. B. de Jong, H. M.; Kromhout, H.; Vermeulen, R.; Postma, D. S.; Vonk, J. M.; LifeLines Cohort, study	Pesticides and other occupational exposures are associated with airway obstruction: the LifeLines cohort study	2014	OBJECTIVES: Occupational exposures are important and possibly modifiable contributors to the global burden of chronic obstructive pulmonary disease (COPD). Exposure to vapours, gases, dusts and fumes (VGDF) has been associated with a two- to threefold higher COPD risk. Less is known about effects of occupational exposure to pesticides and solvents. In the current study, we assessed if VGDF, pesticides and solvents are associated with the level of lung function and the prevalence of airway obstruction in the general population. METHODS: We included 11 851 subjects aged 18-89 years from the LifeLines cohort study. Regression models assessing associations between occupational exposures (no/low/high), level of lung function (prebronchodilator FEV(1), FEV(1)/FVC) and mild and moderate/severe airway obstruction were adjusted for sex, age, height, weight, current/ex-smoking and packyears. Additionally, we stratified by smoking status and gender and tested for interaction. A second general population cohort (n=2364) was used to verify our initial findings. RESULTS: Occupational exposure to VGDF and pesticides was associated with a lower level of FEV(1) and FEV(1)/FVC and with a higher prevalence of mild and moderate/severe airway obstruction in the two general populations investigated. There were no associations with exposure to solvents. CONCLUSIONS: Occupational exposure to both VGDF and pesticides is associated with airway obstruction in the general population.	Occupational & Environmental Medicine	71	2	88-96	Job exposure matrix			Cohort (prospective)	Type of pesticide	respiratory	medical test result	Netherlands	hic
604	K. B. Fieten, H. Kromhout, D. Heederik and B. van Wendel de Joode	Pesticide exposure and respiratory health of indigenous women in Costa Rica	2009	A cross-sectional study was conducted in 2007 to evaluate the relation between pesticide exposure and respiratory health in a population of indigenous women in Costa Rica. Exposed women (n = 69) all worked at plantain plantations. Unexposed women (n = 58) worked at organic banana plantations or other locations without pesticide exposure. Study participants were interviewed using questionnaires to estimate exposure and presence of respiratory symptoms. Spirometry tests were conducted to obtain forced vital capacity and forced expiratory volume in 1 second. Among the exposed, prevalence of wheeze was 20% and of shortness of breath was 36% versus 9% and 26%, respectively, for the unexposed. Prevalence of chronic cough, asthma, and atopic symptoms was similar for exposed and unexposed women. Among nonsmokers (n = 105), reported exposures to the organophosphate insecticides chlorpyrifos (n = 25) and terbufos (n = 38) were strongly associated with wheeze (odd ratio = 6.7, 95% confidence interval: 1.6, 28.0; odds ratio = 5.9, 95% confidence interval: 1.4, 25.6, respectively). For both insecticides, a statistically significant exposure-effect association was found. Multiple organophosphate exposure was common; 81% of exposed women were exposed to both chlorpyrifos and terbufos. Consequently, their effects could not be separated. All findings were based on questionnaire data. No relation between pesticide exposure and ventilatory lung function was found.	American Journal of Epidemiology	169	12	1500-6	Job title			Cross-sectional	Job title	NA	self-reported	Costa Rica	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
605	K. B. Flower, J. A. Hoppin, C. F. Lynch, A. Blair, C. Knott, D. L. Shore and D. P. Sandler	Cancer risk and parental pesticide application in children of Agricultural Health Study participants	2004	Parental exposure to pesticides may contribute to childhood cancer risk. Through the Agricultural Health Study, a prospective study of pesticide applicators in Iowa and North Carolina, we examined childhood cancer risk and associations with parental pesticide application. Identifying information for 17,357 children of Iowa pesticide applicators was provided by parents via questionnaires (1993-1997) and matched against the Iowa Cancer Registry. Fifty incident childhood cancers were identified (1975-1998). Risk of all childhood cancers combined was increased [standardized incidence ratio (SIR) = 1.36; 95% confidence interval (CI), 1.03-1.79]. Risk of all lymphomas combined was also increased (SIR = 2.18; 95% CI, 1.13-4.19), as was risk of Hodgkin's lymphoma (SIR = 2.56; 95% CI, 1.06-6.14). We used logistic regression to explore associations between self-reported parental pesticide application practices and childhood cancer risk. No association was detected between frequency of parental pesticide application and childhood cancer risk. An increased risk of cancer was detected among children whose fathers did not use chemically resistant gloves [odds ratio (OR) = 1.98; 95% CI, 1.05-3.76] compared with children whose fathers used gloves. Of 16 specific pesticides used by fathers prenatally, ORs were increased for aldrin (OR = 2.66), dichlorvos (OR = 2.06), and ethyl dipropylthiocarbamate (OR = 1.91). However, these results were based on small numbers and not supported by prior biologic evidence. Identification of excess lymphoma risk suggests that farm exposures including pesticides may play a role in the etiology of childhood lymphoma.	Environmental Health Perspectives	112	5	631-5	Self-reported exposure			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
606	K. C. A. Nordby, A.; Kristensen, P.	Incidence of lip cancer in the male Norwegian agricultural population	2004	OBJECTIVE: To explore lip cancer (LC) associations with work environmental exposures in a record-linkage study of Norwegian farmers. We hypothesize immunosuppressive substances (e.g. mycotoxins, pesticides) to influence LC incidence. METHODS: A cohort of 131,243 male Norwegian farmers born 1925-1971 was established by cross-linkage of national registers and followed up through 1999 for incident LC, (ICD-7 site 140) in the Cancer Registry of Norway. Farm production data from agricultural censuses 1969-1979 and meteorological data on solar radiation and fungal forecasts (events of wet and temperate conditions known to favour fungal growth and mycotoxin formation) served as exposure proxies. Adjusted rate ratios (RR) and 95% confidence intervals (CI) were estimated using Poisson regression. RESULTS: We identified 108 LC cases (rate 4.4 per 100,000 person-years). We found LC to be moderately associated with horses on the farm (RR = 1.6, CI = 1.0-2.4), construction work employment (RR = 1.7, CI = 1.1-2.6), pesticide use (RR = 0.7, CI = 0.4-1.0), grain production (RR = 1.3, CI = 0.9-2.1) and increasing levels of fungal forecasts (RR = 1.6, CI = 0.9-2.8 in the highest two quartiles). CONCLUSION: Moderate associations of LC with grain production and fungal forecasts and the negative association with pesticide could possibly be explained by exposure to immunosuppressive mycotoxins. Some of the associations observed could be explained by solar exposure.	Cancer Causes & Control	15	6	619-26	Registers			Cohort (prospective)	Job title	cancer	doctor-diagnosed	Norway	hic
607	K. C. Nordby, L. M. Irgens and P. Kristensen	Immunological exposures in Norwegian agriculture and pre-eclampsia	2006	Immune system perturbations are involved in pre-eclampsia pathophysiology. We hypothesised that immunomodulating substances, such as mycotoxins, endotoxins or pesticides, affect pre-eclampsia risk. Associations between indicators of immunomodulating exposures in agriculture and pre-eclampsia are reported. In a Norwegian family cohort based on participants in agricultural censuses conducted by Statistics Norway 1969-89, 183 313 pregnancies to farmers were identified in the Medical Birth Registry of Norway. Cases notified as pre-eclampsia as well as pregnancies indicated by hypertension in combination with proteinuria were included. Data on farm production and meteorologically based fungal forecasts 1973-90 (a marker of temperate and humid climatic conditions known to favour fungal growth and mycotoxin formation in grain) were obtained and allocated to each farm. Pre-eclampsia prevalence rates were studied in strata of exposure indicators using Poisson regression models. Adjusted rate ratios (RR) and 95% confidence intervals [CI] were computed. We identified 4912 cases, equivalent to 26.8 pre-eclampsia cases per 1000 pregnancies [95% CI 26.1, 27.6]. Pre-eclampsia showed moderate associations with animal farming, RR 1.14, [95% CI 1.07, 1.22] and moderate negative associations with grain production, RR 0.93, [95% CI 0.86, 1.01], and two or more fungal forecasts appearing in any year 1973-90, RR 0.90 [95% CI 0.84, 0.97], using no years with two or more forecasts as reference. Exposure to immunomodulating substances as indicated by grain farming, animal farming and fungal warnings could possibly have moderate effects on pre-eclampsia risk, thus supporting the study hypothesis. The use of exposure indicators as surrogates for real exposures may introduce a non-differential misclassification of the exposure that would attenuate any true exposure-outcome association. The use of exposure proxies warrants that inferences from the study should be made with caution.	Paediatric and Perinatal Epidemiology	20	6	462-70	Registers			Cohort (prospective)	Pesticides in general	circulatory	doctor-diagnosed	Norway	hic
608	K. Campbell, B. Baker, A. Tovar, E. Economos, B. Williams and L. McCauley	The Association Between Skin Rashes and Work Environment, Personal Protective Equipment, and Hygiene Practices Among Female Farmworkers	2017	The objective of this study was to assess work-related hygiene practices and the frequency and location of skin rashes due to cutaneous contact with crop-associated materials (e.g., pesticides) for female nursery and fernery workers in Central Florida. A cross-sectional, community-based participatory research study of 237 female nursery and fernery workers between the ages of 19 and 43 years with significant cutaneous contact with foliage crops was conducted using a self-report questionnaire and a skin rash chart assessment tool. Of the 237 farmworkers surveyed, 37.1% (n = 88) reported a rash on at least one area of their bodies. Women who were pregnant during the study were 4.7 times more likely to report more than 30% total body surface area (TBSA) covered by rash compared with non-pregnant fernery workers (p = .045; 95% confidence interval [CI] [1.04, 21.35]). Further research is needed to better understand the development of skin rashes among farmworkers, to generate effective prevention strategies.	Workplace Health & Safety	65	7	313-321	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	USA	hic
609	K. D. Rosenman and P. S. Guss	Prevalence of congenital deficiency in serum cholinesterase	1997	The most economical blood test for the monitoring of workers who are exposed to organophosphate pesticides is serum cholinesterase; however, serum cholinesterase can be affected by conditions other than pesticide exposure. The results of studies in Europe indicate a 4% prevalence of congenital serum cholinesterase deficiency. Prevalence rates in the United States have not been reported. In this study, 127 workers who were part of an employee health program were evaluated. Workers who had decreased serum cholinesterase levels on baseline testing before pesticide exposure were evaluated for a congenital deficit in serum cholinesterase. Five (3.9%) individuals had baseline measurements below the laboratory normal reference value: 4 (3.1 %) were heterozygote for the deficiency, and the remaining individual did not return to test for the genetic deficiency. No one was found to have the homozygote deficiency. The prevalence of congenital deficiency in serum cholinesterase in a midwestern population was 3.1-3.9%. We found it useful to incorporate the knowledge of who has a congenital deficiency into our employee health program, the purpose of which is to monitor workers who spray organophosphates.	Archives of Environmental Health	52	1	15432	Biomonitoring (blood)			Cross-sectional	Chemical class	offspring	medical test result	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
610	K. D. Tollestrup, J. R.; Allard, J.	Mortality in a cohort of orchard workers exposed to lead arsenate pesticide spray	1995	During the period from 1890 to 1940, lead arsenate was the major pesticide used in apple orchards to control the coddling moth. In the Wenatchee area of Washington State, lead arsenate spray was used for longer periods and in larger quantities than in other areas of the United States. In 1938, a cohort of 1,231 people who lived in this area was selected for a study to determine the effects of exposure to lead arsenate spray and residue. This same cohort was re-examined to determine whether there was excess mortality that could be attributed to the lead arsenate exposure. Three levels of exposure (i.e., orchardist, intermediate, consumer) were defined, based upon the use of lead arsenate pesticide spray before and during the 1938 apple growing season. Age-adjusted hazard ratios for all causes of mortality were elevated for both male orchardists and male intermediates. The only significantly increased age-adjusted hazard ratio (1.94) was heart disease in male intermediates. No significantly elevated age-adjusted hazard ratios were observed for women in any exposure group. The lack of evidence that supported an increase in mortality from respiratory cancer in this cohort may have resulted from the lower cumulative concentration of arsenic exposure, the type of arsenical compound, and the small number of study subjects.	Archives of Environmental Health	50	3	221-9	Biomonitoring (blood)	Biomonitoring (urine)		Cohort (prospective)	Pesticides in general	mortality (all cause)	doctor-diagnosed	USA	hic
611	K. D. Wiklund, J.	Cancer risks among male farmers in Sweden	1995	We have conducted a cohort study of cancer risks among 140,208 Swedish farmers in order to compare their cancer risks with those of the general male population. Since there were no individual data regarding exposure to agricultural chemicals and acquiring such data was not realistic, we obtained crude and hypothetical estimates for exposure by dividing the data into time periods, year-of-birth cohorts and geographical areas. The cohort was followed-up in the Cancer Environment Register from 1 January 1971 either until death or until 31 December 1987. The relative risk was computed as the ratio of the observed and expected number of cases (SIR = standardized incidence ratio). A total of 15,040 cases were observed vs 18,918 expected, resulting in a statistically significant decreased SIR of 0.80 (95% confidence interval: 0.78-0.81). The SIR was significantly decreased for several cancer sites, and the lowest value was found for tongue, lung, oesophagus, liver and urinary organs, which is in agreement with other studies on cancer risks among farmers. Other major cancer sites with decreased SIRs were the colon, rectum, pancreas and kidney. Lip cancer and multiple myeloma showed statistically significant increased risks. SIRs for stomach cancer, prostate cancer, skin carcinoma, malignant melanoma, tumours in connective tissue or muscle, malignant lymphomas and leukaemia were all close to unity, which is not consistent with several other studies that have shown increased risks for these sites. For malignant lymphomas the SIR increased over time, though not significantly, and was highest among younger farmers. The SIR for non-Hodgkin lymphoma was lowest in the northernmost region. This gives some support to the hypothesis that there is an association between non-Hodgkin lymphoma and exposure to pesticides and other agricultural chemicals. It is of note that the SIR for multiple myeloma was significantly increased in those parts of Sweden where the use of pesticides has been less frequent and in lower amounts.	European Journal of Cancer Prevention	4	1	81-90	Job title			Cohort (prospective)	Job title	cancer	doctor-diagnosed	Sweden	hic
612	K. Das, C. Nag and M. Ghosh	Familial, environmental, and occupational risk factors in development of amyotrophic lateral sclerosis	2012	Background: Definite etiology of amyotrophic lateral sclerosis (ALS) is still a matter of debate. Aims: The study was designed to evaluate the role of environmental, occupational, and familial risk factors in development of ALS. Materials and Methods: This was a case control study of 110 cases of definite ALS with 240 age and sex matched controls. Investigations were done on the following aspects- family history, occupation, living place, source of drinking water, exposure to industrial, chemical, agricultural toxins and heavy metals, physical and electrical injury, working under magnetic field for more than 10 years in both the groups. Clinical examinations, electrophysiological, and neuroimaging studies were done in every patient. Chi square test, logistic regression analysis, and calculation of odds ratio were used to analyze the data. Results: Rural livings (odds ratio = 1.99), smoking (odds ratio = 1.88), insecticides, and pesticides exposures (odds ratio = 1.61), electrical injury (odds ratio = 6.2) were detected as the associated factors in development amyotrophic lateral sclerosis. Conclusions: The study expressed the need of extensive research globally in molecular and genetic levels to detect the associated factors in etiopathogenesis of ALS for better understanding the etiology and for remedial aspects.	North American Journal of Medical Sciences	4	8	350-355	Self-reported exposure			Case-control	Pesticides in general	neurological	doctor-diagnosed	India	lmic
613	K. Das, M. Ghosh, C. Nag, S. P. Nandy, M. Banerjee, M. Datta, G. Devi and G. Chaterjee	Role of familial, environmental and occupational factors in the development of Parkinson's disease	2011	BACKGROUND: Despite intensive research during the past several decades, the cause of Parkinson's disease remains unknown. Infections, toxins, lifestyle and hereditary factors have all been supposed to play a role in the genesis of Parkinson's disease. The final mechanisms of neuronal injury and death are probably similar, where both genetic and environmental factors are important, and these two factors interact along the etiopathogenic pathway. OBJECTIVE: The purpose of the present study is to evaluate the role of familial, environmental and occupational factors in the development of Parkinson's disease. METHODS: We evaluated 345 cases of idiopathic Parkinson's disease (215 males, 130 females; mean age 62 +/- 2 years) and 370 controls (220 males, 150 females; mean age 62 +/- 3 years) between January 2003 and January 2008 with regard to the following aspects in detail: place of living, family history of Parkinson's disease and tremor, source of drinking water, exposure to insecticides, pesticides, herbicides and industrial toxins, acute poisoning, CNS infections and head injury. The duration of exposure to the risk factors and the history of Parkinson's disease among the cases were investigated after obtaining written informed consent from cases and controls. RESULTS AND CONCLUSIONS: Family history of Parkinson's disease and familial tremor (p = 0.035), exposure to insecticides and pesticides (p = 0.049), well water use for drinking purposes (p = 0.03), Japanese B encephalitis (p = 0.04) and acute organophosphate poisoning (p = 0.046) were associated with the development of Parkinson's disease in this region of India. Further research is needed at the epidemiological, genetic and molecular levels for a better understanding of the etiopathogenesis of Parkinson's disease as well as remedial aspects.	Neurodegenerative Diseases	8	5	345-51	Self-reported exposure			Case-control	Type of pesticide	neurological	doctor-diagnosed	India	lmic

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614	K. De Jong, H. M. Boezen, H. Kromhout, R. Vermeulen, D. S. Postma and J. M. Vonk	Association of occupational pesticide exposure with accelerated longitudinal decline in lung function	2014	Cross-sectional studies have shown that occupational exposure to vapors, gases, dusts, and fumes (VGDF) and pesticides is associated with a lower level of lung function. These associations seem to be stronger in ever smokers. In the current study, we aimed to assess whether occupational exposure to VGDF and pesticides is associated with longitudinal decline in lung function. We used 12,772 observations from 2,527 participants in the Vlagtwedde-Vlaardingen Study, a general-population-based cohort study that followed subjects for 25 years, from 1965 to the last survey in 1989/1990. Job-specific exposure was estimated with the ALOHA+ job exposure matrix. Associations between exposures and annual changes in forced expiratory volume in 1 second (FEV1) and FEV 1 as a percentage of inspiratory vital capacity (FEV1%VC) were assessed with linear mixed-effect models including sex, age, and level of lung function at the first measurement and pack-years of smoking at the last measurement. We tested for interaction between smoking and occupational exposure and assessed associations separately for never smokers and ever smokers. Exposure to VGDF was not associated with accelerated lung function decline after adjustment for co-exposure to pesticides. Exposure to pesticides, both in the last-held job and as a cumulative measure, was associated with accelerated decline in FEV1 and FEV1%VC, especially among ever smokers, where we found an excess change in FEV1 of-6.9 mL/year (95% confidence interval:-10.2,-3.7) associated with high pesticide exposure. <U+00AC><U+00A9> 2014 The Author 2014. Published by Oxford University Press on behalf of the Johns Hopkins Bloomberg School of Public Health. All rights reserved.	American Journal of Epidemiology	179	11	1323-1330	Job exposure matrix			Cohort (prospective)	Type of pesticide	respiratory	medical test result	Netherlands	hic
615	K. Ernest, M. Thomas, M. Paulose, V. Rupa and C. Gnanamuthu	Delayed effects of exposure to organophosphorus compounds	1995	In a group of 34 industrial workers, chronically exposed to organophosphorus (OP) compounds, serum pseudocholinesterase activity was depressed significantly in the exposed group as compared to the control group. There was a significantly higher incidence of peripheral neuropathy among the workers exposed to OP compounds, as compared to the control group. Mild to profound sensorineural hearing deficits were detected in both the exposed and control groups. As the pre-exposure hearing status of the workers was not known and since many other factors can also cause pathological changes in the cochlear nerve, a definite conclusion about the ototoxic nature of the OP compounds could not be drawn.	Indian Journal of Medical Research	101	NA	29677	Biomonitoring (blood)			Cohort (prospective)	Chemical class	pesticide-related symptoms	medical test result	India	lmic
616	K. G. Harley, A. R. Marks, A. Bradman, D. B. Barr and B. Eskenazi	DDT exposure, work in agriculture, and time to pregnancy among farmworkers in California	2008	OBJECTIVE: This study examined whether exposure to pesticides, including dichlorodiphenyltrichloroethane (DDT), was associated with longer time to pregnancy (TTP). METHODS: Pregnant women (N = 402) living in a migrant farmworker community were asked how many months they took to conceive. Women reported their and their partners' occupational and home pesticide exposure preceding conception. In a subset (N = 289), levels of DDT and dichlorodiphenyldichloroethylene (DDE), were measured in maternal serum. RESULTS: No associations were seen with p, p'-DDT, o, p'-DDT, or p, p'-DDE. Maternal occupational pesticide exposure (fecundability odds ratios [fOR] = 0.8, 95% CI: 0.6 to 1.0), home pesticide use (fOR = 0.6, 95% CI: 0.4 to 0.9), and residence within 200 ft of an agricultural field (fOR = 0.7, 95% CI: 0.5 to 1.0) were associated with reduced fecundability (ie, longer TTP). CONCLUSIONS: Longer TTP was seen among women, but not men, reporting exposure to agricultural and home pesticides.	Journal of Occupational & Environmental Medicine	50	12	1335-42	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	reproductive	self-reported	USA	hic
617	K. H. Barry, S. Koutros, S. I. Berndt, G. Andreotti, J. A. Hoppin, D. P. Sandler, L. A. Burdette, M. Yeager, L. E. Beane Freeman, J. H. Lubin, X. Ma, T. Zheng and M. C. R. Alavanja	Genetic variation in base excision repair pathway genes, pesticide exposure, and prostate cancer risk	2011	Previous research indicates increased prostate cancer risk for pesticide applicators. Given evidence suggesting a role of oxidative DNA damage and the importance of the base excision repair (BER) pathway in repairing this damage, we evaluated interactions between 39 pesticides and 394 tag single nucleotide polymorphisms (SNPs) for 31 BER genes among 776 prostate cancer cases and 1,444 controls in a nested case-control study of white male Agricultural Health Study (AHS) pesticide applicators.We used likelihood ratio tests from logistic regression models to estimate interaction P-values, using three-level pesticide variables (none/low/high) based on lifetime days of use weighted to an intensity score, and the False Discovery Rate (FDR) multiple comparison adjustment approach. Men with CT or TT genotypes for NEIL3 rs1983132 exhibited a monotonic increase in prostate cancer risk with increasing fonofos exposure (Odds Ratio for high versus no use = 3.25; 95% Confidence Interval: 1.78-5.92), whereas men with the CC genotype exhibited no change (Pinteraction = 9.3x10-6; FDR P-value = 0.01). Carbofuran and EPTC interacted similarly with rs1983132, as did fonofos, terbufos and atrazine with other NEIL3, XRCC1, TDG, LIG1 and POLE SNPs, although results did not meet FDR < 0.2. Our significant fonofos finding is consistent with previous AHS findings of increased prostate cancer risk with fonofos exposure among those with a family history of prostate cancer. While requiring replication, our results suggest a role of BER genetic variation in pesticide-associated prostate cancer risk.	American Journal of Epidemiology	173	NA	S162	Self-reported exposure	Algorithm/model		Case-control	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
618	K. H. K. Barry, S.; Lubin, J. H.; Coble, J. B.; Barone-Adesi, F.; Beane Freeman, L. E.; Sandler, D. P.; Hoppin, J. A.; Ma, X.; Zheng, T.; Alavanja, M. C.	Methyl bromide exposure and cancer risk in the Agricultural Health Study	2012	PURPOSE: Methyl bromide is a genotoxic soil fumigant with high acute toxicity, but unknown human carcinogenicity. Although many countries have reduced methyl bromide use because of its ozone depleting properties, some uses remain in the United States and other countries, warranting further investigation of human health effects. METHODS: We used Poisson regression to calculate rate ratios (RR) and 95 % confidence intervals (CI) for associations between methyl bromide use and all cancers combined, as well as 12 specific sites, among 53,588 Agricultural Health Study pesticide applicators with follow-up from 1993 to 2007. We also evaluated interactions with a family history for four common cancers (prostate, lung, colon, and lymphohematopoietic). We categorized methyl bromide exposure based on lifetime days applied weighted by an intensity score. RESULTS: A total of 7,814 applicators (14.6 %) used methyl bromide, predominantly before enrollment. Based on 15 exposed cases, stomach cancer risk increased monotonically with increasing methyl bromide use (RR = 1.42; 95 % CI, 0.51-3.95 and RR = 3.13; 95 % CI, 1.25-7.80 for low and high use compared with no use; p (trend) = 0.02). No other sites displayed a significant monotonic pattern. Although we previously observed an association with prostate cancer (follow-up through 1999), the association did not persist with longer follow-up. We observed a nonsignificant elevated risk of prostate cancer with methyl bromide use among those with a family history of prostate cancer, but the interaction with a family history did not achieve statistical significance. CONCLUSIONS: Our results provide little evidence of methyl bromide associations with cancer risk for most sites examined; however, we observed a significant exposure-dependent increase in stomach cancer risk. Small numbers of exposed cases and declining methyl bromide use might have influenced our findings. Further study is needed in more recently exposed populations to expand on these results.	Cancer Causes & Control	23	6	807-18	Self-reported exposure	Algorithm/model		NA	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

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619	K. H. Kilburn	Effects of onboard insecticide use on airline flight attendants	2004	Flight attendants (FAs) exposed to insecticide spray in an aircraft were compared with unexposed subjects for neurobehavioral function, pulmonary function, mood states, and symptoms. The 33 symptomatic FAs were self-selected, and 5 had retired for disability. Testing procedures included balance, reaction time, color discrimination, visual fields, grip strength, verbal recall, problem solving, attention and discrimination functions, and long-term memory functions. Measurements were expressed as a percentage of their predicted values (derived from unexposed controls), and the author compared the means of the percentage predicted values by analysis of variance. Symptom frequencies and Profile of Mood States (POMS) scores were assessed. FAs were significantly more impaired than controls with respect to balance with eyes closed, grip strength, and color discrimination. Nearly half had 3 or more abnormal neurobehavioral functions, after adjustment was made for age, sex, and education level. Neither elevated POMS scores nor frequencies of average symptoms correlated with their numbers of abnormal measurements. Occupational exposure to synthetic pyrethrin insecticides on airliners was associated with neurobehavioral impairment and disability retirement.	Archives of Environmental Health	59	6	284-91	Job title			Cross-sectional	Type of pesticide	pesticide-related symptoms	medical test result	USA	hic
620	K. Hohenadel, S. A. Harris, J. M. McLaughlin, J. J. Spinelli, P. Pahwa, J. A. Dosman, P. A. Demers and A. E. Blair	Exposure to multiple pesticides and risk of nonhodgkin lymphoma in men from six Canadian provinces	2011	A number of individual pesticides have been linked to non-Hodgkin lymphoma (NHL) with variable consistency. However, the impact of exposure to multiple pesticides has not been well studied. Data from a six-province Canadian case-control study conducted between 1991 and 1994 were analyzed to investigate the relationship between NHL and exposure to: (a) the total number of insecticides, herbicides, and fungicides used; (b) the number of potentially carcinogenic pesticides used; and (c) commonly used pesticide combinations. Cases (n = 513) were identified through provincial cancer registries and controls (n = 1506), frequency matched by age and region, were obtained through provincial health records, telephone listings or voter lists. In multiple logistic regression analyses, risk of NHL tended to increase with the number of pesticides used. Participants reporting exposure to a single pesticide were not at increased risk of NHL (odds ratio [OR] = 0.80, 95% confidence interval [CI] = 0.44-1.47), while those exposed to two to four (OR = 1.39, CI = 1.02-1.91) or five or more pesticides (OR = 1.63, CI = 1.20-2.21) were at greater risk. Similar results were obtained in analyses restricted to herbicides and insecticides. Odds ratios increased further when only pesticides designated as potentially carcinogenic by the International Agency for Research on Cancer were considered (OR[1 pesticide] = 1.30, CI = 0.90-1.88; OR[2 to 4] = 1.54, CI = 1.11- 2.12; OR[5 or more] = 1.94, CI = 1.17-3.23). Since exposure to multiple pesticides is common among commercial applicators and agricultural workers these results underscore the importance of not restricting our assessment of cancer risk to single exposures.	American Journal of Epidemiology	173	NA	S251	Job title			Case-control	Job title	cancer	doctor-diagnosed	Canada	hic
621	K. I. Khan, A. A.; Abdel Rasoul, G.; Bonner, M. R.; Lasarev, M. R.; Hendy, O.; Al-Batanony, M.; Crane, A. L.; Singleton, S. T.; Olson, J. R.; Rohlman, D. S.	Longitudinal assessment of chlorpyrifos exposure and self-reported neurological symptoms in adolescent pesticide applicators	2014	OBJECTIVES: Occupational exposure of organophosphorus pesticides, such as chlorpyrifos (CPF), in adolescents is of particular concern because of the potential vulnerability of the developing neurological system. The objectives of this study were to examine how neurological symptoms reported over the application season vary across time, whether these effects are reversible postapplication and if there are associations between CPF biomarkers and neurological symptoms in an adolescent study population. SETTING: The longitudinal study was conducted in two agricultural districts of Menoufia Governorate, Egypt between April 2010 and January 2011. PARTICIPANTS: Male adolescent participants, including CPF applicators (n=57) and non-applicators (n=38), were recruited. PRIMARY AND SECONDARY OUTCOME MEASURES: Self-reported data for 25 neurological symptoms were collected at 32 time points over the 8-month period before, during and after the application season. Additionally, urine and blood samples were collected to measure urine trichloro-2-pyridinol (TCPy), a CPF-specific biomarker and blood cholinesterase activity. RESULTS: Applicators and non-applicators report the highest numbers of symptoms during the application season, followed by a reduction in symptoms after the application ended. Applicators reported a greater percentage of neurological symptoms, relative to baseline, than non-applicators after accounting for potential covariates. Among the applicators, cumulative TCPy was positively and significantly associated with the average percentage of symptoms (B=4.56, 95% CI 3.29 to 5.84; p<0.001). Significant associations (p=0.03-0.07) between the change in butyrylcholinesterase activity from the preapplication to the postapplication season and several domains of neurological symptoms were also found, even after adjusting for potential covariates. CONCLUSIONS: These observations demonstrate changes in the reporting of symptoms across the application season, showing an increase in symptom reporting during application and recovery following the end of pesticide application. These findings reinforce the growing concern regarding the neurotoxic health effects of CPF in adolescent applicators in developing countries and the need for developing and implementing intervention programmes.	BMJ Open	4	3	e004177	Biomonitoring (blood)	Biomonitoring (urine)		Cohort (prospective)	Specific active ingredient	neurological	self-reported	Egypt	lmic
622	K. Kimura, K. Yokoyama, H. Sato, R. B. Nordin, L. Naing, S. Kimura, S. Okabe, T. Maeno, Y. Kobayashi, F. Kitamura and S. Araki	Effects of pesticides on the peripheral and central nervous system in tobacco farmers in Malaysia: studies on peripheral nerve conduction, brain-evoked potentials and computerized posturography	2005	We examined the effects of pesticides on the central and peripheral nervous system in the setting of a tobacco farm at a developing country. Maximal motor and sensory nerve conduction velocities (MCV and SCV, respectively) in the median, sural and tibial nerves, postural sway, and brain-evoked potentials (auditory event-related and visual-evoked potentials) were measured in 80 male tobacco farmers and age- and sex-matched 40 controls in Kelantan, Malaysia. Median SCV (finger-wrist) in farmers using Delsen (mancozeb, dithiocarbamate fungicide), who showed significant decrease of serum cholinesterase activities, were significantly lower compared with the controls. Sural SCV in farmers using Fastac (alpha-cypermethrin, pyrethroid insecticide) and median MCV (elbow-wrist) in farmers using Tamex (butralin, dinitroaniline herbicide) were significantly slowed compared with their respective controls. In Delsen (mancozeb, dithiocarbamate) users, the power of postural sway of 0-1 Hz was significantly larger than that in the controls both in the anterior-posterior direction with eyes open and in the right-left direction with eyes closed. The former type of sway was also significantly increased in Tamaron (methamidophos, organophosphorus insecticide) users. In conclusion, nerve conduction velocities and postural sway seem to be sensitive indicators of the effects of pesticides on the central and peripheral nervous system.	Industrial Health	43	2	285-94	Biomonitoring (blood)			Cross-sectional	Chemical class	neurological	medical test result	Malaysia	umic

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623	K. L. Harrison	Semen parameter defects and toxin contact related to occupation in infertility patients	1998	Objective: To identify, in the male partners of a group of infertility patients, those occupations associated with an increased incidence of semen parameter defects and potential spermatogenic toxins which may be responsible. Design: Retrospective survey of all patients for whom a fixed occupation was recorded. Setting: A private assisted reproduction clinic, located in Brisbane and conducting satellite clinics in two locations in North Queensland. Participants: The male partners of 1402 infertile couples. Results: The building, motor/mechanical and welding trades, machinery operators, workers in chemical and petroleum industries, primary producers and miners show increased incidences of semen parameter defects. Within the building trades, contact petroleum products, paints, glues, chemicals and solvents were significantly associated with semen parameter defects. Conclusion: The results have significant workplace health and safety implications requiring strategies to be developed for protection of workers from substances toxic to spermatogenesis.	Middle East Fertility Society Journal	3	NA	43169	Job title			Cohort (prospective)	Job title	reproductive	medical test result	USA	hic
624	K. M. Atherton, F. M. Williams, F. J. Egea Gonzalez, R. Glass, S. Rushton, P. G. Blain and E. Mutch	DNA damage in horticultural farmers: a pilot study showing an association with organophosphate pesticide exposure	2009	A study of horticultural farmers exposed to organophosphate pesticides (OPs) and controls investigated the relationships between OP exposure, DNA damage and oxidative stress. Blood acetylcholinesterase (AChE) and urinary dialkylphosphate (DAP) levels determined exposure and 8-hydroxy-29- deoxyguanosine (8OHdG) indicated oxidative stress status. The farmers had approximately 30% lower AChE activity and increased DAP levels compared with the controls, reflecting moderate OP exposure. They had higher DNA damage than the controls and there was a significant positive relationship between DAP and DNA damage with greater than 95% power. The farmers also had a significant positive relationship between urinary DAP and 8OHdG levels.	Biomarkers	14	7	443-51	Biomonitoring (blood)	Biomonitoring (urine)		NA	Chemical class	genetic (biomarkers)	medical test result	UK	hic
625	K. M. Hayden, M. C. Norton, D. Darcey, T. Ostbye, P. P. Zandi, J. C. Breitner, K. A. Welsh-Bohmer and I. Cache County Study	Occupational exposure to pesticides increases the risk of incident AD: the Cache County study	2010	BACKGROUND: Commonly used organophosphate and organochlorine pesticides inhibit acetylcholinesterase at synapses in the somatic, autonomic, and central nervous systems and may therefore have lasting effects on the nervous system. Few studies have examined the relationship of pesticide exposure and risk of dementia or Alzheimer disease (AD). We sought to examine the association of occupational pesticide exposure and the risk of incident dementia and AD in later life. METHODS: Residents of the agricultural community of Cache County, UT, who were aged 65 years and older as of January 1995, were invited to participate in the study. At baseline, participants completed detailed occupational history questionnaires that included information about exposures to various types of pesticides. Cognitive status was assessed at baseline and after 3, 7, and 10 years. Standardized methods were used for detection and diagnosis of dementia and AD. Cox proportional hazards survival analyses were used to evaluate the risk of incident dementia and AD associated with pesticide exposure. RESULTS: Among 3,084 enrollees without dementia, more men than women reported pesticide exposure ($p < 0.0001$). Exposed individuals ($n = 572$) had more years of education ($p < 0.01$) but did not differ from others in age. Some 500 individuals developed incident dementia, 344 with AD. After adjustment for baseline age, sex, education, APOE epsilon4 status, and baseline Modified Mini-Mental State Examination scores, Cox proportional hazards models showed increased risks among pesticide-exposed individuals for all-cause dementia, with hazard ratio (HR) 1.38 and 95% confidence interval (CI) 1.09-1.76, and for AD (HR 1.42, 95% CI 1.06-1.91). The risk of AD associated with organophosphate exposure (HR 1.53, 95% CI 1.05-2.23) was slightly higher than the risk associated with organochlorines (HR 1.49, 95% CI 0.99-2.24), which was nearly significant. CONCLUSIONS: Pesticide exposure may increase the risk of dementia and Alzheimer disease in late life.	Neurology	74	19	1524-30	Self-reported job history			Cohort (prospective)	Pesticides in general	neurological	doctor-diagnosed	USA	hic
626	K. M. Kasiotis, K. Kyriakopoulou, C. Emmanouil, N. Tsantila, J. Liesivuori, H. Souki, S. Manakis and K. Machera	Monitoring of systemic exposure to plant protection products and DNA damage in orchard workers	2012	The systemic exposure of plum tree growers and operators to plant protection products (PPPs) and effects on DNA were assessed. Specifically, a GC-MS/MS method was developed and validated for the analysis of serum samples for the presence of seven active substances of PPPs. The analytical results verified the presence of myclobutanil, propargite, cypermethrin and deltamethrin in 7 out of 19 serum samples. The incidence of DNA damage was monitored using the single cell electrophoresis assay (comet assay). A paired Student's t-test revealed a statistically significant increase of SSBs in the blood samples collected at the end of the cropping period as compared to the samples collected from the same subjects before the start of PPPs application period. Moreover, the group of seven subjects with detectable serum pesticides levels revealed statistically significant increase of SSBs as compared to the group of subjects with no detectable PPP levels. The results of the present study demonstrate that the agriculture workers may exhibit detectable level of systemic exposure to the applied PPPs which are correlated to increased DNA damage during the cultivation period.	Toxicology Letters	210	2	182-8	Biomonitoring (blood)	Self-reported exposure		Cohort (prospective)	Specific active ingredient	genetic (biomarkers)	medical test result	NA	NA
627	K. M. Lakew, Y.	The health status of northern Omo State Farm workers exposed to chlorpyrifos and profenofos	1998	The health effects of organophosphorus (OP) pesticides on cholinesterase (ChE) activities were assessed among 81 pest control workers from Northern Omo State Farm (Ethiopia), following the occupational use of Chlorpyrifos 25 and 48% ULV and Profenifos 250 EC/ULV. Plasma ChE (PChE) and erythrocyte ChE (AChE) activities were determined electrometrically before and after pesticide exposure. Plasma alkaline phosphatase (AP) and glutamic pyruvic transaminase (GPT) values were estimated colorimetrically. Risk factors of pesticide poisoning and related occupational factors were assessed following the WHO recommendations. The mean PChE and AChE activities determined after pesticide exposures were significantly lower than the pre-exposure values ($P < 0.05$); 16% and 40% of the pest control workers had PChE and AChE levels below 50% of the pre-exposure values, respectively. The mean plasma AP and GPT values were found to be within the recommended normal limits. No significant difference in either of the ChE activities was observed between the spray men and the pest assessors, although the former were believed to have frequent contact with the concentrated OP formulations. Risk factors of pesticide poisoning such as workers ignorance about the toxicity of pesticides, poor personal hygiene and total absence or improper use of personal protective devices were prevalent. Measures that should be considered to minimize the problem in the farm population are recommended.	Ethiopian Medical Journal	36	3	175-84	Biomonitoring (urine)			Cohort (prospective)	Chemical class	genetic (biomarkers)	medical test result	Ethiopia	lic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
628	K. M. Lee, S. Y. Park, K. Lee, S. S. Oh and S. B. Ko	Pesticide metabolite and oxidative stress in male farmers exposed to pesticide	2017	Background: The objective of this study was to measure malondialdehyde (MDA) and isoprostane which has been used as an index of lipid injury, 8-hydroxy-2'-deoxyguanosine (8-OHdG), which has been used as an index of DNA damage, and dialkyl-phosphate (DAP), which has been used to quantify pesticide exposure, and to investigate the relationship between pesticide exposure and oxidative stress. Methods: This study was a cross-sectional study that evaluated 84 male farmers exposure to pesticide. In this study, 8-OHdG, isoprostane, and MDA were measured as oxidative stress indices, and dialkyl-phosphate (dimethylphosphate(DMP), diethylphosphate(DEP), dimethylthiophosphate(DMTP), and diethylthiophosphate (DETP)) excreted in the urine was also measured to evaluate pesticide exposure. A linear regression analysis was performed to investigate the relationship between pesticide metabolites, and oxidative stress biomarkers. Results: A Correlation analysis was performed for pesticide exposure month (PEI), cumulative exposure index (CEI), and DAP as well as the concentration of the oxidative stress biomarkers. The PEM significantly and positively correlated to the levels of 8-OHdG, isoprostane, CEI, and DMP. CEI showed a correlation to 8-OHdG and PEM. DMP, DEP, and DETP showed a positive correlation to 8-OHdG, isoprostane, and MDA. A correlation analysis was adjusted some demographic characteristics, such as age, smoking, drinking, and exercise to determine the relationship between pesticide exposure and oxidative stress. The 8-OHdG, isoprostane, and MDA levels were significantly related to the DMP (<U+221A><U+00FC> = 0.320), DEP (<U+221A><U+00FC> = 0.390), and DETP (<U+221A><U+00FC> = 0.082); DMP (<U+221A><U+00FC> = 0.396), DEP (<U+221A><U+00FC> = 0.508), and DETP (<U+221A><U+00FC> = 0.504); and DMP (<U+221A><U+00FC> = 0.432), DEP (<U+221A><U+00FC> = 0.508), and DETP (<U+221A><U+00FC> = 0.329) levels, respectively. Conclusions: The concentration between oxidative stress biomarkers and the pesticide metabolite were a positive correlation. Indicators of oxidative stress was associated with a pesticide metabolite DMP, DEP, and DETP. Therefore, Pesticide exposure and oxidative stress were relevant.	Annals of Occupational and Environmental Medicine	29	1	NA	Biomonitoring (urine)			Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	Korea	hic
629	K. M. P. Hayden, B. L.; Potter, G. G.; Norton, M. C.; Tschanz, J. T.; Darcey, D. J.; Zandi, P. P.; Breitner, J. C. S.; Welsh-Bohmer, K. A.	The association between lifetime occupational exposure to pesticides and cognitive decline in the elderly	2014	Background: Pesticide exposure has been associated with AD in some studies; however few, if any, studies have evaluated the effect of pesticides on cognitive decline.We previously reported an increased risk of AD among pesticide users in the Cache County Memory Study (CCMS). Using additional years of follow-up from this longitudinal study of memory and aging, we sought to determine whether pesticide exposure influences cognitive function over time and whether any such effects differ by APOE <U+0152><U+00B5>4 status. Methods: A total of 3,082 nondemented participants aged 65+ completed baseline evaluations, which included a modified version of the Mini Mental State Exam (3MS) and an occupational history questionnaire. The questionnaire included questions about exposures to various classes of pesticides and the regularity and duration of use. Participants were re-examined approximately every three years for up to 12 years of follow-up (mean 7.2 years, standard deviation 3.5). Mixed effects models were used to estimate trajectories of cognitive function over time according to categories of pesticide exposure and APOE <U+0152><U+00B5>4 status. Results: There was a significant difference in baseline scores (p =0.0001) but not change over time between APOE <U+0152><U+00B5>4 negative participants who were exposed to pesticides versus those not exposed to pesticides (Table). Participants with one or more APOE <U+0152><U+00B5>4 allele(s) and no pesticide exposure scored lower (p =0.002) on their baseline 3MS and declined significantly faster over time (p =0.005) compared to unexposed participants who were APOE <U+0152><U+00B5>4 negative. Participants who were exposed to pesticides and had one or more APOE <U+0152><U+00B5>4 alleles had a statistically significant difference in baseline score (p =0.0001) and also declined significantly faster over time (p =0.001) compared to those with no exposure and no APOE <U+0152><U+00B5>4 alleles. Conclusions: Individuals with one or more APOE <U+0152><U+00B5>4 alleles who were exposed to pesticides declined significantly faster than those with no APOE <U+0152><U+00B5>4 alleles and no pesticide exposure. Although the difference in change over time is relatively small, effects over several years could be clinically significant. As pesticides have become so ubiquitous, further study is needed to determine the effect on cognition of non-occupational exposures.	Alzheimer's and Dementia	10	NA	P266-P267	Self-reported exposure			Cohort (prospective)	Pesticides in general	mental disorders	doctor-diagnosed	USA	hic
630	K. M. S. Curtis, D. A.; Weinberg, C. R.; Arbuckle, T. E.	The effect of pesticide exposure on time to pregnancy.[Erratum appears in Epidemiology 1999 Jul;10(4):470]	1999	The Ontario Farm Family Health Study provided data for examination of the effects of pesticide exposure on time to pregnancy. In this retrospective cohort study of farm couples in Ontario, Canada, the farm operator, husband, and wife completed questionnaires during 1991-1992. We asked about pesticides used on the farm and pesticide activities of the husband and wife for each month of trying to conceive. After exclusions, 2,012 planned pregnancies remained for analysis. We used an analog of the Cox proportional hazards model to calculate conditional fecundability ratios (conditional on pregnancy). There was no strong or consistent pattern of associations of pesticide exposure with time to pregnancy. During exposure intervals in which women participated in pesticide activities (during most of which the men also participated), however, 6 of 13 pesticide exposure categories were associated with a decrease in fecundability (conditional fecundability ratio range = 0.51-0.80). For exposure intervals in which only the men participated in pesticide activities or in which neither men nor women participated in pesticide activities but pesticides had been used on the farm, conditional fecundability ratios ranged from 0.75 to 1.50, with no apparent consistency among pesticide classes, chemical families, or active ingredients.	Epidemiology	10	2	112-7	Self-reported exposure			Cohort (retrospective)	Specific active ingredient	reproductive	self-reported	Canada	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
631	K. M. Semchuk, E. J. Love and R. G. Lee	Parkinson's disease: a test of the multifactorial etiologic hypothesis	1993	We studied the relative etiologic importance upon the development of Parkinson's disease (PD) of occupational exposure to herbicides and other compounds, ionizing radiation exposure, family history of PD and essential tremor, smoking, and history of various viral and other medical conditions. We identified patients (n = 130) with neurologist-confirmed idiopathic PD through contacts with Calgary general hospitals, long-term care facilities, neurologists, the Movement Disorder Clinic, and the Parkinson's Society of Southern Alberta, and selected two matched (by sex and age +/- 2.5 years) community controls for each case by random digit dialing. We obtained lifetime work, chemical, radiation, medical, and smoking exposure histories and family histories of PD and essential tremor by personal interviews, and analyzed the data using conditional logistic regression for matched sets. After controlling for potential confounding and interaction between the exposure variables, using multivariate statistical methods, having a family history of PD was the strongest predictor of PD risk, followed by head trauma and then occupational herbicide use. Cases and controls did not differ in their previous exposures to smoking or ionizing radiation; family history of essential tremor; work-related contact with aluminum, carbon monoxide, cyanide, manganese, mercury, or mineral oils; or history of arteriosclerosis, chicken pox, encephalitis, hypertension, hypotension, measles, mumps, rubella, or Spanish flu. These results support the hypothesis of a multifactorial etiology for PD, probably involving genetic, environmental, trauma, and possibly other factors.	Neurology	43	6	1173-80	Self-reported exposure			Case-control	Type of pesticide	neurological	doctor-diagnosed	Canada	hic
632	K. Morvan, L. Multigner, P. Blanchet and D. Luce	Occupational risk factors for prostate cancer: A case-control study in Guadeloupe (French West Indies)	2014	Objectives To study the associations between occupation, industry and prostate cancer risk in Guadeloupe, a high incidence area. Method Incident cases of prostate cancer (707 cases) and 722 population controls were included. Information on lifetime occupational history and other potential risk factors was collected by interview. Logistic regression was used to estimate adjusted odds-ratios (OR) and their 95% confidence intervals (CI). Results A significantly decreased risk was observed in farmers (OR=0.5; CI 0.4-0.7), whereas marginally elevated ORs were found for farm workers, especially in sugarcane and banana farming. Banana plantation workers had been exposed to chlordecone, an estrogenic insecticide previously found to be associated with prostate cancer risk in this population. Significantly increased risks of prostate cancer were found in stock clerks (OR=2.7; CI 1.0-7.2), fishermen (OR=2.0; CI 1.0-4.0), mail distribution clerks (OR=7.7; CI 1.7-34.4) and electricians employed for more than 20 years (OR=4.0; CI 1.0-15.8), as well as in public administration (OR=1.8; CI 1.2-2.9), retail trade (OR=2.6; CI 1.1-6.0) and manufacture of food products (OR=2.0; CI 1.1-3.9), particularly sugar (OR=13.2; IC 1.6-108). Non-significantly elevated ORs were also seen for construction workers and transport equipment operators. Conclusions Although the overall findings suggest that occupational factors have only a limited role in prostate cancer aetiology, elevated risks of prostate cancer were found in several occupations or industries. Exposure to pesticides, solvents, traffic-related air pollution, low physical activity, whole-body vibration may explain some of these increased risks.	Occupational and Environmental Medicine	71	NA	A100	Self-reported job history			Case-control	Type of pesticide	cancer	doctor-diagnosed	Guadeloupe	hic
633	K. P. Cantor and W. Silberman	Mortality among aerial pesticide applicators and flight instructors: follow-up from 1965-1988	1999	BACKGROUND: Vital status followup for a retrospective cohort mortality study of 9,961 male aerial pesticide applicators was extended beyond a previous study (1965-1979) (Cantor et al. 1991), through December 31, 1988. METHODS: Rate ratios (RR) were used to compare directly adjusted mortality rates between applicators and a comparison cohort of 9,969 flight instructors. Standardized mortality ratios (SMR) were calculated for comparisons with the U.S. white male population. RESULTS: Among applicator pilots, there were 1,441 deaths, and among instructors, 1,045. In both groups, aircraft accidents were the major cause of death (446 applicators; 234 instructors). Compared with flight instructors, aerial applicator pilots were at significantly elevated risk for all causes of death (risk ratio = 1.34) and for malignant neoplasms (1.18), non-motor vehicle accidents (1.71), motor vehicle accidents (1.69), and stroke (1.91). Pancreatic cancer (2.71) and leukemia (3.35) were significantly elevated. Applicators were at lower risk of colon cancer (0.51) and multiple myeloma (0.23) mortality. Based on U.S. rates, the SMR for all causes of death among applicators was 111 (95% confidence interval (CI) = 105-117) and among instructors, 81 (CI = 76-85). CONCLUSIONS: Aircraft accidents were a major cause of mortality in both applicator and flight instructor cohorts. Several other causes of death, some possibly related to pesticide exposure, were also elevated among pesticide applicator pilots. Published 1999 Wiley-Liss, Inc.	American Journal of Industrial Medicine	36	2	239-47	Registers			Cohort (retrospective)	Pesticides in general	mortality (all cause)	doctor-diagnosed	USA	hic
634	K. P. Wanigasuriya, R. J. Peiris-John, R. Wickremasinghe and A. Hittarage	Chronic renal failure in North Central Province of Sri Lanka: an environmentally induced disease	2007	This study was conducted to determine the aetiology of chronic renal failure (CRF) in the North Central Province of Sri Lanka. Patients (n=183) with CRF of unknown aetiology were compared with controls (n=200) who had no evidence of chronic renal dysfunction. Exposure to possible risk factors were determined by an interviewer-administered questionnaire. Being a farmer (P<0.001), using pesticides (P<0.001), drinking well water (P<0.001), a family history of renal dysfunction (P=0.001), use of ayurvedic treatment (P<0.001) and a history of snake bite (P<0.001) were risk factors for CRF of unknown aetiology. Using logistic regression analysis, a family history of chronic renal disease, taking ayurvedic treatment and history of snake bite were found to be significant predictors for CRF of unknown aetiology. There is evidence to support an environmental aetiology to CRF in Sri Lanka.	Transactions of the Royal Society of Tropical Medicine & Hygiene	101	10	1013-7	Self-reported exposure			Case-control	Pesticides in general	genitourinary	doctor-diagnosed	Sri Lanka	lmic
635	K. R. Greenop, S. Peters, H. D. Bailey, L. Fritschi, J. Attia, R. J. Scott, D. C. Glass, N. H. de Klerk, F. Alvaro, B. K. Armstrong and E. Milne	Exposure to pesticides and the risk of childhood brain tumors.[Erratum appears in Cancer Causes Control. 2014 Sep;25(9):1239-40]	2013	PURPOSE: Previous research has suggested positive associations between parental or childhood exposure to pesticides and risk of childhood brain tumors (CBT). This Australian case-control study of CBT investigated whether exposures to pesticides before pregnancy, during pregnancy and during childhood, were associated with an increased risk. METHODS: Cases were recruited from 10 pediatric oncology centers, and controls by random-digit dialing, frequency matched on age, sex, and State of residence. Exposure data were collected by written questionnaires and telephone interviews. Data were analyzed by unconditional logistic regression. RESULTS: The odds ratios (ORs) for professional pest control treatments in the home in the year before the index pregnancy, during the pregnancy, and after the child's birth were 1.54 (95% confidence interval (CI): 1.07, 2.22), 1.52 (95% CI: 0.99, 2.34) and 1.04 (95% CI: 0.75, 1.43), respectively. ORs for treatments exclusively before pregnancy and during pregnancy were 1.90 (95% CI: 1.08, 3.36) and 1.02 (95% CI: 0.35, 3.00), respectively. The OR for the father being home during the treatment was 1.79 (95% CI: 0.85, 3.80). The OR for paternal occupational exposure in the year before the child's conception was 1.36 (95% CI: 0.66, 2.80). ORs for prenatal home pesticide exposure were elevated for low- and high-grade gliomas; effect estimates for other CBT subtypes varied and lacked precision. CONCLUSIONS: These results suggest that preconception pesticide exposure, and possibly exposure during pregnancy, is associated with an increased CBT risk. It may be advisable for both parents to avoid pesticide exposure during this time.	Cancer Causes & Control	24	7	1269-78	Self-reported exposure			Case-control	Pesticides in general	offspring	doctor-diagnosed	Australia	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
636	K. R. Muir, C. E. Chilvers, C. Harriss, L. Coulson, M. Grainge, P. Darbyshire, C. Geary, J. Hows, J. Marsh, T. Rutherford, M. Taylor and E. C. Gordon-Smith	The role of occupational and environmental exposures in the aetiology of acquired severe aplastic anaemia: a case control investigation	2003	Aplastic anaemia is a rare but serious disorder with a high morbidity and mortality rate. The causes of aplastic anaemia are, for the most part, unknown. We report on the hypothesis that aplastic anaemia may be caused by occupational and/or environmental exposures to certain chemicals. The UK Aplastic Anaemia Study was an interview-based case-control study covering the whole of Great Britain. Those patients diagnosed between 1 July 1993 and 20 October 1997, aged < or =75 years and born and diagnosed in the UK were eligible for the study. Two hundred eligible cases of aplastic anaemia were compared with 387 age- and sex-matched controls. A number of occupational exposures showed increases in risk. In a multivariate model of these exposures the odds ratios (ORs) for solvents/degreasing agents, pesticides and radiation were >2 and statistically significant. Reported chemical treatment of houses within 5 years of diagnosis had a significantly raised risk for adults [OR = 2.51, 95% confidence interval (CI) 1.02-12.01], particularly for woodworm treatment (OR = 5.1, 95% CI 1.5-17.4). This study identified significant risks associated with self-reported exposure to solvents, radiation and pesticides in the workplace. Self-reported chemical treatment of houses was also associated with an increased risk of developing aplastic anaemia, in keeping with previous literature.	British Journal of Haematology	123	5	906-14	Self-reported exposure			Case-control	Pesticides in general	hematological	doctor-diagnosed	UK	hic
637	K. Rugbjerg, M. A. Harris, H. Shen, S. A. Marion, J. K. Tsui and K. Teschke	Pesticide exposure and risk of Parkinson's disease--a population-based case-control study evaluating the potential for recall bias	2011	OBJECTIVE: The aim of this study was to investigate whether pesticide exposure was associated with Parkinson's disease in a population-based case-control study in British Columbia, Canada. METHODS: Patients reimbursed for anti-parkinsonian agents were identified and screened for eligibility as cases. Controls were selected from the universal health insurance database, frequency-matched to the case sample on birth year, gender, and geographic region. A total of 403 cases and 405 controls were interviewed about their job, medical and personal habits histories, and beliefs about disease risk factors. Among those reporting pesticide exposure, an occupational hygiene review selected participants exposed "beyond background" (ie, above the level expected in the general population). Unconditional logistic regression was used to estimate associations for different pesticide categories. RESULTS: Of the cases, 74 (18%) self-reported pesticide exposure and 37 (9%) were judged to be exposed beyond background. Self-reported exposure was associated with increased risk [odds ratio (OR) 1.76, 95% confidence interval (95% CI) 1.15-2.70], however the risk estimate was reduced following the hygiene review when restricted to those considered exposed (OR, 1.51, 95% CI, 0.85-2.69). When agricultural work was added to the model, the risk for hygiene-reviewed pesticide exposure was not elevated (OR 0.83, 95% CI 0.43-1.61), but agricultural work was (OR 2.47, 95% CI 1.18-5.15). More than twice as many cases as controls thought chemicals cause Parkinson's disease. Discussion This study provides little support for pesticide exposure as a cause of Parkinson's disease. The observed pattern of step-wise decreases in risk estimates might indicate differential recall by case status. The relationship to agricultural jobs suggests that farming exposures--other than pesticides--should be considered as risk factors for Parkinson's disease.	Scandinavian Journal of Work, Environment & Health	37	5	427-36	Self-reported exposure			Case-control	Pesticides in general	neurological	doctor-diagnosed	Canada	hic
638	K. Ruiz-Gamboa, N. Perez-Herrera, R. Camara-Vallejos, M. Medina-Moreno, N. Albertos-Alpuche, R. Esperon-Hernandez, R. Zapata-Vazquez, A. Rojas-Garcia and I. Medina-Diaz	Genotoxic effect in exfoliated buccal cells from indoor sprayers exposed to pesticides in southern Mexico	2016	Introduction: Pesticides are widely used in tropical areas for urban pest control and prevention of public health problems. Human exposure to pesticides has been associated to DNA damage. The Buccal Micronucleus Cytome (BMCyt) assay is a minimally invasive method and economical for studying DNA damage, chromosomal instability and cell death. Objective: To evaluate the genotoxicity by occupational exposure to pesticides using BMCyt in a group of indoor sprayers from southern Mexico. Materials and methods: A cross-sectional, retrospective and comparative survey study was conducted. The exposed group was integrated by 27 sprayers and the non-exposed group by 26 men. A structured questionnaire was applied by an interview to participants. Buccal mucosa smears were collected and Feulgen method was used for staining, observed under 100<U+221A><U+00F3> optical amplification. Frequency of MN and nuclear abnormalities are expressed by 1000 cells. Results: The sprayers have been working with pesticides for 1-17 years, 67% of them did not use personal protection equipment. A total of 18 ingredients active were used as pesticides by workers: PIR, OP and coumarins were the most used chemical groups, 33% of them are genotoxic. The main use of these is given to pesticides: insecticides, acaricides, rodenticides and herbicides. TheMN frequency was different between the groups (p < 0.001), 0.71/1000 cells (0.50-1.01) in sprayers vs 0.46/1000 cells (0.33-0.65) in the non-exposed group. All nuclear anomalies: nuclear bud, binucleated, karyorrhexis, pyknosis, karyolysis, condensed chromatin were different between groups and some workers had scores above regard: binucleated, pyknosis and karyorrhexis. Conclusions: The frequency of the MN and nuclear anomalies were higher in sprayers respect to not exposed group. Our results suggest than occupational pesticides exposure is related to genotoxic effects in these workers.	Toxicology Letters	259	NA	S218	Self-reported exposure			Cross-sectional	Type of pesticide	genetic (biomarkers)	medical test result	Mexico	umic
639	K. S. H. Hougaard, H.; Feveile, H.; Bonde, J. P.; Burr, H.	Infertility among women working in horticulture. A follow-up study in the Danish Occupational Hospitalization Register	2009	The possible association between employment in horticulture with potential exposure to pesticides and female infertility was examined by identification of women with hospital contact due to infertility and working in horticulture through the Danish Occupational Hospitalization Register. This follow-up study gave a standardized incidence ratio of 1.06 (95% confidence interval: 0.84-1.32) for treatment of infertility in women working in horticulture compared with the standard population and did not confirm that women working in the horticultural industry are at increased risk for infertility.	Fertility & Sterility	91	4	1385-7	Job title			Cohort (prospective)	Job title	reproductive	doctor-diagnosed	Denmark	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
640	K. Sharanjeet, I. A. Azizan, K. N. Leong and S. Narayanasamy	Effect of pesticides on colour vision and anterior segment ocular structures of farmers	2012	Purpose: The objective of this study was to determine the prevalence of anterior ocular structure abnormalities and colour vision defects among agricultural workers using pesticides. Methods: Agricultural workers in Cameron Highlands, Malaysia using pesticides were randomly recruited. The inclusion criteria were having no systemic or ocular disease, not on medication, nonsmokers and non-alcoholic. Slit lamp biomicroscopy was carried out to assess anterior ocular structures. Colour vision was assessed binocularly using Ishihara plates, D-15 test and FM100Hue test and performed using daylight illumination. Results: Seventy-four workers of mean age 32.24 <U+00AC><U+00B1> 1.23 years were recruited. The only anterior ocular changes observed were bulbar conjunctival hyperemia with a prevalence of 25.7%. The mean working hours was 8.83 <U+00AC><U+00B1> 3.58 and the mean working years were 7.69 <U+00AC><U+00B1> 8.35. Only 23% of farmers wore goggles to protect their eyes. There was no statistically significant difference found for means of working years (t = 0.019, p = 0.985), working hours (t = 1.014, p = 0.314) or use of goggles (c2(1,N = 74) = 2.238, p = 0.135) among workers with and without hyperemia. The prevalence of colour vision defects was 5% using the Ishihara Plates, 29% using the D15 test and 49% using the FM100Hue test. Majority of the colour defects were of non-polar type. The mean total error score of the colour vision defectives was 170.67. There was a significant correlation between the duration of working hours (r = 0.46, p = 0.000) with the total error score. Conclusion: Exposure to pesticides can cause hyperemia and colour vision defects in farmers and the colour vision defects correlates highly with exposure duration.	Clinical and Experimental Ophthalmology	40	NA	81	Job title			Cross-sectional	Job title	other	other	Malaysia	umic
641	K. Steenland, C. Wesseling, N. Roman, I. Quiros and J. Juncos	Occupational pesticide exposure and screening tests for neurodegenerative disease among an elderly population in Costa Rica	2013	Background: Pesticide exposure has been associated with Parkinson's disease (PD) in many studies, and with Alzheimer's disease (AD) in a few. There are few data on pesticide exposure and screening tests for neurodegenerative disease among the elderly. Methods: We conducted screening tests in a population-based sample of 400 elderly subjects at two government-run clinics in Costa Rica; 361 subjects were given both the Mini-mental States Exam (MMSE) and the 10-item version of the United Parkinson's Disease Rating Scale (UPDRS). The 164 subjects who failed either test were examined by a neurologist . Results: Past occupational pesticide exposure was reported by 18% of subjects. Exposed subjects performed worse on the MMSE than the non-exposed (mean 24.5 versus 25.9, p=0.02, adjusted for age, sex, and education). The exposed had significantly elevated risks for two UPDRS items, tremor- at-rest (OR 2.59, 1.28-5.23), and finger-tapping (OR=2.95, 95% CI 1.03-8.42). Thirty-three (23%) of those examined by the neurologist were diagnosed with possible/probable PD, 3-4 times the expected; 85% of these cases had not been previously diagnosed. Among all 400 subjects, the exposed had an increased risk of PD (OR=2.57, 95% CI 0.91-7.26). No excess risk was found for a diagnosis of AD or mild cognitive impairment (MCI) (n=41)(OR=0.82, 0.30-2.26). Conclusions. Elderly subjects with past occupational pesticide exposure performed significantly worse on screening tests for dementia and PD, and had an increased risk of an eventual PD diagnosis. Screening may be particularly appropriate among elderly subjects with past pesticide exposure.	Environ Res	120	NA	96-101	Self-reported exposure			Cross-sectional	Pesticides in general	neurological	doctor-diagnosed	Costa Rica	umic
642	K. Steenland, L. Cedillo, J. Tucker, C. Hines, K. Sorensen, J. Deddens and V. Cruz	Thyroid hormones and cytogenetic outcomes in backpack sprayers using ethylenebis(dithiocarbamate) (EBDC) fungicides in Mexico	1997	Ethylenebis(dithiocarbamate) (EBDC) fungicides are used heavily in the United States. EBDCs (e.g., mancozeb, maneb) are metabolized to ethylene thiourea (ETU). The EPA classifies ETU as a carcinogen, based on thyroid and other cancers in rodents, and has restricted the use of EBDCs, while requiring workers to use protective equipment. There are no data on the potential carcinogenicity of EBDCs in humans, and there is only one study on human genotoxicity. ETU is known to cause decreases of thyroxine (T4) and increases in thyroid-stimulating hormone (TSH) in rodents. We have studied cytogenetic outcomes and serum thyroid hormone levels among 49 heavily exposed workers without protective equipment spraying EBDC on tomatoes in Mexico. We also studied 14 lightly exposed landowners and 31 nonexposed controls. Urinary ETU was used to compare exposure between groups. We found an increase in TSH (p = 0.05) among applicators compared to controls, but no decrease in thyroid hormone (T4). We found increases in sister chromatid exchange (p = 0.03) and in chromosome translocations (chromosome aberrations that persist through cell division) for applicators compared to controls (p = 0.05). However, the subset of reciprocal translocations showed a lesser increase (p = 0.24). Our data suggest that EBDCs affect the thyroid gland and the lymphocyte genome among heavily exposed workers. However, our data are limited to subclinical outcomes, are of borderline statistical significance, and should be interpreted with caution.	Environmental Health Perspectives	105	10	1126-30	Biomonitoring (urine)			Cross-sectional	Chemical class	endocrine/nutritional/metabolical	medical test result	Mexico	umic
643	K. Steenland, R. B. Dick, R. J. Howell, D. W. Chrislip, C. J. Hines, T. M. Reid, E. Lehman, P. Laber, E. F. Krieg, Jr. and C. Knott	Neurologic function among termiticide applicators exposed to chlorpyrifos	2000	Chlorpyrifos is a moderately toxic organophosphate pesticide. Houses and lawns in the United States receive a total of approximately 20 million annual chlorpyrifos treatments, and 82% of U.S. adults have detectable levels of a chlorpyrifos metabolite (3,5, 6-trichloro-2-pyridinol; TCP) in the urine. The U.S. Environmental Protection Agency has estimated that there are 5,000 yearly reported cases of accidental chlorpyrifos poisoning, and approximately one-fourth of these cases exhibit symptoms. Organophosphates affect the nervous system, but there are few epidemiologic data on chlorpyrifos neurotoxicity. We studied neurologic function in 191 current and former termiticide applicators who had an average of 2.4 years applying chlorpyrifos and 2.5 years applying other pesticides, and we compared them to 189 nonexposed controls. The average urinary TCP level for 65 recently exposed applicators was 629.5 microg/L, as compared to 4.5 microg/L for the general U.S. population. The exposed group did not differ significantly from the nonexposed group for any test in the clinical examination. Few significant differences were found in nerve conduction velocity, arm/hand tremor, vibrotactile sensitivity, vision, smell, visual/motor skills, or neurobehavioral skills. The exposed group did not perform as well as the nonexposed group in pegboard turning tests and some postural sway tests. The exposed subjects also reported significantly more symptoms, including memory problems, emotional states, fatigue, and loss of muscle strength; our more quantitative tests may not have been adequate to detect these symptoms. Eight men who reported past chlorpyrifos poisoning had a pattern of low performance on a number of tests, which is consistent with prior reports of chronic effects of organophosphate poisoning. Overall, the lack of exposure effects on the clinical examination was reassuring. The findings for self-reported symptoms raise some concern, as does the finding of low performance for those reporting prior poisoning. Although this was a relatively large study based on a well-defined target population, the workers we studied may not be representative of all exposed workers, and caution should be exercised in generalizing our results.	Environmental Health Perspectives	108	4	293-300	Biomonitoring (urine)			Case-control	Specific active ingredient	neurological	medical test result	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
644	K. Sunwook, M. A. Nussbaum, S. A. Quandt, P. J. Laurienti and T. A. Arcury	Effects of Lifetime Occupational Pesticide Exposure on Postural Control Among Farmworkers and Non-Farmworkers	2016	OBJECTIVE: The aim of the study was to assess potential chronic effects of pesticide exposure on postural control, by examining postural balance of farmworkers and non-farmworkers diverse self-reported lifetime exposures. METHODS: Balance was assessed during quiet upright stance under four experimental conditions (2 visual x 2 cognitive difficulty). RESULTS: Significant differences in baseline balance performance (eyes open without cognitive task) between occupational groups were apparent in postural sway complexity. When adding a cognitive task to the eyes open condition, the influence of lifetime exposure on complexity ratios appeared different between occupational groups. Removing visual information revealed a negative association of lifetime exposure with complexity ratios. CONCLUSIONS: Farmworkers and non-farmworkers may use different postural control strategies even when controlling for the level of lifetime pesticide exposure. Long-term exposure can affect somatosensory/vestibular sensory systems and the central processing of sensory information for postural control.	Journal of Occupational & Environmental Medicine	58	2	133-9	Self-reported exposure			Cohort (prospective)	Pesticides in general	neurological	medical test result	USA	hic
645	K. Swaminathan and G. Thangavel	Pesticides and human diabetes: A pilot project to explore a possible link	2015	An increasing number of studies show an association between environmental pollutants - especially organophosphorous pesticides - and the development of insulin resistance and hyperglycaemia. Our aim was to explore this hypothesis in farming communities around the city of Madurai, India. Local Ethics Committee approval was obtained. In all, 260 participants more than 18 years of age from farming villages around Madurai were evaluated based on three categories of pesticide exposure. The crude odds ratio for farmers mixing and spraying pesticides to have diabetes compared to the minimal exposure category was 2.07 (95% CI 1.01-4.24). After adjusting for sex and BMI, the odds ratio was 2.302 (95% CI 1.082-4.896). There seems to be a moderate association between pesticide exposure and diabetes. A good study design and good control of confounding factors will testify to this association.	Practical Diabetes	32	3	111-113	Job title			Cross-sectional	Job title	endocrine/nutritional/metabolical	doctor-diagnosed	India	lmic
646	K. T. B. Mills, A.; Freeman, L. E.; Sandler, D. P.; Hoppin, J. A.	Pesticides and myocardial infarction incidence and mortality among male pesticide applicators in the Agricultural Health Study	2009	Acute organophosphate and carbamate pesticide poisonings result in adverse cardiac outcomes. The cardiac effects of chronic low-level pesticide exposure have not been studied. The authors analyzed self-reported lifetime use of pesticides reported at enrollment (1993-1997) and myocardial infarction mortality through 2006 and self-reported nonfatal myocardial infarction through 2003 among male pesticide applicators in the Agricultural Health Study. Using proportional hazard models, the authors estimated the association between lifetime use of 49 pesticides and fatal and nonfatal myocardial infarction. There were 476 deaths from myocardial infarction among 54,069 men enrolled in the study and 839 nonfatal myocardial infarctions among the 32,024 participants who completed the follow-up interview. Fatal and nonfatal myocardial infarctions were associated with commonly reported risk factors, including age and smoking. There was little evidence of an association between having used pesticides, individually or by class, and myocardial infarction mortality (e.g., insecticide hazard ratio (HR) = 0.91, 95% confidence interval (CI): 0.67, 1.24; herbicide HR = 0.74, 95% CI: 0.49, 1.10) or nonfatal myocardial infarction incidence (e.g., insecticide HR = 0.85, 95% CI: 0.66, 1.09; herbicide HR = 0.91, 95% CI: 0.61, 1.36). There was no evidence of a dose response with any pesticide measure. In a population with low risk for myocardial infarction, the authors observed little evidence of increased risk of myocardial infarction mortality or nonfatal myocardial infarction associated with the occupational use of pesticides.	American Journal of Epidemiology	170	7	892-900	Self-reported exposure			Cohort (prospective)	Chemical class	circulatory	doctor-diagnosed	USA	hic
647	K. T. J. Jorgensen, M. S.; Toft, G. V.; Larsen, A. D.; Bonde, J. P.; Hougaard, K. S.	Risk of cryptorchidism among sons of horticultural workers and farmers in Denmark	2014	OBJECTIVES: Previous studies indicate an increased risk of cryptorchidism, incomplete testicular descent, among sons of women working with pesticides. This study assessed the risk of cryptorchidism among boys of parents employed as horticultural workers and farmers using nationwide registers on occupation and cryptorchidism. METHODS: The cohort consisted of >600 000 boys born in Denmark from 1980-2007 with a parent in employment during pregnancy. These boys were followed for cryptorchidism from 1980-2009 comparing risks among sons of horticultural workers and farmers with sons of parents in other occupations. Hazard ratios (HR) and 95% confidence intervals (95% CI) were estimated using Cox regression adjusting for parental age, birth years, parity, and geographical region. RESULTS: Sons of maternal farmers were at increased risk of cryptorchidism (157 cases; HR 1.31, 95% CI 1.12-1.53) compared to boys of mothers in other occupations (15 511 cases). Paternal occupation as farmer was unrelated to the risk among sons. Maternal occupation as a horticultural worker was associated with a non-significantly increased risk (72 cases; HR 1.20, 95% CI 0.95-1.52). A similar association was found for paternal horticultural workers. Sons of maternal farmers or horticultural workers who likely worked in the first trimester were not at increased risk of cryptorchidism. CONCLUSIONS: This nationwide cohort study found a slightly increased risk of cryptorchidism in sons of maternal horticultural workers and farmers. However, subgroup analyses indicated similar findings for paternal horticultural workers, and no association for women likely working in the first trimester. The main findings should therefore be interpreted with caution.	Scandinavian Journal of Work, Environment & Health	40	3	323-30	Job title			Cohort (prospective)	Job title	offspring	doctor-diagnosed	Denmark	hic
648	K. Togawa, C. Le Cornet, M. Feychting, J. Hansen, E. Pukkala, T. Tynes, A. Olsson, P. Wiebert, S. Oksbjerg Dalton, S. Uuksulainen, T. Woldb<U+221A><U+00B6>k, K. C. Nordby, N. E. Skakkeb<U+221A><U+00B6>k, B. Fervers and J. Sch<U+221A><U+00BA>z	Parental occupational exposures and testicular cancer in offspring: A registrybased case-control study in the nordic countries (nord-test study)	2016	Background Prenatal exposures including parental occupational exposures have been hypothesised to play an etiological role in testicular cancer; however, epidemiological data supporting this hypothesis remain scarce. In the NORD-TEST Study, a registrybased case-control study conducted in the Nordic countries, we examined the associations between certain parental occupational exposures before childbirth and testicular germ cell tumour (TGCT) in offspring. Methods TGCT cases diagnosed at ages 14-49 years between 1978 and 2012 in Denmark, Finland, Norway, and Sweden were identified from the cancer registries. Four controls per case were randomly selected from the central population registry and matched to cases by country and year of birth. We retrieved information on maternal and paternal occupations before childbirth from census or Pension Fund registry. Using the Nordic jobexposure matrices, occupational information was converted to exposure indices of pesticides (all four countries) and of solvents, heavy metals, or welding fumes (Finland, Norway and Sweden only). Further, information on family history of testicular cancer and personal history of genital malformations were retrieved through registry linkages. Conditional logistic regression models were used to estimate odds ratios (OR) and 95% confidence intervals (CI). Results The study sample comprised 9,569 cases and 32,028 controls (8,112 cases and 26,264 controls excluding Denmark). The data showed no significant associations of TGCT risk with maternal (OR = 0.83, 95% CI: 0.56-1.23) or paternal pesticide exposure (OR = 1.03, 95% CI: 0.92-1.14). We found increased TGCT risk associated with maternal exposure to aromatic hydrocarbon solvents (OR = 1.32, 95% CI: 1.06-1.65) but no linear dose-response relationship. Parental exposures to other solvents, heavy metals, or welding fumes did not significantly increase TGCT risk. Conclusions The NORD-TEST Study provided little evidence of associations of parental occupational exposures to pesticides, solvents, heavy metals, or welding fumes to TGCT risk, with the possible exception of maternal exposure to aromatic hydrocarbon solvents.	Occupational and Environmental Medicine	73	NA	A41	Job exposure matrix			Case-control	Pesticides in general	offspring	doctor-diagnosed	Nordic Countries	AHIC

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
649	K. Yahata, K. Fujishiro, H. Hori and T. Higashi	An investigation of symptoms in ethylene oxide sterilization workers in hospitals	2001	We investigated the frequency of particular symptoms reported during daily sterilization work with ethylene oxide (EO). By means of a self-administered questionnaire we received 287 replies from 66 institutions where sterilization work was performed, (148 used EO, and 139 used other substances). In these two groups, complaints such as stiff shoulders (19.2%), low back pain (13.9%), and skin burning (13.2%) were frequently reported. When we compared the EO sterilization workers with other workers by means of Fisher's exact test, significant differences were observed among the cases of diarrhea, headache, dullness, sore throat and eye irritation. We also investigated some safety and health management factors that suggested correlations with the manifestation of these symptoms.	Journal of Occupational Health	43	4	180-184	Job title			Cross-sectional	Specific active ingredient	pesticide-related symptoms	self-reported	Japan	hic
650	K. Zhu, R. S. Levine, E. A. Brann, H. I. Hall, L. S. Caplan and D. R. Gnepp	Case-control study evaluating the homogeneity and heterogeneity of risk factors between sinonasal and nasopharyngeal cancers	2002	Sinonasal cancer and nasopharyngeal cancer may share some risk factors because both are located within the upper aerodigestive tract. They may also have different etiological profiles because of anatomic or pathologic differences. However, the similarities and differences in risk factors have rarely been studied within the same population. We assessed the risk factor profiles of sinonasal and nasopharyngeal cancers, using data from a case-control study. The 2 case groups consisted of men aged 31-59 and diagnosed pathologically with sinonasal cancer (n=70) and nasopharyngeal cancer (n=113), respectively. Controls were men without these cancers and selected from the same areas (n=1910). Logistic regression analysis showed that smoking was a risk factor for both sinonasal [odds ratio (OR)=2.5, 95% confidence interval (CI) 1.1-5.4] and nasopharyngeal cancer (OR=1.8, 95%CI 1.1-3.0). However, ever use of barbiturates without a prescription (OR=4.9, 95%CI 1.7-13.8), working with or around cutting oils on a job (OR=1.9, 95%CI 1.1-3.1) and ever having had sinus infections (OR=2.3, 95%CI 1.1-4.6) were associated with nasopharyngeal cancer only. Having received blood products other than a transfusion (OR=9.1, 95%CI 2.2-37.4) and exposure to a pesticide containing 2,4,5-T (OR=5.9, 95%CI 1.5-23.7) were related to sinonasal cancer only. When data analyses were confined to squamous cell type, smoking and exposure to chlorophenols were related to squamous cell tumors at both sites. However, use of barbiturates and sinus problems other than infection only increased the risk of nasopharyngeal carcinoma. Our study suggests that except for smoking and chlorophenol exposure, which are associated with both sites, the risk factor profiles may differ between sinonasal and nasopharyngeal cancers.	International Journal of Cancer	99	1	119-23	Self-reported exposure			Case-control	Chemical class	cancer	doctor-diagnosed	USA	hic
651	L. A. Hou, G.; Baccarelli, A. A.; Savage, S.; Hoppin, J. A.; Sandler, D. P.; Barker, J.; Zhu, Z. Z.; Hoxha, M.; Dioni, L.; Zhang, X.; Koutros, S.; Freeman, L. E.; Alavanja, M. C.	Lifetime pesticide use and telomere shortening among male pesticide applicators in the Agricultural Health Study	2013	BACKGROUND: Telomere length (TL) in surrogate tissues may be influenced by environmental exposures. OBJECTIVE: We aimed to determine whether lifetime pesticides use is associated with buccal cell TL. METHODS: We examined buccal cell TL in relation to lifetime use of 48 pesticides for 1,234 cancer-free white male pesticide applicators in the Agricultural Health Study (AHS), a prospective cohort study of 57,310 licensed pesticide applicators. Participants provided detailed information on lifetime use of 50 pesticides at enrollment (1993-1997). Buccal cells were collected from 1999 to 2006. Relative telomere length (RTL) was measured using quantitative real-time polymerase chain reaction. We used linear regression modeling to evaluate the associations between specific pesticides and the logarithm of RTL, adjusting for age at buccal cell collection, state of residence, applicator license type, chewing tobacco use, and total lifetime days of all pesticide use. RESULTS: The mean RTL for participants decreased significantly in association with increased lifetime days of pesticide use for alachlor (p = 0.002), 2,4-dichlorophenoxyacetic acid (2,4-D; p = 0.004), metolachlor (p = 0.01), trifluralin (p = 0.05), permethrin (for animal application) (p = 0.02), and toxaphene (p = 0.04). A similar pattern of RTL shortening was observed with the metric lifetime intensity-weighted days of pesticide use. For dichlorodiphenyltrichloroethane (DDT), we observed significant RTL shortening for lifetime intensity-weighted days (p = 0.04), but not for lifetime days of DDT use (p = 0.08). No significant RTL lengthening was observed for any pesticide. CONCLUSION: Seven pesticides previously associated with cancer risk in the epidemiologic literature were inversely associated with RTL in buccal cell DNA among cancer-free pesticide applicators. Replication of these findings is needed because we cannot rule out chance or fully rule out bias.	Environmental Health Perspectives	121	8	919-24	Self-reported exposure			Cohort (prospective)	Specific active ingredient	genetic (biomarkers)	medical test result	USA	hic
652	L. A. McCauley, M. Lasarev, J. Muniz, V. Nazar Stewart and G. Kisby	Analysis of pesticide exposure and DNA damage in immigrant farmworkers	2008	In the last decade, the Comet assay has been used increasingly in studies of workers potentially exposed to genotoxic substances in the workplace or environment. Significant increases in DNA damage measured with the Comet assay has been reported in lymphocytes of agricultural workers; however, less intrusive means of biomonitoring are needed in epidemiological investigations. This study was designed to use the Comet assay to describe the association of markers of DNA damage in oral leukocytes with biomarkers of pesticide exposure in 134 farmworkers working in berry crops in Oregon compared to control populations. The authors also examined the extent of DNA damage in young workers compared to adults and the effect of work histories, lifestyle factors, and diet on markers of DNA damage. Urinary levels of organophosphate pesticides were low at the time of sampling; however, mean levels of the Captan metabolite tetrahydrophthalimide (THPI) were found to be shifted significantly higher in the farmworkers (0.14 microg/ml) compared to controls (0.078 microg/ml) (one-sided p value=.01). Likewise, the combined molar equivalent of all dialkylphosphate metabolites was marginally higher in farmworkers (p value=.05). The mean tail intensity was significantly greater for agricultural workers compared to controls (one-sided p value<.001), indicating more DNA damage in the oral leukocytes. On average, the mean tail intensity was 10.9 units greater for agricultural workers (95% CI: 6-16 units greater). Tail moment was also significantly greater for agricultural workers compared to nonagricultural workers (one-sided p value<.001). No Comet parameter was significantly associated with years spent working in agriculture, age, sex, body mass index, diet, and alcohol or tobacco use. The results of this study demonstrate the feasibility for using the Comet assay in biomonitoring studies of farmworkers. Additional studies are needed to examine the effects of different pesticide types on DNA damage and to capture the temporal relationship between exposure to agricultural chemicals and changes in Comet parameters.	Journal of Agromedicine	13	4	237-46	Biomonitoring (urine)			Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
653	L. A. Smit, B. N. van-Wendel-de-Joode, D. Heederik, R. J. Peiris-John and W. van der Hoek	Neurological symptoms among Sri Lankan farmers occupationally exposed to acetylcholinesterase-inhibiting insecticides	2003	BACKGROUND: In many agricultural districts in Sri Lanka, pesticide poisoning is a leading cause of death. This study aims to evaluate the impact of pesticide use on Sri Lankan farmers' health. METHODS: A total of 260 subjects were surveyed in both a low and a high exposure period. Acetylcholinesterase activity was measured and data on symptoms were collected with questionnaires. RESULTS: Twenty-four percent of surveyed farmers had suffered at least once from acute pesticide poisoning. Farmers showed significantly more inhibition of cholinesterase activity than controls. Acute symptoms indicative for exposure to cholinesterase-inhibiting pesticides were associated with farming and a higher degree of cholinesterase suppression (more than 13% inhibition). Integrated Pest Management (IPM) training seemed to result in less insecticide use, and less cholinesterase inhibition. CONCLUSIONS: Our results suggest that occupational acetylcholinesterase-inhibiting insecticide exposures have a negative impact on Sri Lankan farmers' health. Overall reduction in pesticide use seems the best option to protect farmers from the adverse effects of pesticides.	American Journal of Industrial Medicine	44	3	254-64	Biomonitoring (blood)			Cross-sectional	Chemical class	NA	self-reported	Sri Lanka	lmic
654	L. Avnon, I. Oryan, E. Kordysh, J. Goldsmith, R. Sobel and M. Friger	Cancer incidence and risks in selected agricultural settlements in the Negev of Israel	1998	Medical staff of two Negev kibbutzim invited epidemiologists to help them investigate cancer rates among their members. Our objectives were (a) to determine whether the cancer rate in the kibbutzim was elevated or abnormal and (b) to determine the role of agricultural and other relevant exposures if cancer incidence was elevated. We validated cases of cancer by kibbutz records and by surveying other information; we computed expected values on the basis of the age-sex-calendar period and site-specific cancer incidence rates reported by the Israel Cancer Registry for the entire population; and we compared the data for the 2 kibbutzim with data derived for similar age and sex groups in 2 other kibbutzim, which were assumed not to have increased cancer rates. In addition, we planned and conducted a case-referent study, including the design, pretest, and use of questionnaires, including data about lifetime exposures (i.e., type of work and its duration, agricultural and industrial chemicals, smoking and alcohol use, demographic variables, health experiences, and family history). In only one of the kibbutzim, for which high cancer rates were suspected, was there significant excess for all sites in persons who were less than 40 y of age. In one of the "comparison" kibbutzim, we found increased cancer rates overall. Much of the excess in the high cancer kibbutzim was in hematological cancer (i.e., leukemia and lymphoma). Multiple years of work in fields, orchards, and landscape, as well as orchard work that commenced before 1960, were associated with increased risk of cancer ($p < .08$). We also found an association between cancer rate and numbers of industrial chemicals used ($p < .08$). Pipe and cigarette smoking were also associated with increased cancer incidence. In the multivariate analysis, the association with calendar year in which orchard work was started and multiple exposures to industrial chemicals was stronger than associations noted in the univariate analyses. Although duration of agricultural work or multiple industrial exposures were clearly associated with increase in cancer risk, we were unable to identify the causal role of specific agent(s). Nonetheless, educational programs for cancer prevention can be based, in part, on the results of such a study.	Archives of Environmental Health	53	5	336-43	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Israel	hic
655	L. B. R. Freeman, J.; Hoppin, J.; Lubin, J.; Koutros, S.; Andreotti, G.; Zahm, S. H.; Hines, C.; Coble, J.; Barone-Adesi, F.; Sloan, J.; Sandler, D.; Blair, A.; Alavanja, M.	Atrazine and cancer incidence among pesticide applicators in the agricultural health study (1994-2007)	2011	Objectives Atrazine is a triazine herbicide with endocrinedisrupting properties and is used widely in the United States. Atrazine causes mammary tumours in rats, but the mechanism does not appear to operate in humans. Few epidemiologic studies have provided evidence for an association. Here we extend a previous analysis of cancer risk associated with self-reported atrazine use in the Agricultural Health Study a prospective cohort that includes 57 310 licensed pesticide applicators, with six additional years of follow-up and over twice as many cancer cases (n=3146). Methods Using Poisson regression, we calculated RR estimates and 95% CI for lifetime days of use of atrazine and intensity-weighted lifetime days, which accounts for factors that impact exposure. Results Overall, 68% of applicators reported using atrazine. There was no increased risk among atrazine users for cancer overall or at most sites. Based on 29 exposed cases of thyroid cancer, there was a significant risk in the highest category of intensity-weighted lifetime days (RR=4.86; 95% CI: 1.31 to 17.99, p-trend=0.01). There was a similar pattern for lifetime days (RR=2.31; 95% CI: 0.65 to 8.19, p-trend=0.27), but neither the risk estimates nor the trend were statistically significant and for neither metric was the trend monotonic. For ovarian cancer, there was a suggestion of increased risk among female applicators who ever used atrazine, but numbers were small (n=4). Conclusions There was a suggestion of increased risk of cancers of the thyroid and ovaries, sites of a priori interest due to their hormonal involvement, but with minimal supporting evidence.	Occupational and Environmental Medicine	68	NA	A15	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
656	L. Buzio, G. De Palma, P. Mozzoni, M. Tondel, C. Buzio, I. Franchini, O. Axelson and A. Mutti	Glutathione S-transferases M1-1 and T1-1 as risk modifiers for renal cell cancer associated with occupational exposure to chemicals	2003	AIMS: To investigate the possible interaction between occupational risk factors and genotype for glutathione S-transferases M1 and T1 (GSTM1 and GSTT1) in renal cell cancer (RCC). METHODS: One hundred patients with RCC and 200 outpatient controls were enrolled at Parma University Hospital. The polymorphisms of glutathione S-transferase M1-1 (GSTM1) and T1-1 (GSTT1) were investigated by PCR; occupational history was collected by a structured questionnaire. RESULTS: Subjects with GSTM1 present genotype showed higher risks for RCC, compared to GSTM1 null subjects, if exposed to metals (OR 2.73; 95% CI 0.91 to 8.22 v 1.14; 95% CI 0.46 to 2.82) or pesticides (OR 3.46; 95% CI 1.12 to 10.74 v 1.59; 95% CI 0.48 to 5.34). The GSTT1 present genotype also enhanced the risk (about twofold) of RCC among subjects exposed to solvents and pesticides, compared with those GSTT1 null. CONCLUSIONS: Results support the hypothesis that GSTM1 and GSTT1 polymorphisms can interact with several occupational exposures to significantly modify the risk of RCC among exposed subjects.	Occupational & Environmental Medicine	60	10	789-93	Self-reported job history			Case-control	Pesticides in general	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
657	L. C. Costas, R. Infante, C. , T. Van, Z. and S. De	Endocrine disruptors and the risk of lymphoma in the Epilymph study	2013	Objectives Some industrial chemicals and pesticides might have endocrine disrupting effects. While some pesticides and solvents have been associated with an increased risk of lymphoma, whether this would be the result of their potential endocrine disrupting effect has not been investigated as yet. We explored the role of occupational exposure to endocrine disruptors in lymphoma aetiology. Methods The Epilymph study is a multicenter case-control study carried out in six European countries from 1998 to 2004. We evaluated 2,457 controls and 2,013 lymphoma cases and its subtypes. Information on occupational history was collected through face-to-face interviews. We applied a job-exposure matrix (JEM) for endocrine disrupting chemicals to assess occupational exposures (Brouwers et al. 2009). We evaluated exposure to ten chemical groups: polycyclic aromatic hydrocarbons, polychlorinated organic compounds, pesticides, phthalates, solvents, bisphenol-A, alkylphenolic compounds, brominated flame retardants, metals and a miscellaneous group. Results Prevalence of ever occupationally exposed among controls ranged from 1% (bisphenol-A) to 48% (solvents). Risks for non-Hodgkin lymphoma (NHL) and chronic lymphocytic leukaemia (CLL) were increased with cumulative exposure to endocrine disruptors among men (OR = 1.20 CI95%:1.04-1.38 and 1.28 CI95%:1.01-1.61, respectively). However, none of the individual chemical groups evaluated was associated with NHL or follicular lymphoma risk. For other subtypes such as CLL, multiple myeloma, Hodgkin lymphoma and T-cell neoplasms risks were increased with several exposures, including metals (arsenic and copper), solvents (toluene and xylene), flame retardants, and ethylene glycol ethers. Conclusions Some endocrine disruptors may play a role in the aetiology of certain lymphoma subtypes. Limitations in interpreting our findings include time- and country-related changes in exposure not reflected by the JEM, multiple comparisons and nondifferential misclassification leading to the attenuation of estimates for binary exposures.	Occupational and Environmental Medicine	70	NA	NA	Job exposure matrix			Case-control	Pesticides in general	cancer	doctor-diagnosed	AHIC	AHIC
658	L. C. Sanchez-Pena, B. E. Reyes, L. Lopez-Carrillo, R. Recio, J. Moran-Martinez, M. E. Cebrian and B. Quintanilla-Vega	Organophosphorous pesticide exposure alters sperm chromatin structure in Mexican agricultural workers	2004	Our objective was to evaluate alterations in sperm chromatin structure in men occupationally exposed to a mixture of organophosphorus pesticides (OP) because these alterations have been proposed to compromise male fertility and offspring development. Chromatin susceptibility to in situ acid-induced denaturation structure was assessed by the sperm chromatin structure assay (SCSA). Urinary levels of alkylphosphates (DAP) were used to assess exposure. Diethylthiophosphate (DETP) was the most frequent OP metabolite found in urine samples indicating that compounds derived from thiophosphoric acid were mainly used. Chromatin structure was altered in most samples. About 75% of semen samples were classified as having poor fertility potential (>30% of Percentage of DNA Fragmentation Index [DFI%]), whereas individuals without OP occupational exposure showed average DFI% values of 9.9%. Most parameters of conventional semen analysis were within normality except for the presence of immature cells (IGC) in which 82% of the samples were above reference values. There were significant direct associations between urinary DETP concentrations and mean DFI and SD-DFI but marginally (P = 0.079) with DFI%, after adjustment for potential confounders, including IGC. This suggests that OP exposure alters sperm chromatin condensation, which could be reflected in an increased number of cells with greater susceptibility to DNA denaturation. This study showed that human sperm chromatin is a sensitive target to OP exposure and may contribute to adverse reproductive outcomes. Further studies on the relevance of protein phosphorylation as a possible mechanism by which OP alter sperm chromatin are required.	Toxicology & Applied Pharmacology	196	1	108-13	Biomonitoring (urine)			Cross-sectional	Chemical class	reproductive	medical test result	Mexico	umic
659	L. Cameron, N. Lalich, S. Bauer, V. Booker, H. O. Bogue, S. Samuels and A. L. Steege	Occupational health survey of farm workers by camp health aides	2006	Little is known about the magnitude of occupational health problems among migrant farm workers. A community-based cross-sectional survey was conducted in two migrant farm worker communities: Homestead, Florida, and Kankakee, Illinois. Camp Health Aides (CHAs) interviewed 425 workers about job tasks, personal protective equipment (PPE), field sanitation, work exposures, and selected health conditions. Limited provision of personal protective equipment was reported among those reporting early re-entry tasks: 35% in Kankakee and 42% in Homestead were provided gloves, and 22% in Homestead and 0% in Kankakee were provided protective clothing. About two-thirds were provided toilet facilities and water for hand-washing. Workers reported high prevalences of health conditions consistent with exposure to ergonomic hazards and pesticides. The prevalence of back pain in the past 12 months was 39% in Homestead and 24% in Kankakee. Among Homestead participants, 35% experienced eye symptoms, while 31% reported skin symptoms. These symptoms were less prevalent among Kankakee participants (16% for both eye and skin symptoms). Specific areas of concern included back pain associated with heavy lifting and ladder work; eye and skin irritation associated with fertilizer application tasks and with working in fields during or after spraying of chemicals, especially early re-entry of sprayed fields; and skin irritation associated with a lack of access to hand-washing facilities. In both Kankakee and Homestead, better adherence to safety standards is needed, as well as greater efforts to implement solutions that are available to help prevent work-related musculoskeletal problems.	Journal of Agricultural Safety & Health	12	2	139-53	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	USA	hic
660	L. Chatzi, A. Alegakis, N. Tzanakis, N. Siafakas, M. Kogevinas and C. Lionis	Association of allergic rhinitis with pesticide use among grape farmers in Crete, Greece	2007	OBJECTIVE: To explore the association of allergic rhinitis with the use of pesticides among grape farmers in Crete. METHODS: A cross-sectional study of 120 grape farmers and 100 controls at the Malevisi region in Northern Crete was conducted. The protocol consisted of a questionnaire, skin prick tests for 16 common allergens, measurement of specific IgE antibodies against 8 allergens, and spirometry before and after bronchodilatation. RESULTS: Grape farmers who used pesticides had higher prevalence rates of allergic rhinitis symptoms (OR, 3.0; 95% CI, 1.4 to 6.2) compared with grape farmers who reported no current use of pesticides, and control subjects. Logistic regression models controlling for age, sex and smoking status showed that 6 of the 12 predefined groups of major pesticides were significantly related to allergic rhinitis symptoms. The highest risks were observed for paraquat and other bipyridyl herbicides (OR, 2.2; 95% CI, 1.0 to 4.8), dithiocarbamate fungicides (OR, 2.5; 95% CI, 1.1 to 5.3) and carbamate insecticides (OR, 3.0; 95% CI, 1.4 to 6.5). A factor analysis of pesticides used identified 3 distinct factors. The most common factor was that of multiple pesticide use that included 9 pesticides and was significantly associated with allergic rhinitis (OR, 1.5; 95% CI, 1.0 to 2.3). ORs were higher when allergic rhinitis was defined using both questionnaire data on symptoms and atopy. CONCLUSIONS: Occupational exposure to multiple agricultural chemicals could be related to allergic rhinitis in grape farmers.	Occupational & Environmental Medicine	64	6	417-21	Self-reported exposure			Cross-sectional	Pesticides in general	respiratory	medical test result	Greece	hic

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661	L. D. Mull and S. R. Kirkhorn	Child labor in Ghana cocoa production: focus upon agricultural tasks, ergonomic exposures, and associated injuries and illnesses	2005	OBJECTIVES: The goal of this study was to determine the occupational hazards experienced by children harvesting cocoa in western Ghana in order to design a vocational literacy life skills curriculum and radio social messaging campaign with a safety component to decrease hazardous work exposures in child agricultural work. METHODS: An observational analysis was conducted of children aged 9 through 17 based upon personal interviews of agricultural workers, focus groups, and direct observation of work practices and activities. Job site analysis incorporated task mapping, job hazard review, and a review of equipment and use of protective gear. RESULTS: Children and young people aged 9 through 17 are exposed to hazardous occupational exposures including strenuous work, sharp tools, and pesticides. Lack of training in proper safety practices and inadequate personal protective equipment were commonly noted. Injuries and illnesses included musculoskeletal disorders, sprains, strains, lacerations to the head, fractures, eye injuries, rashes, and coughing. CONCLUSION: Children working in cocoa harvesting are exposed to physical and chemical hazards without proper training or personal protective equipment. Unless safety interventions occur, there are potential long-term adverse health consequences.	Public Health Reports	120	6	649-55	Self-reported exposure	Expert case-by-case assessment		Cross-sectional	Pesticides in general	pesticide-related symptoms	self-reported	Ghana	lmic
662	L. E. B. Beane Freeman, M. R.; Blair, A.; Hoppin, J. A.; Sandler, D. P.; Lubin, J. H.; Dosemeci, M.; Lynch, C. F.; Knott, C.; Alavanja, M. C.	Cancer incidence among male pesticide applicators in the Agricultural Health Study cohort exposed to diazinon	2005	Little is known about the potential carcinogenicity associated with routine application of diazinon, a common organophosphate insecticide. The authors explored a possible association of diazinon exposure with cancer risk in the Agricultural Health Study, a prospective cohort of licensed pesticide applicators in Iowa and North Carolina enrolled in 1993-1997. A total of 23,106 male applicators provided information in a self-administered questionnaire. Among 4,961 applicators who reported using diazinon, 301 incident cancer cases were diagnosed during the follow-up period ending December 2002 compared with 968 cases among 18,145 participants who reported no use. Poisson regression was used to calculate rate ratios and 95% confidence intervals. Two quantitative exposure metrics were used: lifetime exposure days and intensity-weighted lifetime exposure days, a measure that incorporates probability of pesticide exposure with lifetime pesticide application frequency. When lifetime exposure days were used, increased risks for the highest tertile of exposure and significant tests for trend for lung cancer and leukemia were observed. No other cancer site showed an association with diazinon for the highest tertile of exposure. Because these results were based on small numbers, additional analyses are necessary as more cases accrue to clarify whether diazinon is associated with cancer risk in humans.	American Journal of Epidemiology	162	11	1070-9	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
663	L. E. B. Fleming, J. A.; Rudolph, M.; Hamilton, K.	Cancer incidence in a cohort of licensed pesticide applicators in Florida	1999	This study is a standardized incidence ratio (SIR) analysis of cancer incidence of licensed pesticide applicators in Florida, compared with that of Florida's general population. Through extensive data linkages, 33,658 applicators were assembled who had 1266 incident cancers and 279,397 person-years from January 1, 1975, to December 31, 1993. Disease risk from ethanol and tobacco use were significantly decreased. Among males, prostate cancer (SIR = 1.91; 95% confidence interval [CI], 1.72-2.13) and testicular cancer (SIR = 2.48; 95% CI, 1.57-3.72) were significantly elevated. No confirmed cases of soft tissue sarcoma (STS) were found, and the incidence of non-Hodgkin's lymphoma was not increased. There were few female applicators; nevertheless, cervical cancer incidence (SIR = 3.69; 95% CI, 1.84-6.61) was significantly increased, while the incidence of breast cancer was significantly decreased. Cancers that have been associated with estrogen disrupters were found in male, but not female, pesticide applicators. The lack of soft tissue sarcoma is at odds with prior literature associated with the use of phenoxy herbicides.	Journal of Occupational & Environmental Medicine	41	4	279-88	Job title			Cohort (prospective)	Job title	cancer	doctor-diagnosed	USA	hic
664	L. E. B. Fleming, J. A.; Rudolph, M.; Hamilton, K.	Mortality in a cohort of licensed pesticide applicators in Florida	1999	OBJECTIVES: Although the primary hazard to humans associated with pesticide exposure is acute poisoning, there has been considerable concern surrounding the possibility of cancer and other chronic health effects in humans. Given the huge volume of pesticides now used throughout the world, as well as environmental and food residue contamination leading to chronic low level exposure, the study of possible chronic human health effects is important. METHODS: This was a retrospective cohort study, analysed by general standardised mortality ratio (SMR) of licensed pesticide applicators in Florida compared with the general population of Florida. A cohort of 33,658 (10% female) licensed pesticide applicators assembled through extensive data linkages yielded 1874 deaths with 320,250 person-years from 1 January 1975 to 31 December 1993. RESULTS: The pesticide applicators were consistently and significantly healthier than the general population of Florida. As with many occupational cohorts, the risks of cardiovascular disease and of diseases associated with alcohol and tobacco use were significantly lower, even in the subpopulations--for example, men, women, and licence subcategories. Among male applicators, prostate cancer mortality (SMR 2.38 (95% confidence interval (95% CI) 1.83 to 3.04) was significantly increased. No cases of soft tissue sarcoma were confirmed in this cohort, and non-Hodgkin's lymphoma was not increased. The number of female applicators was small, as were the numbers of deaths. Mortality from cervical cancer and breast cancer was not increased. Additional subcohort and exposure analyses were performed. CONCLUSIONS: Consistent with previous publications on farmers but at odds with current theories about the protective effects of vitamin D, prostate cancer was increased in these pesticide applicators. Female breast cancer was not increased despite theories linking risk of breast cancer with exposure to oestrogen disruptors--such as the organochlorines. The lack of cases of soft tissue sarcoma is at odds with previous publications associating the use of the phenoxy herbicides with an increased risk of these cancers.	Occupational & Environmental Medicine	56	1	14-21	Job title			Cohort (retrospective)	Job title	mortality (all cause)	doctor-diagnosed	USA	hic
665	L. E. Charles, C. M. Burchfiel, D. Fekedulegn, J. K. Gu, H. Petrovitch, W. T. Sanderson, K. Masaki, B. L. Rodriguez, M. E. Andrew and G. W. Ross	Occupational exposure to pesticides, metals, and solvents: the impact on mortality rates in the Honolulu Heart Program	2010	OBJECTIVE: To investigate the impact of occupational exposure to pesticides, metals, and solvents on mortality. PARTICIPANTS: Middle-aged Japanese-American men (n = 7,540) who had participated in the Honolulu Heart Program during 1965-1968. METHODS: Industrial hygienists assessed participants' potential for exposure based on their primary job. Cumulative exposure scores were categorized as none, low, medium, and high. The underlying cause of death was ascertained by a physician panel. All associations were assessed using Cox proportional hazards models. RESULTS: A total of 4, 485 deaths occurred. Compared to no exposure, pesticide exposure was significantly associated with mortality from all causes, circulatory diseases, stroke, and all cancers. Results for all-cause mortality at the 0-yr lag after risk-factor adjustment were: Low, hazard ratio (HR) = 0.85, 95% confidence interval (CI)=0.68-1.08; medium, HR = 1.18, 95% CI = 1.01-1.37; and high, HR = 1.29, 95% CI = 1.06-1.57; trend, p=0.002. Exposure to metals and solvents was significantly associated with mortality from all causes, cancer, and respiratory disease, and exposure to solvents was additionally associated with mortality from circulatory disease. Associations were strongest at the 15-yr lag. CONCLUSIONS: Results show that occupational exposures to pesticides, metals, and solvents during mid-life are independently associated with increased mortality, and indicate potential importance of exposures that occurred approximately 15 years prior to death.	Work	37	2	205-15	Expert case-by-case assessment			Cohort (prospective)	Pesticides in general	mortality (all cause)	doctor-diagnosed	USA	hic

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666	L. E. Charles, C. M. Burchfiel, D. Fekedulegn, M. L. Kashon, G. W. Ross, H. Petrovitch and W. T. Sanderson	Occupational exposures and movement abnormalities among Japanese-American men: the Honolulu-Asia Aging Study	2006	OBJECTIVE: The authors analyzed data on 1,049 men aged 71-93 years (excluding those with prevalent Parkinson's disease and stroke) from the Honolulu Heart Program (1965-1968) and the Honolulu-Asia Aging Study (1991-1999) to determine whether occupational exposures to pesticides, solvents, metals, manganese, and mercury during middle age were associated with 14 movement abnormalities 25 years later. METHODS: Analyses of variance and multivariate logistic regression were used to assess associations of interest. RESULTS: After adjustment for age, BMI, cognitive functioning, smoking, alcohol drinking, education, and physical activity, there was a positive association between abnormal 'facial expression' and the highest exposure to metals [odds ratio (OR) = 2.62; 95% confidence interval (CI) = 1.35-5.11; trend, p = 0.02], and the highest exposure to mercury (OR = 1.91; 95% CI = 1.04-3.49; trend, p = 0.03). Age was positively associated with all movement abnormalities, and cognitive function, body mass index and physical activity were inversely associated with most movement abnormalities. CONCLUSION: Higher exposure to any metal, and specifically mercury, was associated with abnormal facial expression.	Neuroepidemiology	26	3	130-9	Expert case-by-case assessment			Cohort (prospective)	Pesticides in general	neurological	medical test result	USA	hic
667	L. E. Charles, C. M. Burchfiel, D. Fekedulegn, M. L. Kashon, G. W. Ross, W. T. Sanderson and H. Petrovitch	Occupational and other risk factors for hand-grip strength: the Honolulu-Asia Aging Study	2006	BACKGROUND: In certain occupations, including farm work, workers are exposed to hazardous substances, some of which are known to be toxic to the nervous system and may adversely affect muscle strength. Measurement of hand-grip strength may be useful for detecting neurotoxic exposure. METHODS: The authors studied 3522 participants of the Honolulu Heart Program and the Honolulu-Asia Aging Study to determine whether occupational exposures to pesticides, solvents, and metals assessed at exam I (1965-68) are associated with hand-grip strength at exam IV (1991-93) and change in hand-grip strength over 25 years. Correlation, analysis of variance and covariance, and linear regression were used to evaluate the associations. RESULTS: At exam IV, participants ranged in age from 71-93 years; mean hand-grip strength was 39.6 kg at exam I and 30.3 kg at exam IV. Over 25 years, the decline in hand-grip strength was an average of 8-9 kg for all exposures. Hand-grip strength was inversely associated with age and glucose but directly associated with cognitive function, BMI, and haemoglobin level. No other exposures were associated with hand-grip strength. CONCLUSION: This study did not provide evidence that occupational exposure to pesticides, solvents, and metals adversely affected hand-grip strength in this population, but confirmed other important associations with hand-grip strength.	Occupational & Environmental Medicine	63	12	820-7	Expert case-by-case assessment			Cohort (prospective)	Pesticides in general	muskuloskeletal	medical test result	USA	hic
668	L. E. Fleming, O. Gomez-Marin, D. Zheng, F. Ma and D. Lee	National Health Interview Survey mortality among US farmers and pesticide applicators	2003	BACKGROUND: The mortality experience of pesticide-exposed workers across the US has not been thoroughly studied. METHODS: Cox regression mortality analyses adjusted for the complex sample survey design were performed on mortality-linked 1986-1994 National Health Interview Survey (NHIS) data. RESULTS: Nine thousand four hundred seventy-one farmers and pesticide applicators with 571 deaths were compared to 438,228 other US workers with 11,992 deaths. Age-adjusted risk of accidental death, as well as cancers of the nervous and lymphatic/hematopoietic systems, was significantly elevated in male and female pesticide-exposed workers; breast, prostate, and testicular cancer mortality risks were not elevated. CONCLUSIONS: Compared to all other workers, farmers and pesticide applicators were at greater risk of accidental mortality. These pesticide-exposed workers were not at an increased risk of cancers possibly associated with exposure to estrogen analogue compounds, but were at an increased risk of hematopoietic and nervous system cancers. NHIS mortality follow-up represents an important occupational health surveillance instrument.	American Journal of Industrial Medicine	43	2	227-33	Registers			Cohort (prospective)	Job title	mortality (all cause)	doctor-diagnosed	USA	hic
669	L. E. Moore, L. Gold, P. A. Stewart, G. Gridley, J. R. Prince and S. H. Zahm	Parental occupational exposures and Ewing's sarcoma	2005	A case-control study of Ewing's sarcoma (ES) was conducted to search for occupational exposures associated with ES. The study consisted of 196 cases and 196 random-digit controls matched on geographical region, gender, ethnic origin and birth date. A questionnaire was administered to mothers of participants to obtain information on medical conditions, medications, and parental occupations during and after the index pregnancy. An occupational exposure expert coded jobs and industries for possible and probable exposure to selected occupational hazards. Risk of ES was increased with probable parental exposure to wood dusts during their usual occupation post pregnancy (odds ration [OR] = 3.2; 95% confidence interval [CI] = 1.1-9.2). Other exposures, including a priori suspected risk factors such as exposure to pesticides and farm animals, were not significantly associated with ES. A history of household pesticide extermination was associated with ES among boys aged 15 or younger (OR = 3.0; 95% CI = 1.1-8.1), but not among girls or older boys. Our results suggest that earlier reports of associations of ES with parental farm employment may have been describing risks associated with organic dusts encountered when working on a farm, rather than agricultural exposures or other farming related exposures.	International Journal of Cancer	114	3	472-8	Self-reported job history	Expert case-by-case assessment		Case-control	Job title	cancer	doctor-diagnosed	USA	hic
670	L. Elfman, C. Hogstedt, K. Engvall, E. Lampa and C. H. Lindh	Acute health effects on planters of conifer seedlings treated with insecticides	2009	OBJECTIVES: The aim of this study was to assess acute health effects on planters caused by planting conifer seedlings treated with two insecticides, with active ingredients imidacloprid and cypermethrin, in comparison with untreated seedlings. METHODS: The investigation was a double-blind crossover study, which included a follow-up of 19 planters over a 3-week period. During Week 1, the 19 planters handled untreated conifer seedlings while they planted imidacloprid- and cypermethrin-treated seedlings during study Week 2 and 3, respectively. Signs and symptoms of acute health effects were documented by a questionnaire, administered by the field staff, during these 3 weeks. Inflammation markers in the nasal mucous membrane were also measured as an objective test. Exposure to cypermethrin was further assessed by measuring 3-phenoxybenzoic acid (3-PBA) in urine. No validated biomarker was available to assess internal exposure to imidacloprid. RESULTS: No clear, acute adverse health effects could be found in planters during the week of exposure to conifer seedlings treated with imidacloprid (Merit Forest) or cypermethrin (Forester), as compared to during the week of planting untreated seedlings. During the week of cypermethrin exposure, the individuals had 3-PBA values that were 12-54% higher ($P < 0.05$), depending on the worker, than those observed during the untreated week. There were no statistically significant correlations between the raised levels of 3-PBA and self-reported health problems. These results have been obtained during planting in late summer/early autumn and with good use of protective clothing. CONCLUSIONS: No clear, acute adverse health effects could be found in planters after exposure to conifer seedlings treated with imidacloprid (Merit Forest) or cypermethrin (Forester), as compared with planting untreated seedlings. The metabolite, 3-PBA, was found in low levels in urine and was increased after exposure to cypermethrin. However, no clear relationships could be found between exposure and reported symptoms or between elevated 3-PBA levels and reported symptoms.	Annals of Occupational Hygiene	53	4	383-90	Biomonitoring (urine)			Cohort (prospective)	Specific active ingredient	pesticide-related symptoms	medical test result	Sweden	hic

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671	L. Fritschi and J. Siemiatycki	Lymphoma, myeloma and occupation: results of a case-control study	1996	The known risk factors for lymphoma and myeloma cannot account for the current incidence rates of these cancers, and there is increasing interest in exploring occupational causes. We present results regarding lymphoma and myeloma from a large case-control study of hundreds of occupational exposures and 19 cancer sites. We examine in more detail those exposures previously considered to be related to these cancers, as well as exposures which were strongly related in our initial analyses. Lymphoma was not associated in our data with exposure to solvents or pesticides, or employment in agriculture or wood-related occupations, although numbers of exposed cases were sometimes small. Hodgkin's lymphoma was associated with exposure to fabric dust, and non-Hodgkin's lymphoma was associated with exposure to copper dust, ammonia and a number of fabric and textile-related occupations and exposures. Employment as a sheet metal worker was associated with development of myeloma.	International Journal of Cancer	67	4	498-503	Self-reported job history	Expert case-by-case assessment		Case-control	Job title	cancer	doctor-diagnosed	Australia	hic
672	L. Fritschi, D. C. Glass, J. S. Tabrizi, J. E. Leavy and G. L. Ambrosini	Occupational risk factors for prostate cancer and benign prostatic hyperplasia: a case-control study in Western Australia	2007	OBJECTIVE: To assess the association of selected occupational exposures with risk of prostate cancer and with risk of benign prostatic hyperplasia (BPH). METHODS: This population-based case-control study recruited 606 men with a diagnosis of confirmed prostate cancer, 400 men who had undergone their first prostatectomy for BPH and 471 male controls randomly selected from the electoral roll between 1 August 2001 and 1 October 2002 in Western Australia. chi(2) tests and logistic regressions were used for univariate and multivariate analyses to investigate the association of the two outcomes with occupational exposure to pesticides, fertilisers, metals, wood dust, oils, diesel exhaust and polyaromatic hydrocarbons (PAHs). RESULTS: Exposure to toxic metals at a non-substantial level increased the risk of BPH (odds ratio (OR) 1.39, 95% confidence interval (CI) 1.1 to 1.84) and led to a non-significant excess risk of prostate cancer (OR 1.25, 95% CI 0.96 to 1.61). Non-significant excess risks were observed for prostate cancer after exposure to oils other than mineral oil (OR 1.54, 95% CI 0.95 to 2.51) and for BPH after exposure to PAHs (OR 1.20, 95% CI 0.91 to 1.58). A non-statistically significant protective effect for prostate cancer was seen after exposure to organophosphate pesticides (OR 0. 69, 95% CI 0.43 to 1.12). No other associations were found for either prostate cancer or BPH and no dose-response relationships were seen for the exposures investigated. CONCLUSIONS: These results do not provide evidence that any of the occupational factors examined are risk factors for either prostate cancer or BPH.	Occupational & Environmental Medicine	64	1	22037	Self-reported exposure	Self-reported job history		Case-control	Type of pesticide	cancer	doctor-diagnosed	Australia	hic
673	L. Fritschi, G. Benke, A. M. Hughes, A. Kricker, J. Turner, C. M. Vajdic, A. Grulich, S. Milliken, J. Kaldor and B. K. Armstrong	Occupational exposure to pesticides and risk of non-Hodgkin's lymphoma	2005	Pesticide exposure may be a risk factor for non-Hodgkin's lymphoma, but it is not certain which types of pesticides are involved. A population-based case-control study was undertaken in 2000-2001 using detailed methods of assessing occupational pesticide exposure. Cases with incident non-Hodgkin's lymphoma in two Australian states (n = 694) and controls (n = 694) were chosen from Australian electoral rolls. Logistic regression was used to estimate the risks of non-Hodgkin's lymphoma associated with exposure to subgroups of pesticides after adjustment for age, sex, ethnic origin, and residence. Approximately 10% of cases and controls had incurred pesticide exposure. Substantial exposure to any pesticide was associated with a trebling of the risk of non-Hodgkin's lymphoma (odds ratio = 3.09, 95% confidence interval: 1.42, 6.70). Subjects with substantial exposure to organochlorines, organophosphates, and "other pesticides" (all other pesticides excluding herbicides) and herbicides other than phenoxy herbicides had similarly increased risks, although the increase was statistically significant only for "other pesticides." None of the exposure metrics (probability, level, frequency, duration, or years of exposure) were associated with non-Hodgkin's lymphoma. Analyses of the major World Health Organization subtypes of non-Hodgkin's lymphoma suggested a stronger effect for follicular lymphoma. These increases in risk of non-Hodgkin's lymphoma with substantial occupational pesticide exposure are consistent with previous work.	American Journal of Epidemiology	162	9	849-57	Self-reported exposure			Case-control	Chemical class	cancer	doctor-diagnosed	Australia	hic
674	L. Fritschi, G. Benke, H. A. Risch, A. Schulte, P. M. Webb, D. C. Whiteman, J. Fawcett and R. E. Neale	Occupational exposure to N-nitrosamines and pesticides and risk of pancreatic cancer	2015	OBJECTIVES: Animal evidence shows that N-nitrosamines and similar xenobiotic compounds are pancreatic carcinogens. We aimed to determine whether occupational exposure to N-nitrosamines or to pesticides increases risk of pancreatic cancer development. METHODS: Participants (504 cases, 643 controls) in a population-based case-control study (The Queensland Pancreatic Cancer Study) provided data on demographic, medical and lifestyle factors and lifetime job histories. Specific questions were asked regarding work in rubber and leather industries, metalworking jobs and occupational or direct use of pesticides on animals or crops. An occupational hygienist reviewed this information (blind to case status) to assess likelihood of exposure to N-nitrosamines and pesticides, and estimated level and frequency of such exposures. RESULTS: No associations were found for risk of pancreatic cancer and occupational exposure to N-nitrosamines (OR=0.90, 95% CI 0.51 to 1.42) and no associations were seen with level or frequency of exposure. No associations were observed for ever exposure to pesticides in general (OR=0.90, 95% CI 0.61 to 1.33) or to any of the pesticide subgroups. Stratification by history of cigarette smoking did not change these results. CONCLUSIONS: This comprehensive analysis of a large case-control study does not support an association between occupational exposure to N-nitrosamines or pesticide use and risk of pancreatic cancer.	Occupational & Environmental Medicine	72	9	678-83	Self-reported job history	Expert case-by-case assessment		Case-control	Job title	cancer	doctor-diagnosed	Australia	hic
675	L. G. S. van Amelsvoort, J. J.; Tsai, S. P.; de Jong, G.; Kant, I.	Cancer mortality in workers exposed to dieldrin and aldrin: over 50 years of follow up	2009	OBJECTIVE: Dieldrin and aldrin, pesticides widely used until the 1970s, have been under suspicion of being carcinogenic. In this study, overall and cause-specific mortality was assessed in a cohort of 570 employees occupationally exposed to the pesticides dieldrin and aldrin to investigate the long-term health effects, in particular carcinogenic effects. METHODS: All of the employees worked in the production plants between January 1954 and January 1970 and were followed for cause-specific mortality until 30 April 2006. Based on dieldrin levels in blood samples taken from 343 workers during the exposure period, the total intake of dieldrin was estimated for each individual subjects in the cohort. The estimated total intake ranged from 11 to 7,755 mg of dieldrin, with an average of 737 mg. RESULTS: Two hundred and twenty-six workers had died before 30 April 2006 compared with an expected number of 327.3, giving a standardized mortality ratio (SMR) of 69.0 (95% confidence interval (CI): 60.3-78.7). Overall cancer mortality was also significantly lower than expected (SMR: 76.4, 95% CI: 60.8-94.9). Also, none of the specific cancer sites showed a significant excess mortality and no association between exposure level and cancer mortality was found. CONCLUSION: The results from this study support findings from other epidemiological and recent animal studies concluding that dieldrin and aldrin are not likely human carcinogens.	International Archives of Occupational & Environmental Health	82	2	217-25	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	mortality (all cause)	doctor-diagnosed	Denmark	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
676	L. Gaspari, F. Paris, C. Jandel, N. Kalfa, M. Orsini, J. P. Daures and C. Sultan	Prenatal environmental risk factors for genital malformations in a population of 1442 French male newborns: a nested case-control study	2011	BACKGROUND: Over the past decades, an increasing trend in male external genital malformations such as cryptorchidism and hypospadias has led to the suspicion that environmental chemicals are detrimental to male fetal sexual development. Several environmental pollutants, including organochlorine pesticides, polychlorinated biphenyls, bisphenol A, phthalates, dioxins and furans have estrogenic and anti-androgenic activity and are thus considered as endocrine-disrupting chemicals (EDCs). Since male sex differentiation is critically dependent on the normal production and action of androgens during fetal life, EDCs may be able to alter normal male sex differentiation. OBJECTIVE: The objective of this study was to determine the incidence of external genital malformations in a population of full-term newborn males in southern France. We also performed a case-control study to identify the risk factors for male external genital malformations, with a focus on parental occupational exposure to EDCs. METHODS: Over a 16-month period, 1615 full-term newborn males with a birth weight above 2500 g were registered on a level-1 maternity ward, and the same pediatrician systematically examined 1442 of them (89%) for cryptorchidism, hypospadias and micropenis. For every male newborn with genital malformation, we enrolled nearly two males matched for age, parity and term. All parents of the case and control newborns were interviewed about pregnancy aspects, personal characteristics, lifestyle and their occupational exposure to EDCs using a detailed questionnaire. RESULTS We report 39 cases of genital malformation (2.70%), with 18 cases of cryptorchidism (1.25%), 14 of hypospadias (0.97%), 5 of micropenis (0.35%) and 2 of 46,XY disorders of sexual differentiation (DSD; 0.14%). We observed a significant relationship between newborn cryptorchidism, hypospadias or micropenis and parental occupational exposure to pesticides [odds ratio (OR) = 4.41; 95% confidence interval (95% CI), 1.21-16.00]. Familial clustering for male external genital malformations (OR = 7.25; 95% CI, 0.70-74.30) and medications taken by mothers during pregnancy (OR = 5.87; 95% CI, 0.93-37.00) were associated with the risk of cryptorchidism, hypospadias and micropenis, although the association was not statistically significant. CONCLUSIONS: Although the causes of male genital malformation are multifactorial, our data support the hypothesis that prenatal contamination by pesticides may be a potential risk factor for newborn male external genital malformation and it should thus be routinely investigated in all undervirilized newborn males.	Human Reproduction	26	11	3155-62	Self-reported exposure			Case-control	Pesticides in general	offspring	doctor-diagnosed	France	hic
677	L. H. D. R. Schinasi, A. J.; Ray, R. M.; Edlefsen, K. L.; Parks, C. G.; Howard, B. V.; Meliker, J. R.; Bonner, M. R.; Wallace, R. B.; LaCroix, A. Z.	Insecticide exposure and farm history in relation to risk of lymphomas and leukemias in the Women's Health Initiative observational study cohort	2015	PURPOSE: Relationships of farm history and insecticide exposure at home or work with lymphohematopoietic (LH) neoplasm risk were investigated in a large prospective cohort of US women. METHODS: In questionnaires, women self-reported history living or working on a farm, personally mixing or applying insecticides, insecticide application in the home or workplace by a commercial service, and treating pets with insecticides. Relationships with non-Hodgkin lymphoma (NHL), chronic lymphocytic leukemia/small lymphocytic lymphoma (CLL/SLL), diffuse large B-cell lymphoma (DLBCL), follicular lymphoma, plasma cell neoplasms, and myeloid leukemia were investigated using Cox proportional hazard models. Age and farming history were explored as effect modifiers. RESULTS: The analysis included 76,493 women and 822 NHL cases. Women who ever lived or worked on a farm had 1.12 times the risk of NHL (95% confidence interval [CI] = 0.95-1.32) compared to those who did not. Women who reported that a commercial service ever applied insecticides in their immediate surroundings had 65% higher risk of CLL/SLL (95% CI = 1.15-2.38). Women aged less than 65 years who ever applied insecticides had 87% higher risk of DLBCL (95% CI = 1.13-3.09). CONCLUSIONS: Insecticide exposures may contribute to risk of CLL/SLL and DLBCL. Future studies should examine relationships of LH subtypes with specific types of household insecticides.	Annals of Epidemiology	25	11	803-10	Self-reported exposure			Cohort (prospective)	Type of pesticide	cancer	doctor-diagnosed	USA	hic
678	L. H. Kachuri, M. A.; MacLeod, J. S.; Tjepkema, M.; Peters, P. A.; Demers, P. A.	Cancer risks in a population-based study of 70,570 agricultural workers: results from the Canadian census health and Environment cohort (CanCHEC)	2017	BACKGROUND: Agricultural workers may be exposed to potential carcinogens including pesticides, sensitizing agents and solar radiation. Previous studies indicate increased risks of hematopoietic cancers and decreased risks at other sites, possibly due to differences in lifestyle or risk behaviours. We present findings from CanCHEC (Canadian Census Health and Environment Cohort), the largest national population-based cohort of agricultural workers. METHODS: Statistics Canada created the cohort using deterministic and probabilistic linkage of the 1991 Canadian Long Form Census to National Cancer Registry records for 1992-2010. Self-reported occupations were coded using the Standard Occupational Classification (1991) system. Analyses were restricted to employed persons aged 25-74 years at baseline (N = 2,051,315), with follow-up until December 31, 2010. Hazard ratios (HR) and 95% confidence intervals (CI) were modeled using Cox proportional hazards for all workers in agricultural occupations (n = 70,570; 70.8% male), stratified by sex, and adjusted for age at cohort entry, province of residence, and highest level of education. RESULTS: A total of 9515 incident cancer cases (7295 in males) occurred in agricultural workers. Among men, increased risks were observed for non-Hodgkin lymphoma (HR = 1.10, 95% CI = 1.00-1.21), prostate (HR = 1.11, 95% CI = 1.06-1.16), melanoma (HR = 1.15, 95% CI = 1.02-1.31), and lip cancer (HR = 2.14, 95% CI = 1.70-2.70). Decreased risks in males were observed for lung, larynx, and liver cancers. Among female agricultural workers there was an increased risk of pancreatic cancer (HR = 1.36, 95% CI = 1.07-1.72). Increased risks of melanoma (HR = 1.79, 95% CI = 1.17-2.73), leukemia (HR = 2.01, 95% CI = 1.24-3.25) and multiple myeloma (HR = 2.25, 95% CI = 1.16-4.37) were observed in a subset of female crop farmers. CONCLUSIONS: Exposure to pesticides may have contributed to increased risks of hematopoietic cancers, while increased risks of lip cancer and melanoma may be attributed to sun exposure. The array of decreased risks suggests reduced smoking and alcohol consumption in this occupational group compared to the general population.	BMC Cancer	17	1	343	Job title			NA	Job title	cancer	doctor-diagnosed	Canada	hic
679	L. Hardell, A. Nasman, C. G. Ohlson and M. Fredrikson	Case-control study on risk factors for testicular cancer	1998	Occupational exposures were assessed in a case-control study on testicular cancer using self administered questionnaires. Answers were obtained for 148 (91%) cases and 314 (87%) controls. Of the cases 101 had seminoma and 47 had embryonal testicular cancer. Occupational plastics work yielded odds ratio (OR) 2.9 with 95% confidence interval (CI) 1.3-6.5. Increased risk was found for embryonal cancer regarding farming (OR 3.1; CI 1.03-9.1) and contact with farm animals (OR 3.3; CI 1.00-10.9), but not for seminoma. For all testicular cancer exposure to insects repellents, mostly containing N,N-diethyl-m-toluamide (DEET) gave OR 1.7; CI 1.03-2.8, with a dose-response effect. Somewhat increased risks were found for amateur radio operators (OR 2.2; CI 0.7-6.6), work with radar equipment (OR 2.0; CI 0.3-14.2) and engineers in electronics and telecommunication industry (OR 2.3; CI 0.8-6.7) based on few exposed subjects, however. Video display unit work gave OR 1.5; CI 0.98-2.3 and for exposure 480 working days (median number) the risk increased further to OR 1.8; CI 1.1-3.2. Because of low numbers of exposed subjects in some calculations some of these results might be spurious and need to be further studied.	International Journal of Oncology	13	6	1299-303	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Sweden	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
680	L. Hourani and S. Hilton	Occupational and environmental exposure correlates of adverse live-birth outcomes among 1032 US Navy women	2000	The integration of women into non-traditional military occupations raises questions concerning the impact of such jobs on women's reproductive health. This study examines the extent to which US Navy women in their reproductive years report exposures to potential occupational and environmental hazards, and the degree to which such exposures are associated with self-reported adverse live-birth outcomes. Data from a survey of pregnant Navy women provided both maternal and paternal exposure information on more than 1000 active-duty women. Self-reported exposures to heavy metals, pesticides, petroleum products, and other chemicals were associated with adverse live-birth outcomes at the bivariate level. Only a father's exposure to pesticides at work predicted an adverse live-birth outcome (preterm delivery) in multivariate models. Maternal occupational exposures may exert their influence through maternal health and/or pregnancy complications and may act as mediators of health-reproductive outcome relationships.	Journal of Occupational & Environmental Medicine	42	12	1156-65	Self-reported exposure			Cross-sectional	Pesticides in general	offspring	self-reported	USA	hic
681	L. I. Dharmawardene	Pesticide poisoning among farmers in a health area in Sri Lanka	1994	OBJECTIVES: 1. To determine the incidence and the prevalence of pesticide poisoning in Kelaniya Medical Officer of Health (MOH) area. 2. To establish causes of pesticide poisoning in the community. DESIGN: Questionnaire survey based on 10% cluster sample of agricultural workers. SETTING: Kelaniya MOH area situated 10 km north-east of Colombo, during April 1986 to May 1987. FUNDING: Natural Resources Energy and Science Authority of Sri Lanka. RESULTS: The percentage of pesticide users ever poisoned in the past was 21.7% and during the year before the study was 7.5%. CONCLUSION: Lack of knowledge on pesticides and inability to afford protective clothing are the major factors contributing to pesticide poisoning.	Ceylon Medical Journal	39	2	101-3	Self-reported exposure			Cross-sectional	Pesticides in general	pesticide-related illness	self-reported	Sri Lanka	lmic
682	L. J. Bloemen, J. S. Mandel, G. G. Bond, A. F. Pollock, R. P. Vitek and R. R. Cook	An update of mortality among chemical workers potentially exposed to the herbicide 2,4-dichlorophenoxyacetic acid and its derivatives	1993	Four years of additional mortality follow-up through 1986 are reported for a previously studied cohort of 878 chemical workers who were potentially exposed to 2,4-dichlorophenoxyacetic acid (2,4-D) and its derivatives between 1945 and 1983. Observed mortality was compared with expected levels based on death rates of the US population and of 36,804 "unexposed" workers from the same manufacturing location. Non-Hodgkin's lymphoma (NHL) was a particular focus of the study because of a suggested association with 2,4-D exposure in some case-control studies. For the total observation period, the standardized mortality ratios for all causes and for malignant neoplasms were 92 and 91, respectively. Analyses using the internal comparison group yielded virtually identical results. The initial study had found two deaths from NHL, both of which occurred under circumstances (ie, short latency and modest exposure) which made it less plausible that they were related to 2,4-D exposure. No new deaths from NHL were observed in the extended follow-up period and mortality for this cause showed a nonstatistically significant excess (standardized mortality ratio, 196; 95% confidence interval 24 to 708) for the total observation period. Analyses by production area, and by two different measures of exposure, combined with two different approaches to account for latency, did not show patterns suggestive of a causal relationship between exposure to 2,4-D or its derivatives and any particular cause of death.	Journal of Occupational Medicine	35	12	1208-12	Registers	Algorithm/model		Cohort (prospective)	Job title	mortality (all cause)	doctor-diagnosed	USA	hic
683	L. K. Kachuri, D. , B. , S. , P. , M. , D. , P. and H.	Multiple pesticide exposures and the risk of multiple myeloma in Canadian men	2013	Objectives Multiple myeloma (MM) has been linked to certain agricultural exposures, including pesticides, however the effects of exposure to multiple pesticides have not been explored. This analysis investigated the association between self-reported use of multiple pesticides and MM risk. Commonly used pesticide combinations and interactive effects were also assessed. Methods A frequency matched population-based case-control study was conducted among men in 6 Canadian provinces between 1991 and 1994. Data from 342 MM cases and 1506 controls were analysed using logistic regression to calculate odds ratios (OR) and 95% confidence intervals (CI). Pesticides were grouped by type, chemical class and carcinogenicity. Carcinogenic probability values were created using evaluations from the International Agency for Research on Cancer and U. S. Environmental Protection Agency. Regression models were adjusted for age, province of residence, use of proxy respondents, smoking, and selected medical history variables. Trends were examined using ordinal variables. Commonly used pesticide combinations were assessed for interaction on the additive scale using the interaction contrast ratio (ICR). Results Multiple pesticide use was not associated with monotonically increasing odds of MM, although positive trends were observed for <U+201A><U+00C4><U+00FA>probably<U+201A><U+00C4><U+00F9> carcinogenic pesticides (ptrend = 0.01), insecticides (ptrend = 0.07), and fungicides (ptrend = 0.05). Higher odds of MM were observed among men who reported using at least one carbamate pesticide (OR = 1.99, 95% CI: 1.19-3.33), one phenoxyherbicide (OR = 1.60, 95% CI: 1.11-2.30), 3 or more <U+201A><U+00C4><U+00FA>probably<U+201A><U+00C4><U+00F9> carcinogenic pesticides (OR = 2.14, 95% CI: 1.01-4.52), and 3 or more organochlorines (OR = 2.26, 95% CI: 1.07-4.78). Investigating commonly used pesticide combinations, revealed increased odds among men who used both chlordane and mecoprop (OR = 2.18, 95% CI: 1.12-4.27; ICR = 0.63). Conclusions Focusing on multiple pesticides is important because this more accurately reflects how exposures occur in occupational settings. Although the overall pattern of results was complex, excess risks observed for certain pesticide types and chemical classes suggest these may be MM risk factors.	Occupational and Environmental Medicine	70	NA	NA	Self-reported exposure			Case-control	Type of pesticide	cancer	doctor-diagnosed	Canada	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
684	L. K. Kachuri, Harris; , Peters; , Tjepkema; , Demers	Cancer risks among Canadian agricultural workers in a population-based cohort	2013	Objectives Agricultural workers may be exposed to several potential carcinogens including pesticides, sensitising agents and solar radiation. Previous studies have shown increased risks of hematopoietic cancers in this population, as well as reduced risks of other types of cancer, possibly due to differences in lifestyle and risk behaviours. This study aimed to estimate cancer risks among agricultural workers in a national population-based cohort. Methods The 1991 Canadian Census Cohort was created by Statistics Canada through probabilistic linkage between the 1991 Canadian Census (long form) to national cancer registry records from 1969-2003. Occupations were self-reported. Analyses were restricted to persons aged 74 and under who reported working at baseline (1991, total cohort N = 2050300). Follow-up continued until December 31, 2003. Hazard ratios (HR) and corresponding 95% confidence intervals were estimated by Cox proportional hazards modelling for all workers in agricultural occupations (N = 70300; 49000 male), stratified by sex and adjusted for age at cohort entry and province of residence. Results There were 5437 cancer cases among agricultural workers. Among men, an increased risk of multiple myeloma was observed (HR: 1.38, 1.04-1.83), as well as oral cancer (HR: 1.28, 1.09-1.51), specifically lip cancer (HR: 2.94, 2.26-3.83), but had decreased risks of lung, esophageal, and liver cancers. Female agricultural workers were at increased risk of pancreatic cancer (HR: 1.44, 1.05-1.99), but decreased risk of lung, breast and cervix cancer. Higher risks of rectal cancer were also observed specifically among female farm workers and labourers (HR: 1.44, 1.02-2.04). Conclusions Exposure to pesticides may have contributed to the increased risks of multiple myeloma in men and pancreatic cancer in women. Increased risks of lip cancer in men could be attributed to sun exposure in agricultural workers while the array of decreased risks suggests reduced smoking and alcohol consumption in agricultural workers compared to the general population.	Occupational and Environmental Medicine	70	NA	NA	Self-reported job history			Cohort (prospective)	Job title	cancer	doctor-diagnosed	Canada	hic
685	L. K. L. Dennis, C. F.; Sandler, D. P.; Alavanja, M. C.	Pesticide use and cutaneous melanoma in pesticide applicators in the agricultural heath study	2010	BACKGROUND: Melanoma rates continue to increase; however, few risk factors other than sun sensitivity and ultraviolet radiation (including sun exposure) have been identified. Although studies of farmers have shown an excess risk of melanoma and other skin cancers, it is unclear how much of this is related to sun exposure compared with other agricultural exposures. METHODS: We examined dose-response relationships for 50 agricultural pesticides and cutaneous melanoma incidence in the Agricultural Health Study cohort of licensed pesticide applicators, along with ever use of older pesticides that contain arsenic. Logistic regression was used to examine odds ratios (ORs) and 95% confidence intervals (CIs) associated with pesticide exposure adjusted for age, sex, and other potential confounders. RESULTS: We found significant associations between cutaneous melanoma and maneb/mancozeb (>or= 63 exposure days: OR = 2.4; 95% CI, 1.2-4.9; trend p = 0.006), parathion (>or= 56 exposure days: OR = 2.4; 95% CI, 1.3-4.4; trend p = 0.003), and carbaryl (>or= 56 exposure days: OR = 1.7; 95% CI, 1.1-2.5; trend p = 0.013). Other associations with benomyl and ever use of arsenical pesticides were also suggested. CONCLUSIONS: Most previous melanoma literature has focused on host factors and sun exposure. Our research shows an association between several pesticides and melanoma, providing support for the hypotheses that agricultural chemicals may be another important source of melanoma risk.	Environmental Health Perspectives	118	6	812-7	Self-reported exposure	Algorithm/model		NA	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
686	L. K. Tarvainen, P.; Kauppinen, T.; Pukkala, E.	Cancer of the mouth and pharynx, occupation and exposure to chemical agents in Finland [in 1971-95]	2008	The objective of this article was to find associations between cancer of the mouth and pharynx, occupation and chemical exposure. A cohort of Finns born between 1906 and 1945 was followed-up for 46.8 (21.5 in males and 25.3 in females) million person-years during 1971-95. Incident cases of cancer of the mouth and pharynx (n = 2,708) were identified in a record linkage with the Finnish Cancer Registry. The Census occupations in 1970 were converted to chemical exposures with a job-exposure matrix (FINJEM). Cumulative exposure (CE) was calculated as the product of prevalence, level and duration of the exposure. Standardized incidence ratio (SIR) was calculated for each of the 393 occupations, and for CE categories of the 43 chemical agents, using total Finnish population as reference. Relative risks (RR) comparing various CE-categories with unexposed ones were defined for selected agents by Poisson regression analysis. Elevated SIRs were observed among lawyers, authors, journalists, performing artists, musicians, electronics and telefitters, painters (building), building hands, dockers, unskilled labourers and hotel porters in males and private secretaries, dressmakers, shoemakers and cobblers, waiters, pursers and stewardesses in females. The multivariate analyses showed high RRs for high exposure to aliphatic and alicyclic hydrocarbons, pesticides and alcohol. In conclusion, occupations with high SIRs were mostly the ones with high consumption of alcohol. Exposure to solvents and possibly to pesticides, engine exhaust, textile dust and leather dust may increase the risk of cancer of mouth and pharynx.	International Journal of Cancer	123	3	653-9	Job exposure matrix			Cohort (prospective)	Type of pesticide	cancer	doctor-diagnosed	Finland	hic
687	L. L. Hou, W. J.; Rusiecki, J.; Hoppin, J. A.; Blair, A.; Bonner, M. R.; Lubin, J. H.; Samanic, C.; Sandler, D. P.; Dosemeci, M.; Alavanja, M. C.	Pendimethalin exposure and cancer incidence among pesticide applicators	2006	BACKGROUND: Pendimethalin, a widely used herbicide, has been classified as a group C possible human carcinogen by the U.S. Environmental Protection Agency. We evaluated the incidence of cancer in relation to reported pendimethelin use among pesticide applicators in the Agricultural Health Study, a prospective cohort of licensed pesticide applicators in Iowa and North Carolina. METHODS: Information on pesticide use came from two questionnaires (enrollment and take-home). The present analysis includes 9089 pendimethalin-exposed and 15,285 nonpendimethalin-exposed pesticide applicators with complete information on pendimethalin use and covariates from a take-home questionnaire. We conducted Poisson regression analyses to evaluate the association of pendimethalin exposure with cancer incidence (mean follow-up = 7.5 years) using two exposure metrics: tertiles of lifetime days of exposure and tertiles of intensity-weighted lifetime days of exposure. RESULTS: Overall cancer incidence did not increase with increasing lifetime pendimethalin use, and there was no clear evidence of an association between pendimethalin use and risks for specific cancers. The risk for rectal cancer rose with increasing lifetime pendimethalin exposure when using nonexposed as the reference (rate ratio = 4.3; 95% confidence interval = 1.5-12.7 for the highest exposed subjects; P for trend = 0.007), but the association was attenuated when using the low exposed as the referent group (P for trend = 0.08). Similar patterns for rectal cancer were observed when using intensity-weighted exposure-days. The number of rectal cancer cases among the pendimethalin-exposed was small (n = 19). There was some evidence for an elevated risk for lung cancer, but the excess occurred only in the highest exposure category for lifetime pendimethalin exposure. The trends for lung cancer risk were inconsistent for different exposure metrics. CONCLUSIONS: We did not find a clear association of lifetime pendimethalin exposure either with overall cancer incidence or with specific cancer sites.	Epidemiology	17	3	302-7	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
688	L. L. Kenborg, C. F.; Lander, F.; Olsen, J. H.	Parkinson's disease among gardeners exposed to pesticides--a Danish cohort study	2012	OBJECTIVE: Several studies have found positive associations between exposure to pesticides and Parkinson's disease. As Danish gardeners have had frequent, intensive exposure to pesticides, the aim of this study was to investigate their risk for Parkinson's disease. METHODS: The cohort was comprised of 3124 male members of the Danish Union of Gardeners on 1 April 1975. Hospital register data were used to follow them for a primary diagnosis of Parkinson's disease during 1977-2008 and to calculate standardized hospitalization rate ratios (SHR) for this disease among gardeners and the general Danish population for comparison. Data from the Danish Cancer Registry were used to calculate standardized incidence rate ratios (SIR) for smoking-related cancers among gardeners and the general population. RESULTS: The SHR for Parkinson's disease among gardeners was close to that of the general population [1.14, 95% confidence interval (95% CI) 0.76-1.65]. In a birth cohort analysis, a downward trend was observed, with the highest risk among gardeners born before 1915 (SHR 1.55, 95% CI 0.77-2.77). The SIR for smoking-related cancers did not differ from that of the general population. CONCLUSION: The results indicate a weak but dose-related association between exposure to pesticides and risk for Parkinson's disease; however, the results were based on 28 cases and the possibility of no association cannot be ruled out.	Scandinavian Journal of Work, Environment & Health	38	1	23986	Job title			Cohort (prospective)	Job title	neurological	doctor-diagnosed	Denmark	hic
689	L. L. T. Strong, B.; Coronado, G. D.; Griffith, W. C.; Vigoren, E. M.; Islas, I.	Health symptoms and exposure to organophosphate pesticides in farmworkers	2004	BACKGROUND: Few studies have examined the relationship between reported health symptoms and exposure to organophosphate (OP) pesticides. METHODS: Fisher's exact test was used to assess the relationship between self-reported health symptoms and indicators of exposure to OP pesticides in 211 farmworkers in Eastern Washington. RESULTS: The health symptoms most commonly reported included headaches (50%), burning eyes (39%), pain in muscles, joints, or bones (35%), a rash or itchy skin (25%), and blurred vision (23%). Exposure to pesticides was prevalent. The proportion of detectable samples of various pesticide residues in house and vehicle dust was weakly associated with reporting certain health symptoms, particularly burning eyes and shortness of breath. No significant associations were found between reporting health symptoms and the proportion of detectable urinary pesticide metabolites. CONCLUSIONS: Certain self-reported health symptoms in farmworkers may be associated with indicators of exposure to pesticides. Longitudinal studies with more precise health symptom data are needed to explore this relationship further.	American Journal of Industrial Medicine	46	6	599-606	Self-reported exposure	Biomonitoring (urine)		Cross-sectional	Chemical class	pesticide-related symptoms	self-reported	USA	hic
690	L. London, V. Nell, M. L. Thompson and J. E. Myers	Effects of long-term organophosphate exposures on neurological symptoms, vibration sense and tremor among South African farm workers	1998	OBJECTIVES: This study assessed the relationship between long-term exposure to organophosphate insecticides and neurological symptoms, vibration sense, and motor tremor after control for the effect of past poisoning and acute exposure. METHODS: This cross-sectional study included 164 pesticide applicators and 83 nonspraying reference workers on deciduous fruit farms. The workers were tested on the Vibratron II, on tests of dynamic and static tremor, and for a set of neurological and "dummy" symptoms. Exposure was derived with the use of a job-exposure matrix for pesticides in agriculture. RESULTS: Compared with nonapplicators, current applicators reported significantly more dizziness, sleepiness, and headache and had a higher overall neurological symptom score. This association remained statistically significant after multiple logistic regression analyses controlling for a range of confounders and effect modifiers [odds ratio (OR) 2.25, for current applicators having high neurological score, 95% confidence interval (95% CI) 1.15-4.39]. The average lifetime intensity of organophosphate exposure was nonsignificantly associated with both neurological (OR 1.98, 95% CI 0.49-7.94) and "dummy" symptoms (OR 2.37, 95% CI 0.54-10.35). Previous pesticide poisoning was significantly associated with the neurological scores (OR 4.08, 95% CI 1.48-11.22) but not with the "dummy" symptoms. Vibration sense outcomes were associated with age and height, but not with the organophosphate exposure measures. In the multiple linear regression modeling for tremor intensity in the dominant hand, recent organophosphate exposure in the past 10 days was a significant predictor (partial correlation coefficient = 0.04), but none of the long-term organophosphate exposure measures were significant. CONCLUSIONS: Strong evidence was found for an association between symptom outcomes and past organophosphate poisoning and between symptom outcomes and current spray activity. In contrast to symptoms, there was no association between either past poisoning or current spray activity and vibration sense or tremor outcome. Long-term organophosphate exposure did not appear to predict symptoms, vibration sense, or tremor outcome.	Scandinavian Journal of Work, Environment & Health	24	1	18-29	Job exposure matrix			Cross-sectional	Chemical class	neurological	self-reported	South Africa	umic
691	L. London, V. Nell, M. L. Thompson and J. F. Myers	Health status among farm workers in the Western Cape--collateral evidence from a study of occupational hazards	1998	MOTIVATION: Farm workers are a marginalised occupational group whose poor living and working conditions may place them at increased risk for occupational and non-occupational morbidity and mortality. Research into the health status of farm workers has been neglected in the past. AIMS AND OBJECTIVES: As part of an investigation into the neurological and neurobehavioural effects of exposure to organophosphate insecticides, this study describes the demographics, life histories, risk factors for chronic illness and selected indicators of general health status among a group of farm workers in the Western Cape. STUDY DESIGN: Cross-sectional study conducted in the deciduous fruit farming industry in 1993. SUBJECTS: 164 pesticide applicators and 83 non-spraying controls (all men) from 73 farms, frequency matched for age and education. MEASUREMENTS: A structured questionnaire, venous blood sample for serum and erythrocyte cholinesterase, albumin, gamma glutamyl transferase and haemoglobin assessment, height and weight measurement. RESULTS: Most farm workers were children of farm workers and had lived and worked on farms for most of their lives. The study found substantial levels of illiteracy (21-44%, depending on the definition) and innumeracy (4%) and evidence of a significant morbidity burden: high levels of alcohol intake and ongoing reported application of the 'dop' system, high levels of head injury (70% of subjects) and evidence of substantial adult undernutrition. Protective equipment was relatively well distributed and used, although certain work activities (such as acting as a human marker) continue to pose substantial exposure hazards. There were no differences in respect of cholinesterase levels between spray applicators and controls, although past poisoning was reported by 9% of subjects. CONCLUSION: Farm workers appear to be a closed community with a high disease burden. Their health needs pose substantial challenges to the public health authorities.	South African Medical Journal. Suid-Afrikaanse Tydskrif Vir Geneeskunde	88	9	1096-101	Job title			Cross-sectional	Job title	NA	self-reported	South Africa	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
692	L. Lopez-Carillo and M. Lopez-Cervantes	Effect of exposure to organophosphate pesticides on serum cholinesterase levels	1993	In this paper are reported the effects of organophosphate pesticide exposure. Agricultural workers were compared with an age- and sex-matched control group selected from the general population. A significant difference was detected (Student's t = 1.99, p = .05) between the median activity levels of serum cholinesterase in agricultural workers at the end of the work day (mean 4.44, 95% CI = 4.12-4.77), compared with those in the control group (mean = 4.85, 95% CI = 4.57-5.13). The decrease in cholinesterase activity, measured at the beginning (mean = 4.70, 95% CI = 4.38-5.02) and end of the work day, was very significant (paired t = 2.70, p = .01). An interaction was identified between the type of work and the worker's age. Younger workers tended to perform more dangerous activities, and they experienced a greater decrease in cholinesterase activity. This study indicates that subclinical intoxication of agricultural workers, by pesticides, is occurring in Mexico and indicates the need for primary prevention programs that address occupational contact with such substances.	Archives of Environmental Health	48	5	359-63	Job title			Cohort (prospective)	Job title	neurological	medical test result	Mexico	umic
693	L. Lv, G. Lin, X. Gao, C. Wu, J. Dai, Y. Yang, H. Zou, H. Sun, M. Gu, X. Chen, H. Fu and L. Bao	Case-control study of risk factors of myelodysplastic syndromes according to World Health Organization classification in a Chinese population	2011	Risk factors of mydelodysplastic syndromes (MDS) remain largely unknown. We conducted a hospital-based case-control study consisting of 403 newly diagnosed MDS patients according to World Health Organization classification and 806 individually gender and age-matched patient controls from 27 major hospitals in Shanghai, China, to examine relation of lifestyle, environmental, and occupational factors to risk of MDS. The study showed that all MDS (all subtypes combined) risk factors included anti tuberculosis drugs [odds ratio (OR)(adj) = 3.15; 95% confidence interval (CI) = 1.22-8.12] as an independent risk factor, benzene (OR(adj) = 3.73; 95% CI = 1.32-10.51), hair dye use (OR = 1.46; 95% CI = 1.03-2.07), new building and renovations (OR = 1.69; 95% CI = 1.11-2.00), pesticides (OR = 2.16; 95% CI = 1.22-3.82), and herbicides (OR = 5.33; 95% CI = 1.41-20.10) as relative risk factors. Risk factors of MDS subtype refractory cytopenia with multiple dysplasia (RCMD) were benzene (OR(adj) = 5.99; 95% CI = 1.19-30.16) and gasoline (OR(adj) = 11.44; 95% CI = 1.31-100.03) as independent risk factors, and traditional Chinese medicines (OR = 2.17; 95% CI = 1.15-4.07), pesticides (OR = 2.92; 95% CI = 1.37-6.25), and herbicides (OR = 12.00; 95% CI = 1.44-99.67) as relative risk factors. Smoking tobacco was significantly associated with refractory anemia with excess of blasts (RAEB) (OR(adj) = 2.43; 95% CI = 1.02-5.77). Education is shown as an independent protective factor against all MDS (OR(adj) = 0.90; 95% CI = 0.83-0.99) and RCMD (OR(adj) = 0.89; 95% CI = 0.79-0.99). These findings suggest that multiple modifiable behavioral, environmental, and occupational factors play a role in MDS etiology, and various MDS subtypes may have different susceptibility.	American Journal of Hematology	86	2	163-9	Self-reported exposure			Case-control	Type of pesticide	cancer	doctor-diagnosed	China	umic
694	L. M. B. Kreuziger and V. A. Morrison	The impact of agent orange exposure on presentation and prognosis of patients with chronic lymphocytic leukemia (cll): An exploratory analysis	2012	Background: From 1962-1971, 19 million gallons of Agent Orange (AO) and other herbicides were sprayed in South Vietnam and Cambodia to destroy dense jungle and crops used to conceal and feed enemy troops. In 2004, the Department of Veterans Affairs added chronic lymphocytic leukemia (CLL) to the list of Veterans Diseases Associated with Agent Orange, based upon data from agricultural exposure suggesting a causative association. In our retrospective cohort study, we evaluated if Agent Orange exposure was associated with an altered prognosis, time to treatment, or overall survival in veterans with newly diagnosed CLL. Methods: Clinical data was reviewed from 205 patients (pts) with CLL diagnosed from 2000-2010, identified through the Minneapolis MN VA Tumor Registry. Demographic information and laboratory parameters at diagnosis were collected, and Rai disease stage, marrow cytogenetics and lymphocyte doubling time were determined. Baseline labs, lymphocyte doubling time and time to initial CLL treatment were compared between exposed and unexposed pts using Student's t-test. Kaplan Meier analysis compared overall survival between Agent Orange-exposed and unexposed pts. Results: Of the 199 (97%) pts confirmed to have CLL, 33 pts (16.6%) had Agent Orange exposure. Median follow-up time was 40.7 months (0.1-123 months). Pts with Agent Orange exposure were younger at diagnosis (61 vs. 72 years, p=0.001). WBC, hemoglobin, platelet count, Rai stage, and LDH at diagnosis were similar between the groups. Mean lymphocyte doubling time was comparable in exposed and unexposed pts (27 vs. 23 months (mos), respectively p=0.6). Cytogenetic analysis was limited as 24% of pts underwent a bone marrow biopsy. Poor risk cytogenetics (17p-, 11q-) were found in 1 of 10 (10%) pts with Agent Orange exposure and 3 of 37 (8%) unexposed pts. Time to first CLL treatment was significantly shorter in pts with Agent Orange exposure [9.6 (range 0.1-23.7) vs. 30.2 mos (range 0.1-163.3), respectively; p=0.02]. No significant difference in reason for treatment initiation was found between the groups. First line fludarabine therapy was used more often in exposed than unexposed pts, which may have been due to their younger age at diagnosis (100% AO exposed vs 36% AO unexposed, Fisher's Exact p=0.01). No difference in overall survival was found between exposed and unexposed pts (Wilcoxon p=0.28). In a multivariable Cox regression model adjusted for age, Agent Orange exposure had a hazard ratio of death of 1.8 compared to non-exposure (95% CI: 0.7- 4.5, p = 0.24). Conclusions: CLL pts with Agent Orange exposure were diagnosed at a younger age and had a shorter time to first treatment, as compared to unexposed pts. Agent Orange exposure was not associated with a difference in prognosis in these patients. Although our hazard ratio	Blood	120	21	NA	Registers			Cohort (retrospective)	Chemical class	cancer	doctor-diagnosed	USA	hic
695	L. M. Brown, L. F. Burmeister, G. D. Everett and A. Blair	Pesticide exposures and multiple myeloma in Iowa men	1993	A population-based case-control study of 173 White men with multiple myeloma (MM) and 650 controls was conducted in Iowa (United States), an area with a large farming population, to evaluate the association between MM, agricultural risk factors, and exposure to individual pesticides. A slight nonsignificantly elevated risk for MM was seen among farmers (odds ratio [OR] = 1.2, 95 percent confidence interval [CI] = 0.8-1.7). Although slight excesses were observed, there were no significant associations between MM and handling either classes of pesticides or specific pesticides. Thus, this study found little evidence to suggest an association between risk of MM and farming or pesticides.	Cancer Causes & Control	4	2	153-6	Self-reported exposure			Case-control	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
696	L. M. Louis, C. C. Lerro, M. C. Friesen, G. Andreotti, S. Koutros, D. P. Sandler, A. Blair, M. G. Robson and L. E. Beane Freeman	A prospective study of cancer risk among Agricultural Health Study farm spouses associated with personal use of organochlorine insecticides	2017	BACKGROUND: Organochlorine insecticides (OCs) have historically been used worldwide to control insects, although most have now been banned in developed countries. Evidence for an association between OC exposures and cancer predominantly comes from occupational and population based-studies among men. We evaluated the association between the use of specific OCs and cancer among the female spouses of pesticide applicators in the Agricultural Health Study. METHODS: At enrollment (1993-1997), spouses of private applicators in the cohort provided information about their own use of pesticides, including seven OCs (aldrin, chlordane, dieldrin, DDT, heptachlor, lindane, and toxaphene), and information on potential confounders. We used Poisson regression to estimate relative risks (RRs) and 95% confidence intervals (CIs) for cancers (n >=3 exposed cases) reported to state cancer registries from enrollment through 2012 (North Carolina) and 2013 (Iowa), and use of the individual OCs, as well as use of any of the specific OCs. RESULTS: Among 28,909 female spouses, 2191 (7.58%) reported ever use of at least one OC, of whom 287 were diagnosed with cancer. Most cancers were not associated with OC use. Risk of glioma was increased among users of at least one OC (N_{exposed} = 11, RR = 3.52, 95% CI 1.72-7.21) and specifically among lindane users (N_{exposed} = 3, RR = 4.45, 95% CI 1.36-14.55). Multiple myeloma was associated with chlordane (N_{exposed} = 6, RR = 2.71, 95% CI 1.12-6.55). Based on 3 exposed cases each, there were also positive associations between pancreatic cancer and lindane, and ER-PR- breast cancer and dieldrin. No other associations with breast cancer were found. CONCLUSIONS: Overall, there were some associations with OC use and cancer incidence, however we were limited by the small number of exposed cancer cases. Future research should attempt to expand on these findings by assessing environmental sources of OC exposures, to fully evaluate the role of OC exposures on cancer risk in women.	Environmental Health: A Global Access Science Source	16	1	95	Self-reported exposure			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
697	L. M. M. de Adad, H. H. R. De Andrade, K. Kvitko, M. Lehmann, A. A. C. M. de Cavalcante and R. R. Dihl	Occupational exposure of workers to pesticides: Toxicogenetics and susceptibility gene polymorphisms	2015	Farm workers are often exposed to pesticides, which are products belonging to a specific chemical group that affects the health of agricultural workers and is mostly recognized as genotoxic and carcinogenic. The exposure of workers from Piau<U+221A><U+2260>, Brazil, to these hazardous chemicals was assessed and cytogenetic alterations were evaluated using the buccal micronucleus assay, hematological and lipid parameters, butyrylcholinesterase (BChE) activity and genetic polymorphisms of enzymes involved in the metabolism of pesticides, such as PON1, as well as of the DNA repair system (OGG1, XRCC1 and XRCC4). Two groups of farm workers exposed to different types of pesticides were evaluated and compared to matched non-exposed control groups. A significant increase was observed in the frequencies of micronuclei, kariorrhexis, karyolysis and binucleated cells in the exposed groups (n = 100) compared to controls (n = 100). No differences were detected regarding the hematological parameters, lipid profile and BChE activity. No significant difference was observed either regarding DNA damage or nuclear fragmentation when specific metabolizing and DNA repair genotypes were investigated in the exposed groups.	Genetics and Molecular Biology	38	3	308-315	Biomonitoring (blood)			Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	Brazil	umic
698	L. M. Pastore, I. Hertz-Picciotto and J. J. Beaumont	Risk of stillbirth from occupational and residential exposures	1997	OBJECTIVES: To analyse the risk of stillbirth from 12 residential and occupational maternal exposures during pregnancy. METHODS: Stillbirths and neonatal deaths in 1984 within 24 hours of birth from 10 California counties were identified from death certificates. Controls were randomly selected from live births born in 1984 and frequency matched to cases by maternal age and county. Data sources included vital statistics and a self-administered postal questionnaire. Logistic regression and proportional hazards modelling were performed; the proportional hazards considered the truncated opportunity for exposure among cases. Special focus was given to two cause of deaths groups: congenital anomalies (12% of deaths) and complications of the placenta, cord, and membranes (37% of deaths). RESULTS: Occupational exposure to pesticides during the first two months of gestation was positively associated with stillbirths due to congenital anomalies (odds ratio (OR) 2.4, 95% confidence interval (95% CI) 1.0 to 5.9), and during the first and second trimesters with stillbirths due to all causes of death (risk ratios (RR) 1.3-1.4, 95% CI 1.0 to 1.7) and stillbirths due to complications of the placenta, cord, and membranes (RR 1.6-1.7, 95% CI 1.1 to 2.3). Occupational exposure to video display terminals in the third trimester was found to have a modest inverse association with stillbirths (RR 0.7, 95% CI 0.6, 0.9). Home pesticide exposure was positively associated with stillbirths due to congenital anomalies (OR 1.7, 95% CI 1.0 to 2.9). CONCLUSIONS: Occupational exposure to pesticides, especially during early pregnancy, had a clear positive association with stillbirths regardless of cause of death. Methodologically, this study of stillbirths is unique in its analysis of specific causes of death and use of time specific exposure windows.	Occupational & Environmental Medicine	54	7	511-8	Self-reported exposure			Case-control	Pesticides in general	reproductive	doctor-diagnosed	USA	hic
699	L. Marmol-Maneiro, J. Fernandez-D'Pool, B. J. Sanchez and Y. Sirit	Seminal profile in workers exposed to cholinesterase inhibitor insecticides	2003	The objective of this study was to determine the physical, chemical and cytomorphologic characteristics of semen obtained from workers exposed to cholinesterase inhibitor insecticides and compare them with samples of the same nature obtained from unexposed subjects, and in addition, to correlate those findings with blood levels of cholinesterase. The study group consisted of 29 adult males, age range 20-54, that were exposed to cholinesterase inhibitor insecticides during 4 hours per day for a variable lapse (one year minimum), whereas the control group consisted of 30 unexposed individuals of the same gender, and similar age range. A thorough medical examination was performed in every individual. It consisted of an occupational medical history and complete physical exam. A blood sample was obtained in all the subjects in order to determine total cholinesterase levels by the modified S. Hestrin Hydroxamate method. Semen analysis was done in specimens collected after recent masturbation following a 3-day abstinence period. The data was processed and analyzed by the SAS computerized statistics program. The results revealed significant differences between both groups ($p < 0.05$) for the following variables: sperm count per mL., percentage of fast, mobile and immobile, live and dead spermatozoids. Spermatozoa morphology was found to be within normal limits as established by the WHO. Nevertheless, the differences related to the percentage of big head and amorphous spermatozoids was significant ($p < 0.05$). The results indicate that cholinesterase inhibitor insecticides affect certain variables of the semen analysis and hence the quality of the semen.	Investigacion Clinica	44	2	105-17	Algorithm/model	Biomonitoring (blood)		Cross-sectional	Chemical class	reproductive	medical test result	Venezuela	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
700	L. Miranda-Contreras, I. Cruz, J. A. Osuna, R. Gomez-Perez, L. Berrueta, S. Salmen, M. Colmenares, S. Barreto, A. Balza, Y. Morales, L. Zavala, E. Labarca, N. Garcia, B. Sanchez, C. A. Contreras and H. Andrade	[Effects of occupational exposure to pesticides on semen quality of workers in an agricultural community of Merida state, Venezuela]	2015	Numerous studies report adverse effects of pesticides on male reproductive health. The objectives of this study were to investigate whether there is a relationship between occupational exposure to pesticides and semen quality, and to determine whether chronic exposure to pesticides differentially affects semen quality in men of different ages. A comparative study of 64 farmers and 64 control men was performed. The farmers were interviewed to determine their occupational history and particularly, activities that may involve exposure to pesticides. Semen parameters were evaluated and a comparative analysis of semen variables between exposed and control groups, as well as between age groups: 18-29, 30-37 and 38-60 years was done. Significant alterations of some semen parameters in the exposed group were found, such as: decreases in sperm concentration, slow progressive motility and sperm membrane integrity; at the same time, increases in eosin Y positive and sperm DNA fragmentation index. The results obtained by age groups showed significant differences between exposed and control groups for the parameters of membrane integrity, eosin Y positive and sperm DNA fragmentation index, being the exposed group between 18-29 years that showed the highest altered cases of these parameters. Our results prove that occupational pesticide exposure is associated with alterations in sperm quality, creating a risk to farm workers in their reproductive capacity.	Investigacion Clinica	56	2	123-36	Self-reported exposure			Case-control	Pesticides in general	reproductive	medical test result	Venezuela	umic
701	L. Miranda-Contreras, R. Gomez-Perez, G. Rojas, I. Cruz, L. Berrueta, S. Salmen, M. Colmenares, S. Barreto, A. Balza, L. Zavala, Y. Morales, Y. Molina, L. Valeri, C. A. Contreras and J. A. Osuna	Occupational exposure to organophosphate and carbamate pesticides affects sperm chromatin integrity and reproductive hormone levels among Venezuelan farm workers	2013	OBJECTIVES: Several reports suggest that chronic pesticide exposure may affect semen quality and male fertility in humans. The objective of this study was to evaluate the association between occupational exposure to organophosphate (OP) and carbamate (CB) pesticides and semen quality, as well as levels of reproductive and thyroid hormones of Venezuelan farm workers. METHODS: Thirty-five healthy men (unexposed group) and 64 male agricultural workers (exposed group) were recruited for clinical evaluation of fertility status. Fresh semen samples were evaluated for sperm quality and analyzed for DNA fragmentation index (DFI) by flow cytometry. Pesticide exposure was assessed by measuring erythrocyte acetylcholinesterase (AChE) and plasma butyrylcholinesterase (BuChE) with a Test-mate ChE field kit. Serum levels of total testosterone (Tt), follicle-stimulating hormone (FSH), luteinizing hormone (LH), prolactin (PRL), thyroid stimulating hormone (TSH) and free thyroxine (FT4) were analyzed using enzyme immunoassay kits. RESULTS: Evidence of pesticide exposure was found in 87.5% of farmers based on AChE and BuChE inhibition. Significant increments were observed in sperm DFI with significant decreases in some semen parameters. DFI was negatively correlated with BuChE, sperm concentration, morphology and vitality in these workers. The levels of Tt, PRL, FT4 and TSH appeared to be normal; however, there was a tendency for increased LH and FSH levels in exposed workers. CONCLUSIONS: Our results confirm the potential impact of chronic occupational exposure to OP/CB pesticides on male reproductive function, which may cause damage to sperm chromatin, decrease semen quality and produce alterations in reproductive hormones, leading to adverse reproductive health outcomes.	Journal of Occupational Health	55	3	195-203	Biomonitoring (blood)			Cohort (prospective)	Chemical class	reproductive	medical test result	Venezuela	umic
702	L. Multigner, P. Kadhel, M. Pascal, F. Huc-Terki, H. Kercret, C. Massart, E. Janky, J. Auger and B. Jegou	Parallel assessment of male reproductive function in workers and wild rats exposed to pesticides in banana plantations in Guadeloupe	2008	BACKGROUND: There is increasing evidence that reproductive abnormalities are increasing in frequency in both human population and among wild fauna. This increase is probably related to exposure to toxic contaminants in the environment. The use of sentinel species to raise alarms relating to human reproductive health has been strongly recommended. However, no simultaneous studies at the same site have been carried out in recent decades to evaluate the utility of wild animals for monitoring human reproductive disorders. We carried out a joint study in Guadeloupe assessing the reproductive function of workers exposed to pesticides in banana plantations and of male wild rats living in these plantations. METHODS: A cross-sectional study was performed to assess semen quality and reproductive hormones in banana workers and in men working in non-agricultural sectors. These reproductive parameters were also assessed in wild rats captured in the plantations and were compared with those in rats from areas not directly polluted by humans. RESULTS: No significant difference in sperm characteristics and/or hormones was found between workers exposed and not exposed to pesticide. By contrast, rats captured in the banana plantations had lower testosterone levels and gonadosomatic indices than control rats. CONCLUSION: Wild rats seem to be more sensitive than humans to the effects of pesticide exposure on reproductive health. We conclude that the concept of sentinel species must be carefully validated as the actual nature of exposure may varies between human and wild species as well as the vulnerable time period of exposure and various ecological factors.	Environmental Health: A Global Access Science Source	7	NA	40	Self-reported exposure			Cross-sectional	Job title	reproductive	medical test result	Guadelope	hic
703	L. Nicolle-Mir	Exposure to pesticides and lung cancer in the Agricultural Health Study	2017	This second analysis of the risk of lung cancer in the large US cohort of people with occupational exposure to pesticides provides new elements in support of an effect of exposure to pendimethalin and dieldrin. Two other pesticides, chlorimuron ethyl and parathion, could increase the risk of lung cancer. However, at this stage in the follow-up, the results cannot yet be confirmed.	Environnement, Risques et Sante	16	4	544-551	Self-reported exposure	Algorithm/model		Cohort (prospective)	Chemical class	cancer	doctor-diagnosed	USA	hic
704	L. Orsi, L. Delabre, A. Monnereau, P. Delval, C. Berthou, P. Fenaux, G. Marit, P. Soubeyran, F. Huguet, N. Milpied, M. Leporrier, D. Hemon, X. Troussard and J. Clavel	Occupational exposure to pesticides and lymphoid neoplasms among men: results of a French case-control study	2009	OBJECTIVES: Investigating the relationship between occupational exposure to pesticides and the risk of lymphoid neoplasms (LNs) in men. METHODS: A hospital-based case-control study was conducted in six centres in France between 2000 and 2004. The cases were incident cases with a diagnosis of LN aged 18-75 years. During the same period, controls of the same age and sex as the cases were recruited in the same hospital, mainly in the orthopaedic and rheumatological departments. Exposures to pesticides were evaluated through specific interviews and case-by-case expert reviews. Four hundred and ninety-one cases (244 cases of non-Hodgkin's lymphoma (NHL), 87 of Hodgkin's lymphoma (HL), 104 of lymphoproliferative syndromes (LPSs) and 56 of multiple myeloma (MM) cases) and 456 controls were included in the analyses. The odds ratios (ORs) and 95% CI were estimated using unconditional logistic regressions. RESULTS: Positive associations between HL and occupational exposure to triazole fungicides and urea herbicides were observed (OR = 8.4 (2.2 to 32.4), 10.8 (2.4 to 48.1), respectively). Exposure to insecticides, fungicides and herbicides were linked to a threefold increase in MM risk (OR = 2.8 (1.2 to 6.5), 3.2 (1.4 to 7.2), 2.9 (1.3 to 6.5)). For LPS subtypes, associations restricted to hairy-cell leukaemia (HCL) were evidenced for exposure to organochlorine insecticides, phenoxy herbicides and triazine herbicides (OR = 4.9 (1.1 to 21.2), 4.1 (1.1 to 15.5), 5.1 (1.4 to 19.3)), although based on small numbers. Lastly, despite the increased ORs for organochlorine and organophosphate insecticides, carbamate fungicides and triazine herbicides, no significant associations were evidenced for NHL. CONCLUSIONS: The results, based on case-by-case expert review of occupation-specific questionnaires, support the hypothesis that occupational pesticide exposures may be involved in HL, MM and HCL and do not rule out a role in NHL. The analyses identified specific pesticides that deserve further investigation and the findings were consistent with those of previous studies.	Occupational & Environmental Medicine	66	5	291-8	Self-reported job history	Expert case-by-case assessment		Case-control	Job title	cancer	doctor-diagnosed	France	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
705	L. Orsi, X. Troussard, A. Monnereau, C. Berthou, P. Fenaux, G. Marit, P. Soubeyran, F. Huguet, N. Milpied, M. Leporrier, D. Hemon and J. Clavel	Occupation and lymphoid malignancies: results from a French case-control study	2007	OBJECTIVES: Investigating relationships between potential occupational risk factors and lymphoid malignancy (LM). METHODS: We conducted a multicenter hospital-based case-control study in France between 2000 and 2004, including 824 incident cases of non-Hodgkin lymphoma (NHL), Hodgkin lymphoma (HL), multiple myeloma, and "lymphoproliferative syndrome" and 752 frequency-matched controls. Data were collected through face-to-face standardized and detailed interviews. RESULTS: Farming was significantly associated with NHL (odds ratio [OR] = 1.4 [1.0 to 2.0]) and, although not significantly, with lymphoproliferative syndrome and multiple myeloma. ORs were higher for longest durations of exposure. Self-declared exposure to pesticides was significantly associated with NHL (OR = 1.8 [1.2 to 2.7]) and HL (OR = 2.2 [1.0 to 4.7]). Neither solvent-related jobs nor self-reported exposure to solvents were related to LM. Systematic screening based on job titles did not evidence any other association. CONCLUSIONS: The results support the hypothesis that farming plays a role in most types of LM.	Journal of Occupational & Environmental Medicine	49	12	1339-50	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	France	hic
706	L. P. Gregio D'Arce and I. M. Colus	Cytogenetic and molecular biomonitoring of agricultural workers exposed to pesticides in Brazil	2000	The use of agricultural chemicals without correct protection may lead to alterations in the genetic material of cells and the possible development of several types of tumors. The individual genetic variability in the enzymes which metabolize agricultural chemicals is also involved in this process, such as when the enzymes are not efficient in the detoxifying process of the organism, the metabolic subproducts accumulate, contributing to the tumorigenic process. Cytogenetic monitoring was carried out on a group of 20 male workers occupationally exposed to a mixture of pesticides in the town of Sao Jeronimo da Serra, PR (Brazil). Student's t = test and Wilcoxon's test showed, respectively, that there was no significant difference between the chromosome aberration frequencies between the exposed and control groups and between the paired individuals. However, there was a significant difference in the two analyses regarding the mitotic index of the sampled individuals. Smoking and time of exposure to agricultural chemicals did not influence the cytogenetic responses obtained, but the mitotic index of the control individuals was higher than that of the exposed individuals from the different age groups. The GSTM1 gene polymorphism was 33% null. When statistical tests were carried out to assess the relationship of the GSTM1 genotypes with the chromosome aberrations and mitotic indexes, there was no significant difference. The CA frequencies found in this study were low, making it difficult to associate it with the GSTM1 gene polymorphism. Teratogenesis Carcinog. Mutagen. 20:161-170, 2000.	Teratogenesis, Carcinogenesis, & Mutagenesis	20	3	161-70	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Brazil	umic
707	L. Quiros-Alcala, A. D. Alkon, W. T. Boyce, S. Lippert, N. V. Davis, A. Bradman, D. B. Barr and B. Eskenazi	Maternal prenatal and child organophosphate pesticide exposures and children's autonomic function	2011	BACKGROUND: Organophosphate pesticides (OP), because of their effects on cholinergic fibers, may interfere with the functions of the autonomic nervous system (ANS). We conducted a study to assess the relation of in utero and child OP pesticide exposures and children's autonomic nervous system (ANS) dysregulation under resting and challenge conditions. We hypothesized that children with high OP levels would show parasympathetic activation and no sympathetic activation during rest and concomitant parasympathetic and sympathetic activation during challenging conditions. METHODS: OP exposures were assessed by measuring urinary dialkylphosphate metabolites (DAPs, total diethyls-DEs, and total dimethyls-DMs) in maternal and children's spot urine samples. ANS regulation was examined in relation to maternal and child DAPs in 149 children at 6 months and 1 year, 97 at 3 1/2 years and 274 at 5 years. We assessed resting and reactivity (i.e., challenge minus rest) measures using heart rate (HR), respiratory sinus arrhythmia (RSA), and preejection period (PEP) during the administration of a standardized protocol. Cross-sectional (at each age) and longitudinal regression models were conducted to assess OP and ANS associations. To estimate cumulative exposure at 5 years, we used an area-under-the-concentration-time-curve (AUC) methodology. We also evaluated whether children with consistently high versus low DAP concentrations had significantly different mean ANS scores at 5 years. RESULTS: Child DMs and DAPs were significantly negatively associated with resting RSA at 6 months and maternal DMs and child DEs were significantly positively associated with resting PEP at 1 year. No associations with resting were observed in 3 1/2- or 5-year-old children nor with reactivity at any age. There was no significant relationship between the reactivity profiles and maternal or child DAPs. Cumulative maternal total DEs were associated with low HR (-3.19 bpm decrease; 95% CI: -6.29 to -0.09, p=0.04) only at 5 years. In addition, there were no significant differences in ANS measures for 5-year-olds with consistently high versus low DAPs. CONCLUSION: Although we observe some evidence of ANS dysregulation in infancy, we report no consistent associations of maternal and child OP pesticide exposure, as measured by urinary DAPs, on children's ANS (HR, RSA, and PEP) regulation during resting and challenging conditions up to age 5 years.	Neurotoxicology	32	5	646-55	Biomonitoring (urine)			NA	Chemical class	offspring	NA	USA	hic
708	L. R. M. Webster, G. H.; Moriarty, H. T.	Organophosphate-based pesticides and genetic damage implicated in bladder cancer	2002	Organophosphate-based pesticides have been associated with pathology and chromosomal damage in humans. There are also epidemiologic links with cancer. The few screening tests for low-level occupational exposure are of doubtful sensitivity; this investigation evaluated four methods. Blood samples were studied from 10 farmers before and after occupational exposure to organophosphate-based pesticides and five unexposed controls. The standard cholinesterase test was insensitive to the exposure (P=0.815). However, a significant increase in Howell-Jolly bodies within erythrocytes was observed (P=0.001). Cytogenetic studies on routine and aphidicolin-induced blood cultures revealed that following organophosphate exposure the total number of gaps and breaks on human chromosomes was significantly increased (P=0.004 and P=0.0006, respectively). We concluded that Howell-Jolly body and fragile site analysis were sensitive indicators of nuclear damage resulting from low-level occupational exposure to organophosphate. Such nuclear damage could be implicated in carcinogenesis. The development of bladder cancer is one such example.	Cancer Genetics & Cytogenetics	133	2	112-7	Biomonitoring (blood)			Cohort (prospective)	Chemical class	cancer	doctor-diagnosed	NA	NA

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709	L. Roldan-Tapia, F. A. Nieto-Escamez, E. M. del Aguila, F. Laynez, T. Parron and F. Sanchez-Santed	Neuropsychological sequelae from acute poisoning and long-term exposure to carbamate and organophosphate pesticides	2006	UNLABELLED: This research examines the effects of different degrees of pesticide exposure on neuropsychological performance. Exposures varied from acute poisoning coupled with chronic exposure to low or high levels of chronic exposure (defined by years of exposure). A cross-sectional neuropsychological and biochemical study was conducted in greenhouse farmers from southern Spain: data from 24 acutely poisoned workers and 40 non-poisoned but chronically (low or high) exposed sprayers were compared to 26 controls. We examined performance on 21 neuropsychological tests that assessed attention, memory, praxis, gnosis, motor coordination, naming and reasoning and also examined values of plasmatic cholinesterase. Results indicated statistically significant neuropsychological deficits in the acute poisoning and high chronic exposure groups after controlling for confounds, whereas similar performance was seen in the low chronic exposed subjects and controls. Subjects who were acutely poisoned performed worse than the other groups on perceptual, visuomotor, visual memory and mood state domains. Both the acutely poisoned and the chronically high exposed subjects obtained significantly lower scores in the perceptual, verbal memory and visuomotor domains. Levels of butyrylcholinesterase were related to the seasonal sprayer activity except in the case of acutely poisoned subjects. CONCLUSIONS: Both acutely poisoned long-term workers and chronically high (>10 years) exposed workers exhibited similar disturbances in perception and visuo-motor processing, in the absence of any related acute effect of butyrylcholinesterase inhibition. In the case of acutely poisoned subjects, verbal and perceptive learning and recall and constructive abilities were also impaired. These results point to the need for follow-up studies to assess the possible sequelae of chronic and acute exposure to pesticides and their interactions.	Neurotoxicology & Teratology	28	6	694-703	Job title			Cross-sectional	Job title	neurological	medical test result	Spain	hic
710	L. Roldan-Tapia, T. Parron and F. Sanchez-Santed	Neuropsychological effects of long-term exposure to organophosphate pesticides	2005	Cholinesterase inhibitors, such as carbamates and organophosphates (OPs), are widely used as insecticides and pesticides and may be stored as biological weapons. The massive use of these products, along with a lack of personal protective equipment on the job, and accidental and intentional ingestions, has produced a great number of poisonings in farmers. A large part of the employment and income in southeastern Spain is concentrated in intensive greenhouse agriculture in which growers are exposed to a varying degree of subsymptomatic doses of a combination of pesticides, mainly OPs and carbamates. We conducted a cross-sectional survey of workers in high-exposure conditions to assess possible neurobehavioral deficits, using a wide array of tasks to test neuropsychological functioning and emotional status. Linear and logistic regression series revealed the importance of the variable "years working with pesticides" as a measure of cumulative exposure for risk of worsened perceptive function performance (odds ratio (OR)=6.93, 95% confidence interval (CI): 1.52-31.51), visuomotor praxis (OR=5.00, 95% CI: 1.22-20.40) and integrative task performance time (OR=4.12, 95% CI: 1.18-14.39) with no relation to plasma cholinesterase activity as a measure of recent exposure. This association was statistically significant after controlling for confounds (age and educational level). The findings showed association of long-term exposure and worse performance in neuropsychological functions, which is interpreted as evidence of a chronic effect of cumulative high exposure to OPs and carbamates.	Neurotoxicology & Teratology	27	2	259-66	Biomonitoring (blood)			Cross-sectional	Type of pesticide	neurological	medical test result	Spain	hic
711	L. Rushton and V. Mann	Pesticide-related illness reported to and diagnosed in primary care: implications for surveillance of environmental causes of ill-health	2009	BACKGROUND: In Great Britain (GB), data collected on pesticide associated illness focuses on acute episodes such as poisonings caused by misuse or abuse. This study aimed to investigate the extent and nature of pesticide-related illness presented and diagnosed in Primary Care and the feasibility of establishing a routine monitoring system. METHODS: A checklist, completed by General Practitioners (GP) for all patients aged 18+ who attended surgery sessions, identified patients to be interviewed in detail on exposures and events that occurred in the week before their symptoms appeared. RESULTS: The study covered 59320 patients in 43 practices across GB and 1335 detailed interviews. The annual incidence of illness reported to GPs because of concern about pesticide exposure was estimated to be 0.04%, potentially 88400 consultations annually, approximately 1700 per week. The annual incidence of consultations where symptoms were diagnosed by GPs as likely to be related to pesticide exposure was 0.003%, an annual estimate of 6630 consultations i.e. about 128 per week. 41% of interviewees reported using at least one pesticide at home in the week before symptoms occurred. The risk of having symptoms possibly related to pesticide exposure compared to unlikely was associated with home use of pesticides after adjusting for age, gender and occupational pesticide exposure (OR = 1.88, 95% CI 1.51 - 2.35). CONCLUSION: GP practices were diverse and well distributed throughout GB with similar symptom consulting patterns as in the Primary Care within the UK. Methods used in this study would not be feasible for a routine surveillance system for pesticide related illness. Incorporation of environmental health into Primary Care education and practice is needed.	BMC Public Health	9	NA	219	Self-reported exposure			Cohort (prospective)	Pesticides in general	pesticide-related illness	doctor-diagnosed	UK	hic
712	L. S. C. Engel, H.; Keifer, M. C.; Seixas, N. S.; Longstreth, W. T., Jr.; Scott, K. C.; Hudnell, K.; Anger, W. K.; Camicioli, R.	Parkinsonism and occupational exposure to pesticides	2001	OBJECTIVE: To examine the risk of parkinsonism related to lifetime occupational exposure to pesticides among a cohort of men, mostly orchardists, in Washington State. METHODS: All 310 subjects in this study had previously participated in a cohort study of men occupationally exposed to pesticides. Subjects were given a structured neurological examination and completed a self administered questionnaire which elicited detailed information on pesticide (insecticide, herbicide, and fungicide) use throughout their working careers. Demographic characteristics were also sought. Subjects had a mean age of 69.6 years (range 49-96, SD 8.1). There were 238 (76.8%) subjects who reported some occupational exposure to pesticides, whereas 72 (23.2%) reported none. Parkinsonism was defined by the presence of two or more of rest tremor, rigidity, bradykinesia, and impairment of postural reflexes in subjects not on antiparkinsonian medication, or the presence of at least one sign if they were on such medication. Parkinson's disease was not studied explicitly because of the difficulty in distinguishing it from other parkinsonian syndromes. A generalised linear model was used to estimate prevalence ratios (PRs) for parkinsonism relative to history of farming, pesticide use, and use of well water. RESULTS: A PR of 2.0 (95% confidence interval (95% CI) 1.0 to 4.2) was found for subjects in the highest tertile of years of exposure to pesticides; a similarly increased, non-significant, PR was found for the middle tertile (1.9 (95% CI 0.9 to 4.0)), although a trend test did not show a significant exposure-response relation. No increased risks were found associated with specific pesticides or pesticide classes, nor with a history of farming or use of well water. CONCLUSION: Parkinsonism may be associated with long term occupational exposure to pesticides, although no associations with specific pesticides could be detected. This finding is consistent with most of the publications on this topic.	Occupational & Environmental Medicine	58	9	582-9	Self-reported exposure			Cohort (prospective)	Type of pesticide	neurological	doctor-diagnosed	USA	hic

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713	L. S. Engel, M. C. Keifer, H. Checkoway, L. R. Robinson and T. L. Vaughan	Neurophysiological function in farm workers exposed to organophosphate pesticides	1998	To investigate neurophysiological effects of low-level exposure to foliar organophosphate residues during one season among agricultural workers, the authors performed a cross-sectional study of 67 Hispanic farm workers and 68 age-, gender-, ethnicity-, and education-matched reference subjects. The neurophysiological examination included sensory and motor nerve conduction and neuromuscular junction testing. Erythrocyte cholinesterase activity was measured at the time of examination. No statistically significant neurophysiological differences between the exposed and reference groups were observed. Farm workers and reference subjects had similar sensory nerve latency and amplitude (sural), motor nerve conduction velocity (ulnar), and neuromuscular junction function (ulnar). No relationship between duration of exposure during the season and electrophysiological measures of nerve function was found. Exposure of farm workers to the low levels of organophosphate pesticides during one season experienced by farm workers in this study was not associated with impaired peripheral neurophysiological function.	Archives of Environmental Health	53	1	43295	Job title			Cross-sectional	Job title	neurological	medical test result	USA	hic
714	L. S. Gold, M. H. Ward, M. Dosemeci and A. J. De Roos	Systemic autoimmune disease mortality and occupational exposures	2007	OBJECTIVE: To generate hypotheses regarding occupational exposures that may cause systemic autoimmune diseases. METHODS: Based on examination of US death certificates, we identified deaths in 26 states for which a cause was listed as rheumatoid arthritis (RA) (n = 36,178), systemic lupus erythematosus (SLE) (n = 7,241), systemic sclerosis (n = 5,642), or other systemic autoimmune disease (n = 4,270). Odds ratios (ORs) and 95% confidence intervals (95% CIs) were calculated to estimate associations between occupation and death from any systemic autoimmune disease, and from RA, SLE, and systemic sclerosis, specifically. Additionally, we estimated risks associated with occupational exposures, which were assigned using job-exposure matrices. RESULTS: A broad array of occupations was associated with death from systemic autoimmune diseases, including several of a priori interest. Farming occupation was associated with death from any systemic autoimmune disease (OR 1.3 [95% CI 1.2-1.4]), and increased risk was also seen with occupational exposure to animals and pesticides. Several industrial occupations were associated with death from any systemic autoimmune disease, including mining machine operators (OR 1.3 [95% CI 1.1-1.5]), miscellaneous textile machine operators (OR 1.2 [95% CI 1.0-1.4]), and hand painting, coating, and decorating occupations (OR 1.8 [95% CI 1.0-2.9]). These occupations were also significantly associated with death from the specific autoimmune diseases examined. Certain occupations entailing exposure to the public, such as teachers, were associated with systemic autoimmune disease-related death, whereas others, such as waiters and waitresses, were not. CONCLUSION: Our results suggest that death from systemic autoimmune diseases may be associated with occupational exposures encountered in farming and industry. The hypotheses generated in this study provide leads for future research on determinants of these diseases.	Arthritis & Rheumatism	56	10	3189-201	Job exposure matrix			Cross-sectional	Pesticides in general	mortality (all cause)	doctor-diagnosed	USA	hic
715	L. S. Hoyos, S. Carvajal, L. Solano, J. Rodriguez, L. Orozco, Y. Lopez and W. W. Au	Cytogenetic Monitoring of Farmers exposed to pesticides in Colombia	1996	We have monitored 30 pesticide-exposed workers and 30 matched controls for expression of chromosome aberrations (CA) and sister chromatid exchanges (SCE) in their lymphocytes. Peripheral blood cultures were set up within 3 hr after the collection of samples, and four cultures were set up from each donor. For CA analysis, 100 complete metaphase cells from each donor were evaluated. For the SCE assay, 50 complete metaphase cells from each donor were analyzed. The CA and SCE data were analyzed for differences between the two groups using the chi 2 and the Student's t-test, respectively. From the CA analysis it was obvious that the overwhelming majority of aberrations were chromatid breaks and isochromatid breaks; therefore, only these data are presented and used for statistical analysis. Isochromatid breaks were counted as two breaks each and chromatid breaks as one in calculating the total chromatid break frequencies. Statistical evaluation of the data indicates that there is no significant difference (p > 0.05; chi 2 test) between the exposed and the nonexposed groups based on chromatid breaks per 100 cells (1.2 +/- 0.3 and 1.5 +/- 0.2, respectively) and total chromatid breaks per 100 cells (1.7 +/- 0.3 and 2.1 +/- 0.2, respectively). No significantly difference between the two groups (p > 0.05, Student's t-test) was observed with SCE frequencies (5.0 +/- 1.1 and 4.8 +/- 0.9, respectively). Linear regression analysis indicates that the data were not influenced by age, cigarette smoking, or alcohol consumption. It is assuring that the exposure conditions among these Indian farmers have not caused detectable increases of chromosome damage using standard assays; this suggests the lack of serious long-term health problems. However, periodic monitoring of such exposed populations should be conducted using the same or other more sensitive assays. In addition, other populations with exposure to different types of pesticides in Colombia should also be investigated.	Environmental Health Perspectives	104	NA	535-8	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Colombia	umic
716	L. S. Newman, C. S. Rose, E. A. Bresnitz, M. D. Rossman, J. Barnard, M. Frederick, M. L. Terrin, S. E. Weinberger, D. R. Moller, G. McLennan, G. Hunninghake, L. DePalo, R. P. Baughman, M. C. Iannuzzi, M. A. Judson, G. L. Knatterud, B. W. Thompson, A. S. Teirstein, H. Yeager, Jr., C. J. Johns, D. L. Rabin, B. A. Rybicki, R. Cherniack and A. R. Group	A case control etiologic study of sarcoidosis: environmental and occupational risk factors	2004	Past research suggests that environmental factors may be associated with sarcoidosis risk. We conducted a case control study to test a priori hypotheses that environmental and occupational exposures are associated with sarcoidosis. Ten centers recruited 706 newly diagnosed patients with sarcoidosis and an equal number of age-, race-, and sex-matched control subjects. Interviewers administered questionnaires containing questions regarding occupational and nonoccupational exposures that we assessed in univariable and multivariable analyses. We observed positive associations between sarcoidosis and specific occupations (e.g., agricultural employment, odds ratio [OR] 1.46, confidence interval [CI] 1.13-1.89), exposures (e.g., insecticides at work, OR 1.52, CI 1.14-2.04, and work environments with mold/mildew exposures [environments with possible exposures to microbial bioaerosols], OR 1.61, CI 1.13-2.31). A history of ever smoking cigarettes was less frequent among cases than control subjects (OR 0.62, CI 0.50-0.77). In multivariable modeling, we observed elevated ORs for work in areas with musty odors (OR 1.62, CI 1.24-2.11) and with occupational exposure to insecticides (OR 1.61, CI 1.13-2.28), and a decreased OR related to ever smoking cigarettes (OR 0.65, CI 0.51-0.82). The study did not identify a single, predominant cause of sarcoidosis. We identified several exposures associated with sarcoidosis risk, including insecticides, agricultural employment, and microbial bioaerosols.	American Journal of Respiratory & Critical Care Medicine	170	12	1324-30	Self-reported exposure			Case-control	Type of pesticide	immunological	doctor-diagnosed	USA	hic

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717	L. S. O. M. Engel, E. S.; Schwartz, S. M.	Maternal occupation in agriculture and risk of limb defects in Washington State, 1980-1993	2000	OBJECTIVES: This study examined the association between maternal occupational exposure to agricultural chemicals and the risk of limb defects among offspring. METHODS: A retrospective cohort study was conducted using Washington State birth records for the years 1980 through 1993. The exposed group, consisting of 4466 births to mothers employed in agriculture, was compared with 2 reference groups: (i) 23,512 births in which neither parent worked in agriculture ("nonagricultural" group) and (ii) 5994 births in which only the father worked in agriculture ("paternal agriculture" group). The outcome of interest was limb defects [syndactyly, polydactyly, adactyly, and "other limb reductions" (as listed in the birth record)]. RESULTS: An elevated risk of limb defects was observed for the exposed group in comparison with both the nonagricultural and paternal agriculture groups, with ethnicity-adjusted prevalence ratios of 2.6 [95% confidence interval (95% CI) 1.1-5.8] and 2.6 (95% CI 0.7-9.5), respectively. CONCLUSIONS: These results support the hypothesis that maternal occupational exposure to agricultural chemicals may increase the risk of giving birth to a child with limb defects.	Scandinavian Journal of Work, Environment & Health	26	3	193-8	Job title			Cohort (retrospective)	Pesticides in general	offspring	doctor-diagnosed	USA	hic
718	L. S. Stokes, A.; Marshall, E.; Narang, A.	Neurotoxicity among pesticide applicators exposed to organophosphates	1995	OBJECTIVES: An epidemiological study of 90 male pesticide applicators licensed in New York was conducted to investigate the effect of exposure to organophosphate pesticides on the peripheral nervous system. METHODS: A cohort of farmers and pesticide applicators from New York State were questioned off season (November 1988-February 1989) and again during the spraying season (April 1989-August 1989) about the presence of several acute signs and symptoms. Short term exposure was validated by measuring the concentration of dimethylthiophosphate (DMTP), a metabolite of guthion, in urine. Chronic signs of subtle peripheral nerve damage were determined by vibration threshold sensitivity of the farmers and applicators tested during November 1988-February 1989 and compared with controls drawn from the general population who were tested during the same time period the next year (November 1989-February 1990). Vibration threshold sensitivity was determined for both the hands and feet. Long term exposure to pesticides was determined by questionnaire. RESULTS: Paired t tests show that mean vibration threshold scores were significantly higher for the dominant ($P < 0.00$) and non-dominant ($P < 0.04$) hands among pesticide applicators when compared with scores for population based controls individually matched on age, sex, and county of residence. CONCLUSIONS: A significant increase in mean vibration threshold sensitivity for the dominant and non-dominant hand suggests previous organophosphate exposure among pesticide applicators was associated with a loss of peripheral nerve function.	Occupational & Environmental Medicine	52	10	648-53	Biomonitoring (urine)			Cohort (prospective)	Chemical class	neurological	self-reported	USA	hic
719	L. S. W. Engel, E.; Satagopan, J.; Blair, A.; Hoppin, J. A.; Koutros, S.; Lerro, C. C.; Sandler, D. P.; Alavanja, M. C.; Beane Freeman, L. E.	Insecticide Use and Breast Cancer Risk among Farmers' Wives in the Agricultural Health Study	2017	BACKGROUND: Some epidemiologic and laboratory studies suggest that insecticides are related to increased breast cancer risk, but the evidence is inconsistent. Women engaged in agricultural work or who reside in agricultural areas may experience appreciable exposures to a wide range of insecticides. OBJECTIVE: We examined associations between insecticide use and breast cancer incidence among wives of pesticide applicators (farmers) in the prospective Agricultural Health Study. METHODS: Farmers and their wives provided information on insecticide use, demographics, and reproductive history at enrollment in 1993-1997 and in 5-y follow-up interviews. Cancer incidence was determined via cancer registries. Among 30,594 wives with no history of breast cancer before enrollment, we examined breast cancer risk in relation to the women's and their husbands' insecticide use using Cox proportional hazards regression to estimate adjusted hazard ratios (HRs) and 95% confidence intervals (CIs). RESULTS: During an average 14.7-y follow-up, 39% of the women reported ever using insecticides, and 1,081 were diagnosed with breast cancer. Although ever use of insecticides overall was not associated with breast cancer risk, risk was elevated among women who had ever used the organophosphates chlorpyrifos [HR=1.4 (95% CI: 1.0, 2.0)] or terbufos [HR=1.5 (95% CI: 1.0, 2.1)], with nonsignificantly increased risks for coumaphos [HR=1.5 (95% CI: 0.9, 2.5)] and heptachlor [HR=1.5 (95% CI: 0.7, 2.9)]. Risk in relation to the wives' use was associated primarily with premenopausal breast cancer. We found little evidence of differential risk by tumor estrogen receptor status. Among women who did not apply pesticides, the husband's use of fonofos was associated with elevated risk, although no exposure-response trend was observed. CONCLUSION: Use of several organophosphate insecticides was associated with elevated breast cancer risk. However, associations for the women's and husbands' use of these insecticides showed limited concordance. Ongoing cohort follow-up may help clarify the relationship, if any, between individual insecticide exposures and breast cancer risk. https://doi.org/10.1289/EHP1295.	Environmental Health Perspectives	125	9	97002	Self-reported exposure			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
720	L. Settimi, A. Masina, A. Andrion and O. Axelson	Prostate cancer and exposure to pesticides in agricultural settings	2003	Our study evaluates the association between prostate cancer and exposure to pesticides in agricultural settings in Italy. The data were derived from a hospital-based multi-site case-control study carried out in 5 rural areas between 1990-92. In our study, 124 new cases of prostate cancer were ascertained and interviewed, along with 659 cancer controls. A team of agronomists assessed past exposure to pesticides by using a checklist of 100 chemical families and 217 compounds applied from 1950-85 in the areas considered. The association between prostate cancer and different occupational risk factors was measured by maximum likelihood estimation of the odds ratio, controlling for potential confounders. "Ever been employed in agriculture" was associated with a 40% increased risk (OR = 1.4, 95% CI = 0.9-2.0). Prostate cancer was also related positively to food and tobacco (OR= 2.1, 95% CI = 1.1-4.1), and chemical products (OR = 2.2, 95% CI = 0.7-7.2) industries. The analyses carried out to estimate the association between different types of pesticides and prostate cancer showed increased risks among farmers exposed to organochlorine insecticides and acaricides (OR = 2.5, 95% CI = 1.4-4.2), more specifically to the often contemporary used compounds DDT (OR = 2.1, 95% CI = 1.2-3.8), and dicofol (OR = 2.8, 95% CI = 1.5-5.0), whose effects could not be well separated.	International Journal of Cancer	104	4	458-61	Expert case-by-case assessment			Case-control	Chemical class	cancer	doctor-diagnosed	Italy	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
721	L. Settimi, A. Spinelli, L. Lauria, G. Miceli, N. Pupp, G. Angotzi, A. Fedi, S. Donati, L. Miligi, J. Osborn and I. Figa-Talamanca	Spontaneous abortion and maternal work in greenhouses	2008	BACKGROUND: A positive association between maternal occupational exposure to pesticide and spontaneous abortion has been reported in some studies. Work in greenhouses may imply exposure of pregnant women to pesticides continuously and at elevated level. METHODS: A total of 717 women working in greenhouses provided information on 973 pregnancies, including 110 spontaneous abortions. These pregnancies were classified as exposed or not exposed according to maternal occupation, re-entry activities and application of pesticides in greenhouses during at least 1 month in the first trimester of pregnancy. The ORs for spontaneous abortion were estimated through a generalised estimate equations model for all orders of pregnancy together, and through a logistic regression model limited to first pregnancies. RESULTS: Increased risks of spontaneous abortion were found for maternal re-entry activities within 24 hr after pesticides were applied (all orders of pregnancy: OR 3.2, 95% CI 1.3-7.7; first pregnancies: OR 3.8, 95% CI 1.0-13.9) and for those who applied pesticides (all orders of pregnancy: OR 2.6, 95% CI 1.0-6.6; first pregnancies: OR 3.7, 95% CI 0.7-20,6) CONCLUSIONS: The observed results support the hypothesis of an association between maternal work in greenhouses and spontaneous abortion. The main limitations of the study are lack of information on the specific chemicals used and the small number of pregnancies heavily exposed to pesticides.	American Journal of Industrial Medicine	51	4	290-5	Self-reported job history			Cohort (prospective)	Pesticides in general	reproductive	self-reported	Italy	hic
722	L. Settimi, P. Comba, S. Bosia, C. Ciapini, E. Desideri, A. Fedi, P. L. Perazzo and O. Axelson	Cancer risk among male farmers: a multi-site case-control study	2001	Farmers may experience exposure to several hazardous substances, and cancer risk in this occupational group is considered an important public health issue. In order to examine the association between cancer and farming among male agricultural workers, a hospital-based case-control study was conducted in five Italian rural areas. The cancer sites selected for the study were: lip, oral cavity and oropharynx, oesophagus, stomach, colon, rectum, lung, skin melanoma, skin non-melanoma, prostate, bladder, kidney, and non-Hodgkin's lymphoma. In all, 1525 newly diagnosed cases, aged 20-75 years, were ascertained in hospital records, covering the period between March 1990 and September 1992, and for 1279 of them, a detailed exposure information was collected by a standard questionnaire. Data analyses were performed comparing each cancer site to a control group, including a subset of the other cancer sites in the study. Unconditional logistic regression models were used in the statistical analyses. Increased risks of cancer associated with agricultural work were found for stomach (OR = 1.4, 95%CI:0.9-2.0), rectum (OR = 1.5, 95%CI:0.8-2.7), larynx (OR = 1.4, 95%CI:0.8-2.5), and prostate (OR = 1.4, 95%CI:1.0-2.1). The excess of prostate cancer was specifically related to application of pesticides (OR = 1.7, 95%CI:1.2-2.6).	International Journal of Occupational Medicine & Environmental Health	14	4	339-47	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Italy	hic
723	L. Stallones	Suicide and potential occupational exposure to pesticides, Colorado 1990-1999	2006	A number of occupational studies have reported high rates of suicide among selected occupations, including farmers. Limited work has focused on occupational exposures that may increase the risk of suicide. The purpose of this study is to describe suicide among individuals potentially exposed to pesticides through their occupation. Data from Colorado death certificate files for the period 1990-1999 were obtained. Eligible records were those individuals who were Colorado residents at the time of death who had an occupation listed on their death certificates. Cases had suicide listed as the primary cause of death on the death certificates. The comparison group included Colorado residents who died from any cause during the same period other than cancer, mental disorders and injuries. A total of 4,991 suicide deaths were included and a total of 107,692 other deaths served as the comparison group. Occupations considered pesticide exposed included: veterinarians; pest control occupations; farmers and farm workers; farm managers and supervisors; marine life cultivators; nursery workers; groundskeepers and gardeners; animal caretakers; graders, sorters and inspectors of agricultural products; and forestry workers, supervisors and loggers. All other occupational categories were coded as unexposed. Logistic regression was used to compare the groups, separately for males and females. After controlling for age, race, Hispanic ethnicity, years of education, and marital status, males who were in pesticide exposed occupations had higher odds of suicide (odds ratio 1.14; 95% confidence interval 0.97, 1.34) and females in pesticide exposed occupations also had higher odds of suicide (odds ratio 1.98; 95% confidence interval 1.01, 3.88).	Journal of Agromedicine	11	3	107-12	Job title			Case-control	Job title	other	doctor-diagnosed	USA	hic
724	L. Stallones and C. Beseler	Pesticide illness, farm practices, and neurological symptoms among farm residents in Colorado	2002	The purpose of this study is to evaluate the association between pesticides and neurological symptoms among a population exposed to organophosphate chemicals as a result of agricultural use. Chronic sequelae of acute pesticide poisoning from organophosphate compounds include a variety of neurological symptoms including restlessness, irritability, and trouble sleeping. Individuals who have had an acute pesticide poisoning have been reported to suffer a wide range of neurological symptoms that occur from weeks to months after the initial episode. Data for this study came from a cross-sectional survey of farmers and their spouses conducted in an eight-county area in north-eastern Colorado. Neurological characteristics were assessed to determine their relationship with previously reported pesticide-related illnesses. Symptoms that were significantly associated with a previous poisoning were difficulty concentrating [OR 2.07, 95% confidence interval (CI) 1.22, 3.50]; relatives noticing person had trouble remembering things (OR 2.54, 95% CI 1.47, 4.39); making notes to remember things (OR 2.18, 95% CI 1.20, 3.97); finding it hard to understand the meaning of newspapers, magazines, and books (OR 1.90, 95% CI 1.01, 3.60); felt irritable (OR 1.84, 95% CI 1.08, 3.12); felt depressed (OR 2.82, 95% CI 1.65, 4.81); had heart palpitations without exertion (OR 2.83, 95% CI 1.22, 6.54); sleeping more than usual (OR 3.58, 95% CI 1.95, 6.58); difficulty moving fingers or grasping things (OR 2.08, 95% CI 1.06, 3.24); and headaches at least once a week (OR 1.85, 95% CI 1.06, 3.24). Stepwise regression was used to identify the best explanatory model of pesticide-related illness. Variables that were associated with increased odds of illness were being male, being depressed, sleeping too much, and using crop organophosphates.	Environmental Research	90	2	89-97	Self-reported exposure			Cross-sectional	Specific active ingredient	NA	self-reported	USA	hic

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725	L. Stallones and C. Beseler	Pesticide poisoning and depressive symptoms among farm residents	2002	PURPOSE: The purpose of the study presented is to evaluate the association between pesticides and depressive symptoms among a population exposed to chemicals as a result of agricultural use. Chronic sequelae of acute pesticide poisoning from organophosphate compounds may include anxiety and depression. In some states, farmers have been reported to have higher rates of depression than other population groups. Little work has been done to describe the effects of exposure to organophosphate compounds and depressive symptoms among the farming population. METHODS: Data for this study came from a cross sectional survey of farmers and their spouses conducted in an eight county area in northeastern Colorado. Personal interviews were conducted with the study participants. Depressive symptoms were assessed using the Center for Epidemiologic Studies-Depression (CES-D) scale. Pesticides applied on the farms were assessed using self-reported questionnaires. Conditional logistic regression was used to model the relationship between depression and pesticide-related illness in a stratified analysis. RESULTS: Between 1992-1997, 761 individuals were enrolled in this cross sectional survey. Adjusting for a number of potential confounders, the odds ratio for depression associated with pesticide-related illness was 5.87 [95% confidence interval (CI) = 2.56-13.44]. CONCLUSIONS: Exposure to pesticides at a high enough concentration to cause self reported poisoning symptoms was associated with high depressive symptoms independently of other known risk factors for depression among farm residents.	Annals of Epidemiology	12	6	389-94	Self-reported exposure			Cross-sectional	Chemical class	NA	self-reported	USA	hic
726	L. van Amelsvoort, D. Mohren, J. Slangen, G. Swaen, E. Corsini, S. Fustinoni, T. Vergieva, C. Bosetti, J. Liesivuori, M. Tarkowski, C. Colosio and H. van Loveren	Immune effects and exposure to ethylenebisdithiocarbamate pesticides in re-entry workers in the Netherlands	2008	Ethylenebisdithiocarbamates are widely used as fungicides in agriculture. Although EBDC's have a low acute toxicity, they are suspected to have immune effects at low doses. However, little human studies on these effects have been published. In the Netherlands, a study was conducted among pesticide exposed workers aimed at evaluating the short-term and long-term immune effects of exposure and the relation between ethylenebisdithiocarbamate and immune effects. Forty-one re-entry workers and 40 nonexposed controls were medically examined; furthermore, immune parameters were determined in blood, and all participants filled in a questionnaire regarding exposure and outcome parameters. The level of ethylenethiourea in urine was determined as indicator of exposure. No relevant adverse immune effects were found in the pesticide exposed workers compared with the nonexposed controls. Also no exposure response relationship between immune effects and ethylenebisdithiocarbamate in urine was found. This finding might be due to very low exposure levels of the re-entry work but might also be due to a lack of immunotoxicity of ethylenebisdithiocarbamate at normal exposure levels.	Human & Experimental Toxicology	27	9	693-9	Biomonitoring (urine)			Cohort (prospective)	Chemical class	immunological	medical test result	Netherlands	hic
727	L. W. Figgs, N. T. Holland, N. Rothmann, S. H. Zahm, R. E. Tarone, R. Hill, R. F. Vogt, M. T. Smith, C. D. Boysen, F. F. Holmes, K. VanDyck and A. Blair	Increased lymphocyte replicative index following 2,4-dichlorophenoxyacetic acid herbicide exposure	2000	OBJECTIVE: Evaluate peripheral blood lymphocyte proliferation (replicative index:RI) and micronuclei frequency (MF) among 2,4-D herbicide applicators. METHODS: Twelve applicators spraying only 2,4-D provided a blood and urine specimen upon enrollment, several urine samples during the spraying season, and a blood specimen at the study's end. Nine controls provided blood and urine specimens upon enrollment and at the study's end. Gas chromatography/tandem mass spectroscopy determined urinary 2,4-D levels and standard in-vitro assays determined RI and MF scores. Applicator RI and MF were compared before and after spraying and with controls. RESULTS: Applicators contributed 45 urine specimens with concentrations ranging from 1.0 to 1700 (microg 2,4-D/g creatinine/L urine) that logarithmically (ln) increased as spraying time increased. Applicator RI increased after spraying (p = 0.016), independent of tobacco and alcohol use, and demonstrated a weak dose-response with increasing urinary 2,4-D levels (p = 0.15). Among 2,4-D applicators, pre-exposure complete blood counts and lymphocyte immunophenotypes were not significantly different from post-exposure measurements. CONCLUSION: Urinary 2,4-D concentration, an exposure biomarker, may be associated with lymphocyte replicative index, a cell proliferation biomarker.	Cancer Causes & Control	11	4	373-80	Biomonitoring (urine)			Cohort (prospective)	Specific active ingredient	genetic (biomarkers)	medical test result	USA	hic
728	L. Wang, Z. Liu, J. Zhang, Y. Wu and H. Sun	Chlorpyrifos exposure in farmers and urban adults: Metabolic characteristic, exposure estimation, and potential effect of oxidative damage	2016	Chlorpyrifos is a widely used organophosphorus pesticide that efficiently protects crops against pests. However, recent studies suggest that severe exposure to chlorpyrifos may present adverse health effects in human. To analyze the exposure level and metabolic characteristics of chlorpyrifos pesticide in urban adults and farmers with/without occupation pesticide contact, the occurrence of urinary chlorpyrifos and methyl chlorpyrifos (CP-me), as well as their metabolite, 3,5,6-trichloro-2-pyridinol (TCPy), was determined in farmers of an agricultural village in China, and in urban adults of a nearby town. The geometric mean (GM) concentrations of TCPy, which is the major marker of chlorpyrifos exposure, were 4.29 and 7.57mug/g-creatinine in urban adults and farmers before pesticide application, respectively. Chlorpyrifos spraying significantly increased the concentrations of urinary TCPy. In the first day after spraying, a GM concentration of 43.7mug/g-creatinine was detected in the urine specimens from farmers, which decreased to 38.1 and 22.8mug/g-creatinine in the second and third day after chlorpyrifos spraying. The ratio of TCPy and its parent compounds, i.e. chlorpyrifos and CP-me, was positively associated with the sum concentration of urinary chlorpyrifos, CP-me, and TCPy, suggesting the increasing metabolic efficiency of chlorpyrifos to TCPy at higher chlorpyrifos exposure levels. To estimate the farmers' occupational exposure to chlorpyrifos pesticide, a new model based on the fitted first-order elimination kinetics of TCPy was established. Occupational chlorpyrifos exposure in a farmer was estimated to be 3.70mug/kg-bw/day (GM), which is an exposure level that is higher than the recommended guideline levels. Significant increase of urinary 8-hydroxydeoxyguanosine (8-OHdG) was observed on the first day after chlorpyrifos spraying, which indicates a potential oxidative damage in farmers. However, urinary 8-OHdG returned to its baseline level within two days.	Environmental Research	149	NA	164-170	Biomonitoring (urine)			Cohort (prospective)	Specific active ingredient	endocrine/nutritional/metabolical	medical test result	China	umic
729	L. X. Zhang, D. A. Enarson, G. X. He, B. Li and M. Chan-Yeung	Occupational and environmental risk factors for respiratory symptoms in rural Beijing, China	2002	The aim of the present study was to determine the effects of occupational and environmental exposure on respiratory symptoms in adults in rural Beijing, China. Thirty randomly selected villages in the counties of Shunyi and Tongxian, 50 km north and east, respectively, of the city of Beijing, China, participated in this study. Village doctors interviewed all residents aged > or = 15 yrs and completed the International Union Against Tuberculosis and Lung Disease Questionnaire on Bronchial Symptoms translated into Chinese with added questions on smoking and occupational and environmental exposure. Of the eligible population, 22,528 adults (98%) took part. The prevalence of all respiratory symptoms, i.e. asthma-like symptoms, asthma attacks in the last 12 months, chronic cough and chronic phlegm, was low. Significant determinants for respiratory symptoms were age, sex, smoking and county of residence. A dose-dependent relationship was found between cumulative cigarette consumption and prevalence of respiratory symptoms. After adjusting for these variables, exposure to insecticides and fertilisers significantly increased the risk of most of the respiratory symptoms, whereas exposure to indoor air pollution from domestic fuels did not. Exposure to chemicals such as insecticides and fertilisers contributed independently to the risk of respiratory symptoms in rural Beijing, China.	European Respiratory Journal	20	6	1525-31	Self-reported exposure			Cross-sectional	Pesticides in general	respiratory	self-reported	China	umic

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730	L. Zuniga-Venegas, G. Aquea, M. Taborda, G. Bernal and F. Pancetti	Determination of the genotype and phenotype of serum paraoxonase 1 (PON1) status in a group of agricultural and nonagricultural workers in the Coquimbo Region, Chile	2015	Paraoxonase 1 (PON1) is a glycosylated enzyme that is found associated with high-density lipoproteins in blood. In addition to its endogenous antioxidant role, this enzyme is also involved in hydrolysis of organophosphate (OP) pesticides in plasma. PON1 activity shows great variability in the population as a result of a polymorphism in the coding sequence that is expressed as a Glu(Q)/Arg(R) substitution at position 192 of the amino acid sequence. The aim of this study was to determine the activity levels (phenotype) and genotype of PON1 in a group of 85 agricultural workers occupationally exposed to OP pesticides and compared to 97 control subjects without occupational exposure. Allelic and genotypic frequencies of PON1Q192R polymorphism, as well as their catalytic activities, were established for the first time in a group of agricultural Chilean workers. The Q allele was more frequently represented in our studied population (approximately 60%). The Q allele is less efficient than the R allele at metabolizing chlorpyrifos (CPF), the most widely used OP pesticide in the geographical areas where samples were obtained. Further, a large interindividual variability in PON1 activity was observed, suggesting wide variation of individual susceptibility to CPF, an issue that needs to be considered in human monitoring studies.	Journal of Toxicology & Environmental Health Part A	78	6	357-68	Job title			Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	Chile	hic
731	M. A. A. Dalvie	The impact of hormonally active pesticides on the health of vulnerable communities in South Africa	2015	INTRODUCTION Dichlorodiphenyltrichloroethane (DDT) is used for malaria control and many current agricultural pesticides are hormonally active. A study investigating reproductive health effects of DDT on male vector control workers and one that investigated the effect of agricultural pesticide exposure on pubertal growth of boys in South Africa is described. METHODS AND MATERIALS The DDT study was a crosssectional study of 60 workers from 3 camps situated near the Malaria Control Center (MCC). Tests included a questionnaire, a physical examination, blood reproductive hormones, semen quality and serum DDT metabolites. The agricultural study was a cross-sectional study of 269 boys including 176 boys residing on farms and 93 not residing on farms. Tests included a questionnaire, clinical assessment of sexual maturity development according to Tanner Stage, anthropometric measurements including height, weight and BMI of boys, and reproductive hormones in blood. RESULTS In the DDT study, associations between DDT exposure measures (years worked at MCC and DDT metabolites) and reproductive outcomes were weak and inconsistent. The strongest association was a linear regression relationship between baseline estradiol and p'p' DDT (= 1.14 - 0.33 pg/ml/mg/g lipid, P = 0.001, R2 = 0.31, n = 46; adjusted for age and sex hormone binding globulin). In the agricultural study, farm boys were shorter (Regression coefficient (RC) = -3.42 cm; 95% confidence interval(CI): -6.38 to -0.45 cm); lighter (RC = -2.26 kg; CI: -4.44 to-0.75 kg); had lower serum lutenizing hormone (RC = -0.28 IU/l; CI: -0.48 to -0.08 IU/l); and had higher serum oestradiol (RC = 8.07 pM; CI: 2.34 - 13.81 pM) and follicle stimulating hormone (RC = 0.63 IU/L; CI: 0.19 - 1.08 U/l). CONCLUSIONS In the DDT study, an overall anti-androgenic mechanism best explains the results, but with a number of inconsistencies. The agricultural study provides evidence that environmental exposure to pesticides is associated with adverse reproductive and developmental effects in boys.	Tropical Medicine and International Health	20	NA	66	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	reproductive	medical test result	South Africa	umic
732	M. A. Dalvie, N. White, R. Raine, J. E. Myers, L. London, M. Thompson and D. C. Christiani	Long-term respiratory health effects of the herbicide, paraquat, among workers in the Western Cape	1999	OBJECTIVE: To evaluate the possible effects of paraquat spraying among workers on deciduous fruit farms in the Western Cape, South Africa. Paraquat is a commonly used herbicide world wide and is a well documented cause of pulmonary fibrosis in studies of laboratory animals and in humans after exposure to a high dose (usually accidental or as parasuicide). The respiratory effects of long term, low dose exposure to paraquat have not been fully evaluated. METHODS: A cross sectional study of 126 workers. Administered questionnaires generated information on exposure, respiratory symptoms, and potential confounding variables. Spirometry and gas transfer were measured and chest radiographs performed. Oxygen desaturation on exercise testing was by oximetry during a modified stage one exercise test. RESULTS: No association was found between long term exposure to paraquat and reported symptoms, spirometry (forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), FEV1/FVC) and gas transfer (TLCO and KCO) or chest radiography. Multivariate analysis showed a significant relation between measures of long term exposure to paraquat and arterial oxygen desaturation during exercise independent of short term exposure. CONCLUSION: Previous studies have not shown a significant relation between measures of exposure to paraquat and standard tests of lung function. Arterial oxygen desaturation during exercise represents a more sensitive test. The findings indicate that working with paraquat under usual field conditions is associated with abnormal exercise physiology in a dose dependent fashion independent of recent exposure and acute poisoning events.	Occupational & Environmental Medicine	56	6	391-6	Self-reported exposure			Cross-sectional	Specific active ingredient	respiratory	self-reported	South Africa	umic
733	M. A. Harris, M. , T. , S. and T.	Occupations and parkinson's disease in a population-based case-control study	2013	Objectives Despite mounting evidence on epidemiological risk factors, Parkinson's disease (PD) incidence remains largely unexplained. The purpose of this study was to test associations between occupations and PD to complement analyses of occupational exposures. Methods We used a population-based case-control design in British Columbia, Canada, including 403 cases (users of antiparkinsonian medication) and 405 controls (from the provincial health insurance register, frequency matched on age and sex). Job histories were collected using structured questionnaires querying all jobs held since age 16. Odds ratios were calculated for associations between PD and occupational categories using unconditional logistic regression, adjusting for age, sex, and smoking. Results Significantly elevated risks were found for social science, law and library jobs (OR 1.82; 95% CI 1.01 - 3.29); and farming and horticulture jobs (OR 2.03; 95% CI 1.10 - 3.74). Nonsignificantly elevated risks were found for gas station jobs (OR 2.55; 95% CI 0.84 - 7.72); welders (OR 2.98; 95% CI 0.78 - 11.40); and drivers of heavy equipment (OR 1.95; 95% CI 0.66 - 5.81). Reduced risks were found for management and administration jobs (OR 0.70; 95% CI 0.49 - 0.99); other health care jobs (OR 0.44; 95% CI 0.20 - 0.99); repairers (OR 0.49; 95% CI 0.22 - 1.09); and electricians (OR 0.46; 95% CI 0.17 - 1.26). Conclusions Increased risks for social science jobs could be related to numbers of people contacted in a day and risk of infections. Severe influenza was associated with increased risk of PD but number of people contacted was not. Elevated risks for farmers are typically attributed to pesticide exposure, however our pesticide analyses did not support this attribution. Other exposures of interest for farmers could include animal contact, influenza, head injuries, and vibration from heavy equipment, all associated with PD in our study.	Occupational and Environmental Medicine	70	NA	NA	Self-reported job history			Case-control	Job title	neurological	doctor-diagnosed	Canada	hic

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734	M. A. Kerr, P. C. Nasca, K. A. Mundt, A. M. Michalek, M. S. Baptiste and M. C. Mahoney	Parental occupational exposures and risk of neuroblastoma: a case-control study (United States)	2000	BACKGROUND: A case-control study was conducted with 183 histologically confirmed neuroblastoma cases aged 0-14 years diagnosed among residents of New York State, excluding New York City, between 1976 and 1987. Three hundred seventy-two controls were selected from the New York State live birth certificate registry and were matched to cases on year of birth. METHODS: Parental occupational exposures at the time of each child's birth were obtained from maternal telephone interviews, successfully completed for 85% of cases and 87% of controls. RESULTS: Odds ratios were significantly elevated for maternal occupation in the service (OR = 2.0, 95% CI = 1.0 4.1) and retail (OR = 2.0, 95% CI = 1.1-3.7) industries and paternal occupation in materials handling (OR = 3.8, 95% CI = 1.1-14.6). Odds ratios were also significantly elevated for maternal report of occupational exposure to acetone (OR = 3.1, 95% CI = 1.7-5.6), insecticides (OR = 2.3, 95% CI = 1.4-3.7), lead (OR = 4.7, 95% CI = 1.3-18.2) and petroleum (OR = 3.0, 95% CI = 1.5-6.1) and paternal exposure to creosote (OR = 2.1, 95% CI = 1.1-4.3), dioxin (OR = 6.9, 95% CI = 1.3-68.4), lead (OR = 2.4, 95% CI = 1.2-4.8), and petroleum (OR = 1.8, 95% CI = 1.1-2.8). CONCLUSIONS: Due to the uncertainty of the biologic plausibility of these associations and the possibility of alternative explanations, these results should be interpreted cautiously.	Cancer Causes & Control	11	7	635-43	Self-reported exposure			Case-control	Type of pesticide	cancer	doctor-diagnosed	USA	hic
735	M. Amer, M. Metwalli and Y. Abu el-Magd	Skin diseases and enzymatic antioxidant activity among workers exposed to pesticides	2002	In this study, 150 workers exposed to pesticides and 50 healthy control subjects were given clinical and dermatological examinations, patch tests, tests of liver and renal function, complete blood count, blood sugar and urinalysis. Activity of the antioxidant enzymes superoxide dismutase, glutathione peroxidase and glutathione reductase was also evaluated. Dermatological findings were positive in 78%, 76% and 54% of workers exposed to organophosphates, pyrethroids and carbamate pesticides respectively. The patch test was positive in 70% of workers exposed to pyrethroids and 64% exposed to carbamate pesticides. Liver enzyme levels were generally increased in workers while antioxidant enzyme activity was significantly decreased in all workers compared with the controls.	Eastern Mediterranean Health Journal	8	2	363-73	Biomonitoring (blood)			Cross-sectional	Chemical class	dermatological	self-reported	NA	NA
736	M. Amizadeh, M. Safari-Kamalabadi, G. Askari-Saryazdi, M. Amizadeh and H. Reihani-Kermani	Pesticide Exposure and head and neck cancers: A case-control study in an agricultural region	2017	Introduction: Causes of head and neck cancers (HNCs) are multifactorial, and few studies have investigated the association between chemical exposure and HNCs. The objective of this study was to investigate associations between HNCs, agricultural occupations, and pesticide exposure. The potential for the accumulation of pesticides in the adipose tissue of patients was also investigated. Materials and Methods: A structured questionnaire was used to collect information on demographics, occupation, and exposure to pesticides in a hospital-based case-control study. Pesticide residue in the adipose tissue of the neck in both cases and controls was also monitored via gas chromatography-mass spectroscopy. Results: Thirty-one HNC cases were included in this study as well as 32 gender-, age-, and smoking-matched controls. An agricultural occupation was associated with HNC (odds ratio [OR], 3.26; 95% confidence interval [CI], 1.13-9.43) after controlling for age, sex, and smoking. Pesticide exposure was associated with total HNC cases (OR, 7.45; 95% CI, 1.78-3.07) and larynx cancer (OR, 9.33; 95% CI, 1.65-52.68). A dose-response pattern was observed for HNC cases (P=0.06) and larynx cancer (P=0.01). In tracing the pesticide residue, five chlorinated pesticides, namely dichlorodiphenyltrichloroethane (DDT), dichlorodipheny-ldichloroethane (DDD), dichlorodiphenyldichloroethylene (DDE), dieldrin, and lindane, were identified in the adipose tissue. Chlorinated pesticide detection was significantly associated with HNC (OR, 3.91; 95% CI 0.9-0.16.9). Conclusion: HNCs were found to be associated with pesticide exposure after controlling for confounders. A high education level was identified as a modifying factor decreasing the risk of HNCs. Further studies with larger number of subjects are recommended to assess these relationships in greater detail.	Iranian Journal of Otorhinolaryngology	29	5	275-285	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Iran	umic
737	M. Amr, M. Allam, A. L. Osmaan, M. el-Batanouni, G. el Samra and Z. Halim	Neurobehavioral changes among workers in some chemical industries in Egypt	1993	This study investigates the long-term neuropsychiatric manifestations of single or combined chemicals: manganese; zinc phosphide; lead, mercury, and TNT; and pesticides among exposed industrial workers. We found that 75% of the exposed subjects as a whole and 50% of those exposed to each of Zinc phosphide and pesticides presented with more than one neuropsychiatric symptoms or signs. The main signs were mask faces, hyporeflexia, hyperreflexia, peripheral neuropathy, static tremors, radiculopathy, muscle weakness, mental changes, fasciculations and tremors, wasting, hypotonia, abnormal deep reflexes, and sensory hyposthesia. Neurological manifestations were confirmed by electromyography and their severity was related to the duration of exposure and confirmed as well by electroencephalography. These results are discussed and their implications high-lighted.	Environmental Research	63	2	295-300	Biomonitoring (blood)			Cohort (prospective)	Chemical class	neurological	medical test result	Egypt	lmic
738	M. Araoud, F. Neffeti, W. Douki, H. B. Hfaiedh, M. Akrout, M. Hassine, M. F. Najjar and A. Kenani	Adverse effects of pesticides on biochemical and haematological parameters in Tunisian agricultural workers	2012	Biomonitoring of effects in agricultural workers is necessary to assess the individual risk of handling pesticides. In this study, biochemical and haematological parameters were measured to evaluate the effects of exposure to these compounds in agricultural workers. The study was carried out in 110 workers and 97 control subjects. Several haematological and biochemical parameters were analysed. Assessment of haematological parameters revealed that the mean cell volume and haematocrit levels were significantly lower in workers than in controls (P=0.002 and 0.013, respectively), while mean corpuscular haemoglobin concentrations were higher in workers (P<0.001). There was also a significant inhibition of butyrylcholinesterase activity in workers compared with that in controls (P<0.001). Assessment of biochemical parameters further showed significantly higher activities of transferases, lactate dehydrogenase (P<0.001), alkaline phosphatase (ALP) (P=0.006) and creatine kinase (CK) (P<0.015), as well as higher levels of proteins (P<0.001), creatinine (P=0.001) and urea (P=0.001) in workers compared with controls, along with significantly higher uric acid levels (P=0.012). Furthermore, the number of years exposed to pesticides predicted higher activities of alanine aminotransferase, CK, ALP, as well as uric acid levels. Overall, chronic exposure to pesticides appeared to affect several biochemical parameters. These biomarkers seem to be indicative of adverse effects of pesticides in agricultural workers, confirming their use for routine monitoring of effects.	Journal of Exposure Science & Environmental Epidemiology	22	3	243-7	EAM not reported			Cross-sectional	Pesticides in general	biochemical	medical test result	Tunisia	lmic

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739	M. Araoud, F. Neffeti, W. Douki, M. F. Najjar and A. Kenani	Paraoxonase 1 correlates with butyrylcholinesterase and gamma glutamyl transferase in workers chronically exposed to pesticides	2010	OBJECTIVES: Agricultural workers chronically exposed to complex mixtures of pesticides are at increased risk of acute and chronic toxicity of these compounds. Enzyme activities are among the biomarkers that may be used to detect the effects of pesticides before adverse clinical health effects occur. The aims of this study were to ascertain the relationships between paraoxonase 1 (PON1) and other serum enzymes and to investigate whether long-term exposure to pesticides affects these relationships in Tunisian agricultural workers. METHODS: The activities of butyrylcholinesterase (BChE), aminotransferases, gamma glutamyl transferase (GGT), alkaline phosphatase (ALP), lactate dehydrogenase (LDH) and creatine kinase (CK) were measured in plasma from workers chronically exposed to pesticides using an Integra 400 plus(TM) system. PON1 activity was measured using konelab 30(TM) system. RESULTS: Significant increases in aminotransferases, CK, LDH and ALP activities were found in workers exposed to pesticides. However, BChE and PON1 activities were decreased significantly in these subjects. In addition, PON1 activity was positively correlated with both BChE and GGT activities in these workers. CONCLUSION: This study suggests that pesticides lead to alteration of serum enzymes and that chronic exposure to pesticides might contribute to explain the positive correlation between PON1 and GGT, perhaps in order to protect BChE and simultaneously induce detoxification of pesticides.	Journal of Occupational Health	52	6	383-8	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Tunisia	lmic
740	M. Arshad, M. Siddiqa, S. Rashid, I. Hashmi, M. A. Awan and M. A. Ali	Biomonitoring of Toxic Effects of Pesticides in Occupationally Exposed Individuals	2016	Background Workers in pesticide manufacturing industries are constantly exposed to pesticides. Genetic biomonitoring provides an early identification of potential cancer and genetic diseases in exposed populations. The objectives of this biomonitoring study were to assess DNA damage through comet assay in blood samples collected from industry workers and compare these results with those of classical analytical techniques used for complete blood count analysis. Methods Samples from controls (n = 20) and exposed workers (n = 38) from an industrial area in Multan, Pakistan, were subjected to various tests. Malathion residues in blood samples were measured by gas chromatography. Results The exposed workers who were employed in the pesticide manufacturing industry for a longer period (i.e., 13-25 years) had significantly higher DNA tail length (7.04 <U+0152><U+00BA>m) than the controls (0.94 <U+0152><U+00BA>m). Workers in the exposed group also had higher white blood cell and red blood cell counts, and lower levels of mean corpuscular hemoglobin (MCH), MCH concentration, and mean corpuscular volume in comparison with normal levels for these parameters. Malathion was not detected in the control group. However, in the exposed group, 72% of whole blood samples had malathion with a mean value of 0.14 mg/L (range 0.01-0.31 mg/L). Conclusion We found a strong correlation (R2 = 0.91) between DNA damage in terms of tail length and malathion concentration in blood. Intensive efforts and trainings are thus required to build awareness about safety practices and to change industrial workers' attitude to prevent harmful environmental and anthropogenic effects.	Safety and Health at Work	7	2	156-160	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	genetic (biomarkers)	medical test result	Pakistan	lmic
741	M. Bahrami, P. J. Laurienti, S. A. Quandt, J. Talton, C. N. Pope, P. Summers, J. H. Burdette, H. Chen, J. Liu, T. D. Howard, T. A. Arcury and S. L. Simpson	The impacts of pesticide and nicotine exposures on functional brain networks in Latino immigrant workers	2017	Latino immigrants that work on farms experience chronic exposures to potential neurotoxicants, such as pesticides, as part of their work. For tobacco farmworkers there is the additional risk of exposure to moderate to high doses of nicotine. Pesticide and nicotine exposures have been associated with neurological changes in the brain. Long-term exposure to cholinesterase-inhibiting pesticides, such as organophosphates and carbamates, and nicotine place this vulnerable population at risk for developing neurological dysfunction. In this study we examined whole-brain connectivity patterns and brain network properties of Latino immigrant workers. Comparisons were made between farmworkers and non-farmworkers using resting-state functional magnetic resonance imaging data and a mixed-effects modeling framework. We also evaluated how measures of pesticide and nicotine exposures contributed to the findings. Our results indicate that despite having the same functional connectivity density and strength, brain networks in farmworkers had more clustered and modular structures when compared to non-farmworkers. Our findings suggest increased functional specificity and decreased functional integration in farmworkers when compared to non-farmworkers. Cholinesterase activity was associated with population differences in community structure and the strength of brain network functional connections. Urinary cotinine, a marker of nicotine exposure, was associated with the differences in network community structure. Brain network differences between farmworkers and non-farmworkers, as well as pesticide and nicotine exposure effects on brain functional connections in this study, may illuminate underlying mechanisms that cause neurological implications in later life.	NeuroToxicology	62	NA	138-150	Biomonitoring (blood)	Biomonitoring (urine)		Cohort (prospective)	Chemical class	neurological	medical test result	USA	hic
742	M. Bakhshi, S. Manifar, N. Azizi, H. Asayesh, P. Mansouri, S. Nasiri, Z. Hashemi and A. Mehdipour	Risk factors in patients with oral pemphigus vulgaris: a case-control study	2016	Pemphigus vulgaris (PV) is considered a chronic disease with a potentially fatal outcome. Studies have suggested that environmental factors and personal habits play an important role in the pathogenesis of PV, but more studies are required to elaborate their connection to the disease. The goal of this multicenter case-control study was to determine some of the environmental factors related to PV. Cases (n = 99) were patients with PV, and controls (n = 198) were individuals who did not have PV. Data about demographics, history, clinical findings, occupational exposures to pesticides, smoking status, number of births (parity), herpes simplex virus (HSV) infection, and fast food consumption were collected using a structured questionnaire. Chi-square and logistic regression analyses were used for data analysis. Univariate logistic regression analysis indicated that the statistically significant factors related to PV were infection with HSV in recent weeks (odds ratio [OR], 3.35; 95% confidence interval [CI], 1.75-6.43), parity (OR, 0.50; 95% CI, 0.39-0.63), and lack of occupational exposure to pesticides (OR, 0.36; 95% CI, 0.21-0.60). Multivariate analysis revealed that significant factors were cessation of smoking (adjusted odds ratio [AOR], 4.36; 95% CI, 1.50-12.66), HSV infection (AOR, 2.91; 95% CI, 1.47-5.75), and lack of occupational exposure to pesticides (AOR, 0.35; 95% CI, 0.20-0.63). The findings indicated that cessation of smoking and HSV infection in recent weeks are risk factors for PV, while lack of occupational exposure to pesticides and increasing parity (a greater number of births) are protective factors against PV.	General Dentistry	64	3	e10-3	Self-reported exposure			Case-control	Pesticides in general	dermatological	doctor-diagnosed	Iran	umic
743	M. Baranska, L. Van Amelsvoort, S. Birindelli, S. Fustinoni, E. Corsini, J. Liesivuori and H. Van Loveren	Association of pesticide exposure, vaccination response, and interleukin-1 gene polymorphisms	2008	We performed a cross-sectional study involving workers from four European countries in which exposure to pesticides and immune parameters were evaluated over a short period of time. The total study population consisted of 238 workers occupationally exposed to pesticides and 198 nonoccupationally exposed workers. The study showed that pesticide exposure at levels encountered by workers under different conditions in Europe did not affect the ability of the immune system to respond to vaccination. We could, however, identify individuals within the group of pesticide exposed workers who were genetically characterized by the 2.2 IL-1alpha polymorphism and who showed a lower antibody response, pointing out the importance of the understanding of genetic variability and the interaction between genetic and environmental factors in the identification of high-risk individuals, which may eventually lead to preventive measures.	Human & Experimental Toxicology	27	9	709-13	EAM not reported			Cross-sectional	NA	immunological	medical test result	SHIC	SHIC

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
744	M. Bayrami, T. Hashemi, A. A. Malekirad, H. Ashayeri, F. Faraji and M. Abdollahi	Electroencephalogram, cognitive state, psychological disorders, clinical symptom, and oxidative stress in horticulture farmers exposed to organophosphate pesticides	2012	The aim of this paper was to study the toxicity of organophosphate (OP) pesticides in exposed farmers for electroencephalography, cognitive state, psychological disorders, clinical symptom, oxidative stress, acetylcholinesterase, and DNA damage. A comparative cross-sectional analysis was carried out in 40 horticulture farmers who were exposed to OPs in comparison to a control group containing 40 healthy subjects with the same age and sex and education level. Lipid peroxidation (LPO), superoxide dismutase (SOD), catalase, glutathione peroxidase, DNA damage, total antioxidant capacity (TAC), total thiol molecules, and acetylcholinesterase (AChE) activity were measured in the blood of subjects. Clinical examination and complete blood test were undertaken in order to record any abnormal sign or symptoms. Cognitive function, psychological symptoms, and psychological distress were examined and recorded. Comparing with controls, the farmers showed higher blood levels of SOD and LPO while their TAC decreased. Farmers showed clinical symptoms such as eczema, breathing muscle weakness, nausea, and saliva secretion. Regarding cognitive function, the orientation, registration, attention and calculation, recall, and language were not significantly different in farmers and controls. Among examinations for psychological distress, only labeled somatization was significantly higher in farmers. The present findings indicate that oxidative stress and inhibition of AChE can be seen in chronically OP-exposed people but incidence of neuropsychological disorders seems a complex multivariate phenomenon that might be seen in long-term high-dose exposure situations. Use of supplementary antioxidants would be useful in the treatment of farmers.	Toxicology & Industrial Health	28	1	33025	Job title			Cross-sectional	Chemical class	mental disorders	self-reported	Iran	umic
745	M. Bertin, A. Thebaud-Mony and E. Counil	Gendered patterns of multiple occupational carcinogenic exposures. Results at the job level from a cohort of patients with mostly respiratory cancer (Seine-Saint-Denis, France)	2016	Several national and international initiatives were conducted to estimate or monitor current occupational carcinogenic exposures (OCE). However, older periods are usually less well documented. Moreover, both the methodological approaches used and the limited number of agents considered are likely to underestimate situations of multiple-exposure. The aim of this study was to characterise multiple OCE at the job level among patients with cancer. We used data from the GISCOP93 permanent survey to describe OCE from a list of 54 carcinogens, separately for men and women. Associations between these exposures and jobs' characteristics were assessed by using Poisson model with robust variance. Principal Component Analysis and Hierarchical Ascendant Classification were used to identify gendered patterns of multiple OCE. Respectively 61.1% of men jobs (834 patients, 5202 jobs) and 26.7% of women jobs (183 patients, 885 jobs) were exposed to at least one carcinogen. Among exposed jobs, two-third were multiply-exposed (i.e. - 2 OCE) in men (n = 2173) and 1/3 in women (n = 82). Among men, blue collars workers had an increased risk (factor of three to four) of OCE as compared to employees. Women working as blue collar workers in the metallurgy, confection and mechanics industries were also two to three times more often exposed to carcinogens than employees. Eight patterns of multiple OEC were identified in men's jobs: multipleexposures to widespread carcinogens, mixed silica dust, heavy metals/combustion products, organic compounds/radiations, metal working, solvents/heavy metals, wood dust/formaldehyde/ pesticides, and fuels exhausts. Three patterns of multiple OCE were observed among women's jobs: biological/organic compounds, industrial working, and fuels exhausts. These results based on a study considering cancer as a sentinel event highlight evidence of a gendered pattern in multiple OCE, inconsistent with the criteria in use among the occupational disease compensation system based on a single-factor approach of carcinogenesis.	Occupational and Environmental Medicine	73	NA	A92-A93	Job title			Cross-sectional	Job title	cancer	doctor-diagnosed	France	hic
746	M. Bosch de Basea, M. Porta, J. Alguacil, E. Puigdomenech, M. Gasull, J. A. Garrido, T. Lopez and P. I. S. Group	Relationships between occupational history and serum concentrations of organochlorine compounds in exocrine pancreatic cancer	2011	BACKGROUND: Previous studies investigating associations between occupational history and risk of exocrine pancreatic cancer (EPC) did not use biomarkers of exposure. The only two studies that measured internal concentrations of organochlorine compounds (OCs) in EPC did not analyse their relationship with occupation. OBJECTIVE: To analyse the relationship between occupational history and blood concentrations of seven OCs in patients with EPC. METHODS: Incident cases of EPC were prospectively identified, and during hospital admission were interviewed face-to-face on occupational history and life-style factors (n = 135). Occupations were coded according to the International Standard of Occupations 1988. Some occupational exposures were also assessed with the Finnish job-exposure matrix (Finjem). Serum concentrations of OCs were analysed by high-resolution gas chromatography with electron-capture detection. RESULTS: Craftsmen and related trades workers had significantly higher concentrations of polychlorinated biphenyl (PCB) congeners 138, 153 and 180. Years worked in agriculture did not influence concentrations of p,p'-DDT, p,p'-DDE, hexachlorobenzene or beta-hexachlorocyclohexane. Subjects who ever worked in agriculture had lower concentrations of PCBs (all p < 0.05). Occupational exposure to lead, nickel and low frequency magnetic fields was significantly associated with higher concentrations of PCBs. CONCLUSIONS: Certain occupations were associated with higher concentrations of PCBs, suggesting that these compounds may account for some increased risks found in previous studies. The lack of association between work in agriculture and concentrations of OC pesticides is consistent with occupation playing a lesser role than diet in influencing OC concentrations. Occupational studies on the relationships among exposure to industrial agents and EPC risk may need to consider adjusting for exposure to PCBs.	Occupational & Environmental Medicine	68	5	332-8	Job exposure matrix	Expert case-by-case assessment		Cohort (prospective)	Chemical class	cancer	doctor-diagnosed	Spain	hic
747	M. Butinof, R. A. Fernandez, M. I. Stimolo, M. J. Lantieri, M. Blanco, A. L. Machado, G. Franchini and P. Diaz Mdel	Pesticide exposure and health conditions of terrestrial pesticide applicators in Cordoba Province, Argentina	2015	Agricultural workers represent a population that is highly vulnerable to the toxic effects of pesticide exposure. This cross sectional study aimed to describe the health conditions of terrestrial pesticide applicators in Cordoba Province, Argentina, their work practices and socio-demographic characteristics, by means of a standardized self-administered questionnaire (n = 880). A descriptive analysis reported a high prevalence of occasional or frequent symptoms: 47.4% had symptoms of irritation, 35.5% fatigue, 40.4% headache and 27.6% nervousness or depression. Using logistic regression models, risk and protective factors were found for symptoms of irritation, medical consultation and hospitalization. Among the occupational exposure variables, marital status, length of time in the job, low level of protection with regard to the use of personal protective equipment, combined use of different pesticides and the application of the insecticide endosulfan, were associated with a higher frequency of reported symptoms and higher consultation rates and hospitalization.	Cadernos de Saude Publica	31	3	633-46	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	Argentina	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
748	M. C. Acuna, V. Diaz, R. Tapia and M. A. Cumsille	[Assessment of neurotoxic effects of methyl bromide in exposed workers]	1997	BACKGROUND: Methyl bromide is an aliphatic hydrocarbon derivative used as a pesticide that causes skin, kidney, respiratory, liver and neurological damage. AIM: To assess the neurological and psychiatric damage caused by methyl bromide in exposed workers of seed and fruit export industries in a rural area near Santiago. SUBJECTS AND METHODS: We studied prospectively 15 male middle age workers before and after a fumigation period with methyl bromide, that lasted two to four weeks. According to the initial assessment, 5 of these subjects had a chronic exposure to the chemical. As controls, 10 non exposed workers matched for age, sex and working conditions were studied in two occasions. The evaluation included the WHO Neuro Behavior Core Test Battery, dynamometric and vibrator assessment of peripheral nerve function, the Nothingham test for psychological functioning and Titmus test for visual acuity. Methyl bromide levels were measured in blood and urine. RESULTS: Blood methyl bromide levels increased from 13.3 to 30 mg/dl after exposure. Symptoms that appeared with a higher frequency in exposed workers were insomnia, headache, paresthesiae, mood changes and loss of memory and concentration. In these subjects, the threshold for the Vibraton test increased from 2.4 to 2.85 sec, dynamometry showed a strength reduction in the right side from 51.4 to 47.2 kg and there was an increase in the score for negative auto-perception in the Nothingham test from 11.2 to 13.6. No deterioration in these tests were observed in unexposed workers. CONCLUSIONS: Acute and chronic methyl bromide exposure causes important psychological and neurological derangement.	Revista Medica de Chile	125	1	36-42	Biomonitoring (urine)			Cohort (prospective)	Specific active ingredient	neurological	medical test result	Chile	hic
749	M. C. D. Alavanja, M.; Samanic, C.; Lubin, J.; Lynch, C. F.; Knott, C.; Barker, J.; Hoppin, J. A.; Sandler, D. P.; Coble, J.; Thomas, K.; Blair, A.	Pesticides and lung cancer risk in the agricultural health study cohort	2004	The authors examined the relation between 50 widely used agricultural pesticides and lung cancer incidence in the Agricultural Health Study, a prospective cohort study of 57,284 pesticide applicators and 32,333 spouses of farmer applicators with no prior history of lung cancer. Self-administered questionnaires were completed at enrollment (1993-1997). Cancer incidence was determined through population-based cancer registries from enrollment through December 31, 2001. A lung cancer standardized incidence ratio of 0.44 (95% confidence interval: 0.39, 0.49) was observed overall, due in large part to a low cigarette smoking prevalence. Two widely used herbicides, metolachlor and pendimethalin (for low-exposed groups to four higher exposure categories: odds ratio (OR) = 1.0, 1.6, 1.2, 5.0; p(trend) = 0.0002; and OR = 1.0, 1.6, 2.1, 4.4; p(trend) = 0.003, respectively), and two widely used insecticides, chlorpyrifos and diazinon (OR = 1.0, 1.1, 1.7, 1.9; p(trend) = 0.03; and OR = 1.0, 1.6, 2.7, 3.7; p(trend) = 0.04, respectively), showed some evidence of exposure response for lung cancer. These excesses could not be explained by previously identified lung cancer risk factors. The usage levels in this cohort are considerably higher than those typically experienced by the general population. An excess risk among spouses directly exposed to pesticides could not be evaluated at this time.	American Journal of Epidemiology	160	9	876-85	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
750	M. C. H. Alavanja, J. N.; Lynch, C. F.; Hines, C. J.; Barry, K. H.; Barker, J.; Buckman, D. W.; Thomas, K.; Sandler, D. P.; Hoppin, J. A.; Koutros, S.; Andreotti, G.; Lubin, J. H.; Blair, A.; Beane Freeman, L. E.	Non-hodgkin lymphoma risk and insecticide, fungicide and fumigant use in the agricultural health study	2014	Farming and pesticide use have previously been linked to non-Hodgkin lymphoma (NHL), chronic lymphocytic leukemia (CLL) and multiple myeloma (MM). We evaluated agricultural use of specific insecticides, fungicides, and fumigants and risk of NHL and NHL-subtypes (including CLL and MM) in a U.S.-based prospective cohort of farmers and commercial pesticide applicators. A total of 523 cases occurred among 54,306 pesticide applicators from enrollment (1993-97) through December 31, 2011 in Iowa, and December 31, 2010 in North Carolina. Information on pesticide use, other agricultural exposures and other factors was obtained from questionnaires at enrollment and at follow-up approximately five years later (1999-2005). Information from questionnaires, monitoring, and the literature were used to create lifetime-days and intensity-weighted lifetime days of pesticide use, taking into account exposure-modifying factors. Poisson and polytomous models were used to calculate relative risks (RR) and 95% confidence intervals (CI) to evaluate associations between 26 pesticides and NHL and five NHL-subtypes, while adjusting for potential confounding factors. For total NHL, statistically significant positive exposure-response trends were seen with lindane and DDT. Terbufos was associated with total NHL in ever/never comparisons only. In subtype analyses, terbufos and DDT were associated with small cell lymphoma/chronic lymphocytic leukemia/marginal cell lymphoma, lindane and diazinon with follicular lymphoma, and permethrin with MM. However, tests of homogeneity did not show significant differences in exposure-response among NHL-subtypes for any pesticide. Because 26 pesticides were evaluated for their association with NHL and its subtypes, some chance finding could have occurred. Our results showed pesticides from different chemical and functional classes were associated with an excess risk of NHL and NHL subtypes, but not all members of any single class of pesticides were associated with an elevated risk of NHL or NHL subtypes. These findings are among the first to suggest links between DDT, lindane, permethrin, diazinon and terbufos with NHL subtypes.	PLoS ONE [Electronic Resource]	9	10	e109332	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
751	M. C. S. Alavanja, C.; Dosemeci, M.; Lubin, J.; Tarone, R.; Lynch, C. F.; Knott, C.; Thomas, K.; Hoppin, J. A.; Barker, J.; Coble, J.; Sandler, D. P.; Blair, A.	Use of agricultural pesticides and prostate cancer risk in the Agricultural Health Study cohort	2003	The authors examined the relation between 45 common agricultural pesticides and prostate cancer incidence in a prospective cohort study of 55,332 male pesticide applicators from Iowa and North Carolina with no prior history of prostate cancer. Data were collected by means of self-administered questionnaires completed at enrollment (1993-1997). Cancer incidence was determined through population-based cancer registries from enrollment through December 31, 1999. A prostate cancer standardized incidence ratio was computed for the cohort. Odds ratios were computed for individual pesticides and for pesticide use patterns identified by means of factor analysis. A prostate cancer standardized incidence ratio of 1.14 (95% confidence interval: 1.05, 1.24) was observed for the Agricultural Health Study cohort. Use of chlorinated pesticides among applicators over 50 years of age and methyl bromide use were significantly associated with prostate cancer risk. Several other pesticides showed a significantly increased risk of prostate cancer among study subjects with a family history of prostate cancer but not among those with no family history. Important family history-pesticide interactions were observed.	American Journal of Epidemiology	157	9	800-14	Self-reported exposure			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
752	M. C. S. Alavanja, D. P.; Lynch, C. F.; Knott, C.; Lubin, J. H.; Tarone, R.; Thomas, K.; Dosemeci, M.; Barker, J.; Hoppin, J. A.; Blair, A.	Cancer incidence in the agricultural health study	2005	OBJECTIVES: This large, prospective cohort study of private applicators, commercial applicators, and spouses of farmer applicators was undertaken to ascertain the etiology of cancers elevated in agriculture. METHODS: The participants were matched to cancer registry files in Iowa and North Carolina. Incident cases were identified from enrollment through 31 December 2002. Standardized incidence ratios (SIR) were used to compare the cancer incidence of the participants with that of the total population in the two states. RESULTS: The overall cancer incidence among farmers [SIR 0.88, 95% confidence interval (95% CI) 0.84-0.91] and their spouses (SIR 0.84, 95% CI 0.80-0.90) were significantly lower than expected, particularly for respiratory and urinary cancers. Commercial pesticide applicators had an overall cancer incidence comparable with the expected (SIR 1.01, 95% CI 0.84-1.20). Smoking prevalence was significantly lower than the national average. Prostate cancer was elevated among private applicators (SIR 1.24, 95% CI 1.18-1.33) and commercial applicators (SIR 1.37, 0.98-1.86). Excess ovarian cancer was observed for female applicators (SIR 2.97, 95% CI 1.28-5.85), but not for female spouses (SIR 0.55, 95% CI 0.38-0.78). Female spouses had a significant excess of melanoma (SIR 1.64, 95% CI 1.24-2.09), which was not observed among pesticide applicators. CONCLUSIONS: Low overall cancer incidence rates seem to be a result of low overall smoking prevalence and other lifestyle factors, while excess cancer of the prostate and ovaries among applicators may be occupationally related. The excess risk of melanoma observed among spouses was unexpected.	Scandinavian Journal of Work, Environment & Health	31	NA	39-45; discussion 5-7	Self-reported exposure			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
753	M. C. S. Alavanja, D. P.; McDonnell, C. J.; Lynch, C. F.; Pennybacker, M.; Zahm, S. H.; Lubin, J.; Mage, D.; Steen, W. C.; Wintersteen, W.; Blair, A.	Factors associated with self-reported, pesticide-related visits to health care providers in the agricultural health study	1998	To investigate factors associated with pesticide-related visits to health care providers (i.e., doctor or hospital visits), responses to self-administered questionnaires received from 35,879 licensed restricted-use pesticide applicators participating in the Agricultural Health Study were analyzed. (In Iowa, applicators are actually certified, whereas in North Carolina they are licensed; for ease of reference, the term license will be used for both states in this paper.) The cohort reported a total of more than 10.9 million pesticide-application days. These applications were associated with one or more pesticide-related health care visits by 2,214 applicators (7.0% of the applicator cohort for whom health care visit data were available). The odds of a pesticide-related health care visit were increased for commercial applicators compared to private applicators [odds ratio (OR = 1.77; 95% confidence interval (CI), 1.52-2.06) and for applicators who used insecticides 70 times or more in their lifetime compared to those who used insecticides less frequently (OR = 1.43; CI, 1.26-1.63). After adjusting for the number of applications in a logistic regression model, significantly higher odds of health care visits were observed among North Carolina applicators compared to Iowa applicators (OR = 1.35; CI, 1.17-1.52), among applicators who mixed their own pesticides (OR = 1.65; CI, 1. 22-2.23), and among applicators who personally repaired their pesticide application equipment at least once per year (OR = 1.12; CI, 1.06-1.25). Significantly lower odds were found among female versus male applicators (OR = 0.68; CI, 0.46-0.99) and among applicators who graduated from high school versus those who did not (OR = 0.82; CI, 0.71-0.94 for high school graduates and OR = 0.79; CI, 0.68-0.91 for those with at least some college). Several methods of pesticide application to crops, seed, or stored grain were also associated with significantly elevated odds ratios of health care visits. These observations suggest that several steps can be taken to reduce the number of health care visits resulting from occupational exposure to pesticides. The implications of this pattern of pesticide-related health care visits may have etiologic implications for cancer and other chronic diseases.	Environmental Health Perspectives	106	7	415-20	Self-reported exposure			Cohort (prospective)	Specific active ingredient	pesticide-related illness	doctor-diagnosed	USA	hic
754	M. Casas, M. Nieuwenhuijsen, D. Martinez, F. Ballester, X. Basagana, M. Basterrechea, L. Chatzi, C. Chevrier, M. Eggesbo, M. F. Fernandez, E. Govarts, M. Guxens, J. O. Grimalt, I. Hertz-Picciotto, N. Iszatt, M. Kasper-Sonnenberg, H. Kiviranta, M. Kogevinas, L. Palkovicova, U. Ranft, G. Schoeters, E. Patelarou, M. S. Petersen, M. Torrent, T. Trnovec, D. Valvi, G. V. Toft, P. Weihe, N. Weisglas-Kuperus, M. Wilhelm, J. Wittsiepe, M. Vrijheid and J. P.	Prenatal exposure to PCB-153, p,p'-DDE and birth outcomes in 9000 mother-child pairs: exposure-response relationship and effect modifiers	2015	Low-level exposure to polychlorinated biphenyl-153 (PCB-153) and dichlorodiphenyldichloroethylene (p-p'-DDE) can impair fetal growth; however, the exposure-response relationship and effect modifiers of such association are not well established. This study is an extension of an earlier European meta-analysis. Our aim was to explore exposure-response relationship between PCB-153 and p-p'-DDE and birth outcomes; to evaluate whether any no exposure-effect level and susceptible subgroups exist; and to assess the role of maternal gestational weight gain (GWG). We used a pooled dataset of 9377 mother-child pairs enrolled in 14 study populations from 11 European birth cohorts. General additive models were used to evaluate the shape of the relationships between organochlorine compounds and birth outcomes. We observed an inverse linear exposure-response relationship between prenatal exposure to PCB-153 and birth weight [decline of 194g (95% CI -314, -74) per 1mug/L increase in PCB-153]. We showed effects on birth weight over the entire exposure range, including at low levels. This reduction seems to be stronger among children of mothers who were non-Caucasian or had smoked during pregnancy. The most susceptible subgroup was girls whose mothers smoked during pregnancy. After adjusting for absolute GWG or estimated fat mass, a reduction in birth weight was still observed. This study suggests that the association between low-level exposure to PCB-153 and birth weight exists and follows an inverse linear exposure-response relationship with effects even at low levels, and that maternal smoking and ethnicity modify this association.	Environment International	74	NA	23-31	Biomonitoring (blood)			Cohort (prospective)	Chemical class	offspring	doctor-diagnosed	AHIC	AHIC
755	M. Cattani, K. Cena, J. Edwards and D. Pisaniello	Pest control operators: Risk perception of the use of chlorpyrifos	2001	A questionnaire survey addressing the health symptoms and work practices of 31 Western Australian pest control operators who used chlorpyrifos was conducted. Task observations were also made. The operators reported that: all washed their hands when "dirty" or following a job; 58% spilt the concentrate at least once a week; 74% had recently spilt/splashed diluted chlorpyrifos in their eyes and 90% on their boots; and 52% believed that they would benefit from more education concerning chlorpyrifos. No significant adverse health symptoms were reported. Behavioural assessments showed that: all operators were exposed to chlorpyrifos; 26% were observed to wash their hands; 78% had a spill or splash; and 48% wore inappropriate or no gloves. A discrepancy therefore exists between operators' perceptions of risk and their actual exposure. In order to effectively reduce exposure, a change in the safety culture of organisations is required, for example, the implementation of an OHS management system.	Journal of Occupational Health and Safety - Australia and New Zealand	17	3	295-299	Job title			Cross-sectional	Job title	NA	self-reported	Australia	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
756	M. Chan-Yeung, L. C. Koo, J. C. Ho, K. W. Tsang, W. S. Chau, S. W. Chiu, M. S. Ip and W. K. Lam	Risk factors associated with lung cancer in Hong Kong	2003	The purpose of this study was to investigate the risk factors associated with lung cancer in Hong Kong. Three hundred and thirty-one histologically or cytologically proven consecutive cases of lung cancer and the same number of in- and out-patients without cancer matched for age and sex were recruited for this study using a detailed questionnaire completed by a trained interviewer. Smoking was the most important risk factor associated with lung cancer but the attributable risk (AR) was estimated to be 45.8% in men and 6.2% in women, considerably lower compared with those estimated in early 1980s. In addition, among women, exposure to environmental tobacco smoke (ETS) at work+/-at home and lack of education, were independent risk factors for lung cancer with adjusted odds ratio (OR) 3.60, (95% confidence interval (CI) 1.52-8.51) and OR 2.41 (95% CI 1.27-4.55), respectively. Among men, exposure to insecticide/pesticide/herbicide, ETS exposure at work or at home, and a family history of lung cancer and were independent risk factors with adjusted OR 3.29 (95% CI 1.22-8.9, OR 2.43, 95% CI 1.24-4.76 and OR 2.37, 95% CI 1.43-3.94, respectively). Exposure to incense burning and frying pan fumes were not significant risk factors in both sexes. A moderate or high consumption of fat in the diet was associated with increased risk in men but decreased risk in women. The results of this study suggested that as the prevalence of smoking declined, the influence of smoking as a risk factor for lung cancer decreased even further. Moreover, the contribution of other environmental, occupational and socioeconomic factors may be more apparent as etiological factors for lung cancer in a population with relatively high lung cancer incidence but low AR from active smoking.	Lung Cancer	40	2	131-40	Self-reported exposure			Case-control	Type of pesticide	cancer	doctor-diagnosed	Hong Kong	hic
757	M. Clemens, A. Kochuba, J. Liu, K. Evans, K. Han and M. E. Carter	Cutaneous Agent Orange syndrome	2013	Background: Agent Orange, or TCDD (2, 3,7,8-tetrachlorodibenzodioxin), has been linked to many different malignancies. This study was designed to study whether dioxin exposure leads to an increased incidence nonmelanotic skin cancers. Methods: A retrospective review of 100 consecutive males with Fitzpatrick skin types I to IV from August 2009 to January 2010 at Washington DC Veterans Affair Medical Center. Patient demographics, skin cancer, associated malignancies, timing, and location of dioxin exposure were collected. Data were compared to normative data established nationally. Results: Out of a total 100 patients with an average age of 657, average elapsed time since dioxin exposure was 41 years. Average length of exposure was 2 years. Type of dioxin exposure included working in contaminated areas (49%), spraying Agent Orange (30%), traveling in contaminated areas (14%), and living in contaminated facilities (7%). 26% of patients demonstrated associated malignancies. Patients demonstrated chloracne (43%) and non-melanotic invasive skin cancers (50%). High Fitzpatrick score, darker eye color, and light-exposure were associated with lower nonmelanotic invasive skin cancer incidence (P =.01, .036, and .003, respectively). Chloracne was correlated to higher nonmelanotic invasive skin cancer incidence rates (81% vs 26%; P < .01). Average year to onset from exposure was 28 years. The incidence rate of the study population (51.8%) was significantly higher than the national incidence rate (23.8%; P < .001). Discussion: This is the first time one has shown a link between Agent Orange and nonmelanotic skin cancers. In addition to associated malignancies, service personnel with previous dioxin exposure need to be counseled on the cutaneous sequelae of dioxin exposure. Length and degree of exposure appear to be associated with the development of carcinomas. Frequent screenings (every 6 months) are essential for surveillance of these rapidly growing and invasive cancers. Lesions may be treated with aggressive IPL (intense pulsed light) therapy, flourouracils, cryotherapy, and early surgical excision; however, recurrence is high. Additional studies are warranted to determine a relative risk within this large patient population and to determine appropriate management strategies.	Journal of the American Academy of Dermatology	68	4	AB159	Registers			Cohort (retrospective)	Chemical class	cancer	doctor-diagnosed	USA	hic
758	M. Coskun, M. Coskun, A. Cayir and O. Ozdemir	Frequencies of micronuclei (MNi), nucleoplasmic bridges (NPBs), and nuclear buds (NBUDs) in farmers exposed to pesticides in Canakkale, Turkey	2011	This study aimed to determine the incidence of micronuclei (MNi), nucleoplasmic bridges (NPBs), and nuclear buds (NBUDs) in peripheral blood lymphocytes due to direct exposure to pesticides among 46 farmers in Canakkale, Turkey. 48 non-exposed individuals living in the same socioeconomic conditions were chosen as control. In addition, a cytokinesis-block proliferation index (CBPI) was calculated. MNi and NBUDs frequencies were significantly higher among the farmers ($p < 0.05$). Although the NPB frequency of the farmers was higher than the controls, there was no statistical difference. Multiple linear regression analysis showed that apart from gender, no significant effects of various confounding factors were observed. Regarding CBPI, data obtained for the controls were higher than that of the farmers; however, there was no statistically significant difference.	Environment International	37	1	34121	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Turkey	umic
759	M. Cresci, I. Foffa, L. Ait-Ali, N. Botto, S. Pulignani, C. Vecoli and M. G. Andreassi	Maternal exposure to toxicants and congenital heart disease: The role of GSTM1 and GSTT1 polymorphisms	2011	Background: There is growing concern about the potential health effects of maternal exposure to various environmental chemicals and the risk of congenital malformations, ncluding congenital heart disease (CHD). Glutathione Stransferases (GST) detoxification enzymes (GSTM1 and GSTT1) are involved in the metabolism of various environmental oxicants and endocrine-disrupting chemicals. Aim: The purpose of this study was to evaluate the joint effects between environmental maternal exposures and the GSTM1 and STT1 polymorphisms. Methods: In a case-only design, we enrolled 180 CHD patients (104 male, 4.9<U+00AC><U+00B1>5.8 years). A detailed questionnaire was used in order to record emographics and environmental and occupational exposures from mothers with specific questions on potential teratogens/mutagens that have been linked to human eproductive impairment, such as ionizing radiation, solvents, pesticides, asbestos and heavy metals. Genetic analysis was determined using a co-amplification PCR approach ith GSTM4 gene, which is never deleted, as internal control in order to distinguish the GSTM1 and GSTT1 null genotypes. Results: Maternal exposure to ccupational/environmental toxicants was associated with a 3.6 fold increased CHD risk (95% CI=1.1-11.2, p=0.03) among the offspring with both deleted GSTM1 and GSTT1 enes. Mothers who had exposure to toxicants and carried the GSTM1-null genotype (OR=4.5; 95% CI= 1.6-12.7, p=0.005) and GSTT1-null genotype (OR=3.5; 95% CI= 1.0- 3.1, =0.05) had an increased risk for having a child with CHD compared with the wild type genotype. The risk was five times greater (OR= 5.6; 95% CI=1.1-29.2; p=0.05) in mothers and infants both having the GSTM1-null genotype compared with both having the wild genotype Conclusions: Our findings show that maternal exposure to environmental oxicants interacts with GSTM1 and GSTT1 null genotypes to increase the risk of CHD, supporting the evidence for a pivotal role of the environmental risk factors.	European Heart Journal	32	NA	57	Self-reported exposure			NA	Pesticides in general	offspring	doctor-diagnosed	Italy	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
760	M. D. Fernandes and M. L. Queiroz	Measurement of the respiratory burst and chemotaxis in polymorphonuclear leukocytes from anti-ChE insecticides-exposed workers	1999	Neutrophil function in 32 workers occupationally exposed to anti-ChE insecticides, as measured by chemotaxis through the leading front method and nitroblue tetrazolium dye reduction, was investigated and compared to those of age- and sex-matched controls. The cholinesterase (ChE) activity was normal in all the workers studied, although decrease of chemotaxis and of nitroblue tetrazolium reduction was observed in the exposed population. These results suggest that the identified functional changes in polymorphonuclear neutrophils might be an early indicator of anti-ChE insecticides toxicity, even in those individuals with no impairment in the ChE activity.	Immunopharmacology & Immunotoxicology	21	3	621-33	Biomonitoring (blood)			Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	Brazil	umic
761	M. D. Panemangalore, H. A.; Byers, M. E.	Occupational exposure to agricultural chemicals: effect on the activities of some enzymes in the blood of farm workers	1999	OBJECTIVE: To determine the effect of different durations of exposure to agricultural chemicals on the activities of the blood enzymes delta-aminolevulinic acid dehydratase (ALAD), superoxide dismutase (SOD), and cholinesterase (ChE) in tobacco field workers. METHODS: For this preliminary investigation, 8 volunteers (all smoked tobacco) who were working on a small tobacco farm were monitored over a period of 2 years along with a comparable urban unexposed group (n = 4). During the growing season between 1994 and 1996, dermal and respiratory exposure were determined and blood samples were drawn after the following durations of field work: (1) preexposure (0 DAY); (2) after 1 day of field work (1 DAY) - workers reentered fields at 24 h after spraying of acephate and maleic hydrazide; (3) after 30 days of field work (postspraying; 30 DAYS); and (4) Postexposure - no tobacco production. Standard analytical methods were used. RESULTS: Activity of ALAD was depressed by 30% after 1 DAY and there was no further decrease in ALAD activity after 30 DAYS of field work. SOD activity, in contrast, declined by 29% and 50% after 1 DAY and 30 DAYS, respectively, as compared with 0-DAY activity and that of the urban control, which was similar to 0-DAY activity (P< or =0.05). Plasma ChE activity declined by 19% after both 1 and 30 DAYS of exposure/field work. The activities of all three enzymes were restored to urban control or preexposure levels during postexposure. Plasma Cd levels were high in the samples taken after 30 DAYS as compared with the preexposure levels. Respiratory nicotine exposure was highest after 30 DAYS of field work. CONCLUSION: This preliminary study suggests that erythrocyte SOD is a sensitive indicator of exposure to agricultural chemicals in tobacco field workers.	International Archives of Occupational & Environmental Health	72	2	30895	Job title			Cohort (prospective)	Job title	genetic (biomarkers)	medical test result	USA	hic
762	M. da Silva, N. Stadlinger, A. J. Mmochi, C. Stalsby Lundborg and G. Marrone	Pesticide Use and Self-Reported Health Symptoms Among Rice Farmers in Zanzibar	2016	The agrarian population in low- and middle-income countries suffers from a number of adverse health effects due to pesticide exposure. In Zanzibar, the government subsidizes pesticides to enhance local rice production. The objectives of this study were to assess Zanzibar smallholder rice farmers' pesticide use and self-reported health symptoms in relation to pesticide exposure, training, and use of protective measures and to raise awareness for future local policy formulation. An exploratory cross-sectional interviewer-administered study was conducted among 99 rice farmers. Participants were selected based on convenience sampling and stratified by expected exposure category. The study participants reported using pesticides in World Health Organization (WHO) Class II. Of pesticide users, 61% reported one or more symptoms of possible acute pesticide poisoning. Only 50% of pesticide users had received training in safe handling and application of pesticides, but those who had displayed a higher use of protective measures. Farmers who did not use protective measures were more likely to have reported skin irritation and headache, which, together with eye irritation, were the most commonly reported acute symptoms. The main sociodemographic differences between the expected exposure categories of pesticide users and nonusers were in gender and education level. Scaling up of training in safe handling and application of pesticides is needed. Further studies are required to better understand the mechanisms behind the choice to use pesticides or not.	Journal of Agromedicine	21	4	335-44	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	Tanzania	lic
763	M. E. Palacios-Nava, P. Paz-Roman, S. Hernandez-Robles and L. Mendoza-Alvarado	[Persistent symptomatology in workers industrially exposed to organophosphate pesticides]	1999	OBJECTIVE: To describe the patterns of persistent symptomatology in workers industrially exposed to organophosphate pesticides. MATERIAL AND METHODS: An observational, descriptive and cross-sectional study was performed. A questionnaire was applied to managers of a factory and to 89 workers, whose erythrocytic cholinesterase level was measured with the Magnotti and Lovibond method. Information is described through rates, central tendency measures and dispersion. Differences between groups were evaluated with the chi 2 test and the odds ratio was calculated. RESULTS: Persistent symptomatology was found in 6.3 per 10 workers. 50% had six or more symptoms. No significant differences were found as to the risk of suffering from persistent symptomatology with respect to age, length of service or position at work. However, the highest proportion of symptoms was found in workers of 31 to 40 years of age, with 6 to 13 years of service, from the maintenance area, working as general operators or supervisors. Among the 13 workers with previous intoxication, the prevalence of persistent symptomatology was 6.9 against 6.1 in workers who had not been intoxicated before. The risk of acute poisoning in workers with more than 14 years of service was 4 times greater than in workers with less than 14 years of service (p < 0.005). Average level of blood cholinesterase was normal (4.4 u/ml). CONCLUSIONS: Results show a relationship between exposure to organophosphate pesticides and presence of persistent symptoms. It is necessary to study the prevalence of this symptomatology in exposed and non-exposed populations.	Salud Publica de Mexico	41	1	55-61	Biomonitoring (blood)			Cross-sectional	Chemical class	pesticide-related symptoms	self-reported	Mexico	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
764	M. E. Ueker, V. M. Silva, G. P. Moi, W. A. Pignati, I. E. Mattos and A. M. C. Silva	Parenteral exposure to pesticides and occurence of congenital malformations: hospital-based case-control study	2016	BACKGROUND: Most fetal defects are associated with genetic and environmental causes, among them, exposure of pregnant women to intensive pesticide use. Agribusiness is the economic basis of the state of Mato Grosso, the largest consumer of pesticides of all Brazilian states. The objective of this study was to investigate the association between past parental exposure to pesticides and the occurrence of congenital malformations in children in Mato Grosso, Brazil. METHODS: This hospital-based case-control study was conducted in Cuiaba, the capital of Mato Grosso, from March to October 2011. Data was collected in all public, private, and health plan referral hospitals that provide care for pregnant women in the state of Mato Grosso and were situated in Cuiaba. Cases were children under 5 years of age with congenital malformations classified in Chapter XVIII of the International Classification of Diseases-10 and controls were children within the same age range, without congenital malformations, treated at the same hospitals. Malformation-related data was obtained from the patients' medical records. Socioeconomic data and information about parental exposure to pesticides were obtained in an interview with the mother using a standardized questionnaire. We conducted multivariate logistic regression to assess the relation between parent report of past pesticide use and congenital malformations. We also assessed effect modification to verify whether low maternal education level modified the association between exposure and our outcome. RESULTS: We observed positive effect modification of the association of paternal past exposure to pesticide and congenital malformation in the offspring by maternal education for mothers with low educational level (OR=8.40, 95 % CI 2.17-32.52), father's work related to farming (OR=4.65, 95 % CI 1.03-20.98) and paternal past exposure to pesticides (OR=4.15, 95 % CI 1.24-13.66). CONCLUSION: These findings provide further evidence that paternal exposure to pesticides, especially when associated with a low maternal education level, may be related to higher rates of fetal malformation in Mato Grosso, Brazil.	BMC Pediatrics	16	1	125	Self-reported exposure			Case-control	Pesticides in general	offspring	doctor-diagnosed	Brazil	umic
765	M. E. Varona-Uribe, C. H. Torres-Rey, S. Diaz-Criollo, R. M. Palma-Parra, D. M. Narvaez, S. P. Carmona, L. Briceno and A. J. Idrovo	Exposure to pesticide mixtures and DNA damage among rice field workers	2016	This study describes the use of pesticides mixtures and their potential association with comet assay results in 223 rice field workers in Colombia. Thirty-one pesticides were quantified in blood, serum, and urine (15 organochlorines, 10 organophosphorus, 5 carbamates, and ethylenethiourea), and the comet assay was performed. Twenty-four (77.42%) pesticides were present in the workers. The use of the maximum-likelihood factor analysis identified 8 different mixtures. Afterwards, robust regressions were used to explore associations between the factors identified and the comet assay. Two groups of mixtures--alpha-benzene hexachloride (alpha-BHC), hexachlorobenzene (HCB), and beta-BHC (beta: 1.21, 95% confidence interval [CI]: 0.33-2.10) and pirimiphos-methyl, malathion, bromophos-methyl, and bromophos-ethyl (beta: 11.97, 95% CI: 2.34-21.60)--were associated with a higher percentage of DNA damage and comet tail length, respectively. The findings suggest that exposure to pesticides varies greatly among rice field workers.	Archives of Environmental & Occupational Health	71	1	43168	Biomonitoring (urine)	Biomonitoring (blood)		Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	Colombia	umic
766	M. El-Helaly, K. Abdel-Elah, A. Haussein and H. Shalaby	Paternal occupational exposures and the risk of congenital malformations--a case-control study	2011	OBJECTIVES: This study examined the association between certain paternal occupational exposures during the periconceptional period and the risk of congenital malformations. MATERIALS AND METHODS: A case-control study was carried out from December 2009 to April 2010; on 242 congenital malformation cases and 270 controls. Paternal occupational exposure to certain workplace hazards was assessed by a detailed questionnaire to evaluate the occupational exposure for both fathers and mothers including pesticides, solvents, welding fumes, lead, working with video display terminals (VDTs) and computer monitors. In addition, the questionnaire assessed the presence of other risk factors such as consanguinity, smoking and history of any maternal diseases during the pregnancy with the child. RESULTS: The results revealed that the odds of having a child with congenital malformation was higher ($P < 0.01$) if the father was occupationally exposed to pesticides (OR: 3.42, 95% CI: 1.97-5.92), solvents (OR: 5.63, 95% CI: 2.77-11.42), or welding fumes (OR: 2.98, 0.99-8.54) during the periconceptional period. However, consanguinity (OR: 1.91, 95% CI: 1.25-2.92) was a risk factor of developing congenital malformations among offspring. CONCLUSION: Control of workplace exposures and adherence to threshold limit values of those hazards should be adopted to minimize the risk of developing congenital malformations among offspring.	International Journal of Occupational Medicine & Environmental Health	24	2	218-27	Self-reported exposure			Case-control	Pesticides in general	offspring	doctor-diagnosed	Egypt	lmic
767	M. F. Simoniello, E. C. Kleinsorge, J. A. Scagnetti, C. Mastandrea, R. A. Grigolato, A. M. Paonessa and M. A. Carballo	Biomarkers of cellular reaction to pesticide exposure in a rural population	2010	In the present study we report data obtained from the evaluation of subjects occupationally exposed to pesticide mixtures from Santa Fe province, Argentina, using biomarkers for butyrylcholinesterase (BChE) and acetylcholinesterase (AChE) activities, catalase (CAT), lipid peroxidation (by TBARS assay) and the Damage Index Comet Assay (DICA). Our results showed an AChE inhibition (25% and 15% in directly and indirectly groups, respectively) in relation to controls with no significant modifications in BChE. TBARS levels were higher (51%) in pesticide sprayers while CAT activity was reduced in both, applicators (61%) and non-applicators (43%). DICA was significantly increased in direct (83%) and indirect (98%) exposed groups, compared with controls. These results showed modifications in lipid peroxidation, antioxidant defence system, and DNA damage in lymphocytes of exposed workers. Further investigations are suggested in order to link our findings with adverse health effects observed in chronic pesticide toxicity, where oxidative damage plays a pathophysiological role.	Biomarkers	15	1	52-60	Self-reported exposure			Cross-sectional	Chemical class	neurological	medical test result	Argentina	hic
768	M. F. Simoniello, E. C. Kleinsorge, J. A. Scagnetti, R. A. Grigolato, G. L. Poletta and M. A. Carballo	DNA damage in workers occupationally exposed to pesticide mixtures	2008	Pesticides are used in agriculture to protect crops but represent at the same time a potential risk to farmers and environment. The aim of this work is the evaluation of 54 subjects occupationally exposed to pesticides and 30 subjects as a control group using the quantification of DNA damage level by means of the alkaline Comet assay and the evaluation of repair processes. Damage index Comet assay (DICA) and damage index repair assay (DIRA) were studied in 27 pesticide applicator workers, 27 non-pesticide applicators and controls. Our results show that both exposed groups revealed significant increase in DICA when compared with controls ($P < 0.0001$), as well as in DIRA ($P < 0.0001$). However, the spraying group exhibited a marginally significant difference in DICA ($P = 0.05$) when years of exposure are considered and a significant difference ($P < 0.05$) when the personal protective equipment used by individuals was taken as a comparison factor. The influence of confounding factors on the genotoxic effects of occupational exposure to pesticides was investigated and no significant differences were observed considering age, gender, smoking and alcohol consumption in relation to DICA and DIRA. Since DNA damage is an important step in events leading from carcinogen exposure to cancer disease, our study highlights the potential health risk associated with agrochemical exposure in developing countries with vast cultivated areas, such as Argentina.	Journal of Applied Toxicology	28	8	957-65	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Argentina	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
769	M. Fareed, M. K. Pathak, V. Bihari, R. Kamal, A. K. Srivastava and C. N. Kesavachandran	Adverse respiratory health and hematological alterations among agricultural workers occupationally exposed to organophosphate pesticides: a cross-sectional study in North India.[Erratum appears in PLoS One. 2013;8(8). doi:10.1371/annotation/b7bc0625-6200-4433-9971-f4e571203432]	2013	BACKGROUND: Non-protective work practices followed by farm workers during spraying of pesticides lead to occupational exposure among them. OBJECTIVE: This study is designed to explore the respiratory health and hematological profile of agricultural workers occupationally exposed to OP pesticides. MATERIALS AND METHODS: A cross sectional study was undertaken among 166 pesticide sprayers working in mango orchards of Lucknow district in North India compared with 77 controls to assess the respiratory illness, lung functions, cholinesterase levels and hematological profile. A questionnaire based survey and clinical examination for respiratory health were conducted among study subjects. Lung function test was conducted among study subjects by using spirometer. Cholinesterase level as biomarker of OP pesticides and hematological profile of study subjects were investigated in the laboratory by following the standard protocols. RESULTS: Overall respiratory morbidity observed among exposed subjects was 36.75%. Symptoms for respiratory illness like dry cough, productive cough, wheezing, irritation of throat and blood stained sputum were found to be significantly more (p<0.05) among pesticide sprayers than controls. Lung function parameters viz. PEFR, FEV1, %PEFR predicted, %FEV1 predicted and FEV1/FVC were found to be significantly decreased (p<0.05) among pesticide sprayers as compared to controls. Exposure wise distribution of respiratory illness and lung functions among pesticide sprayers show that the exposure duration significantly elevates (p<0.05) the respiratory problems and significantly decreases (p<0.001) lung functions among pesticide sprayers. Activities of acetylcholinesterase and butyrylcholinesterase were found to be significantly depleted (p<0.001) among pesticide sprayers as compared to controls which show the exposure of OP pesticides among them. The hematological profile viz. RBC, WBC, monocytes, neutrophils, MCV, MCH, MCHC and platelet count were significantly altered (p<0.001) in pesticide sprayers than controls. CONCLUSION: This study shows that the unsafe occupational exposure of OP pesticides causes respiratory illness, decreased lung functions and hematological alterations among pesticide sprayers.	PLoS ONE [Electronic Resource]	8	7	e69755	Biomonitoring (blood)			Cross-sectional	Chemical class	respiratory	medical test result	India	lmic
770	M. Fuciarelli, A. Caccuri, M. De Francesca, F. Ferazzoli, S. Piacentini and F. Porreca	Modulation of the GSTT1 activity by the GSTM1 phenotype in a sample of Italian farm-workers	2009	Glutathione S-transferase (GST) isozymes catalyze nucleophilic attack by reduced Glutathione (GSH) on a variety of electrophilic compounds and play a central role in biotransformation of xenobiotics (Hayes et al., Annu Rev Pharmacol Toxicol 45:51-88, 2005). We performed a case-control study to evaluate the GSTM1 and GSTT1 polymorphisms and to investigate if exposure to pesticides conditions the GSTT1 activity level in 115 healthy controls and 90 farm-workers exposed to pesticides. Polymorphisms were investigated using a GSTM1 or a GSTT1-specific PCR. Enzyme activity was measured by means of DCM as co-substrate, as described by Bruhn et al. (Biochem Pharmacol 56:1189-1193, 1998). There was no significant difference between the farm-workers and the healthy controls regarding the distribution of various alleles of the GSTM1 and GSTT1 genes and the GSTT1 enzyme activity. In farm-workers, the GSTM1 null genotype was associated with a significant increase of GSTT1 activity, suggesting a regulative mechanism common to GSTM1 and GSTT1 enzymes after exposure to xenobiotics.	Archives of Toxicology	83	2	115-20	Job title			Case-control	Job title	genetic (biomarkers)	medical test result	Italy	hic
771	M. Furlong, C. M. Tanner, S. M. Goldman, G. S. Bhudhikanok, A. Blair, A. Chade, K. Comyns, J. A. Hoppin, M. Kasten, M. Korell, J. W. Langston, C. Marras, C. Meng, M. Richards, G. W. Ross, D. M. Umbach, D. P. Sandler and F. Kamel	Protective glove use and hygiene habits modify the associations of specific pesticides with Parkinson's disease	2015	Pesticides have been associated with Parkinson's disease (PD), and protective gloves and workplace hygiene can reduce pesticide exposure. We assessed whether use of gloves and workplace hygiene modified associations between pesticides and PD. The Farming and Movement Evaluation (FAME) study is a nested case-control study within the Agricultural Health Study. Use of protective gloves, other PPE, and hygiene practices were determined by questionnaire (69 cases and 237 controls were included). We considered interactions of gloves and hygiene with ever-use of pesticides for all pesticides with >=5 exposed and unexposed cases and controls in each glove-use stratum (paraquat, permethrin, rotenone, and trifluralin). 61% of respondents consistently used protective gloves and 87% consistently used >=2 hygiene practices. Protective glove use modified the associations of paraquat and permethrin with PD: neither pesticide was associated with PD among protective glove users, while both pesticides were associated with PD among non-users (paraquat OR 3.9 [95% CI 1.3, 11.7], interaction p=0.15; permethrin OR 4.3 [95% CI 1.2, 15.6] interaction p=0.05). Rotenone was associated with PD regardless of glove use. Trifluralin was associated with PD among participants who used <2 hygiene practices (OR 5.5 [95% CI 1.1, 27.1]) but was not associated with PD among participants who used 2 or more practices (interaction p=0.02). Although sample size was limited in the FAME study, protective glove use and hygiene practices appeared to be important modifiers of the association between pesticides and PD and may reduce risk of PD associated with certain pesticides.	Environment International	75	NA	144-50	Self-reported exposure			Case-control	Specific active ingredient	neurological	doctor-diagnosed	NA	NA
772	M. G. Matic, V. M. Coric, A. R. Savic-Radojevic, P. V. Bulat, M. S. Pljesa-Ercegovac, D. P. Dragicevic, T. I. Djukic, T. P. Simic and T. D. Pekmezovic	Does occupational exposure to solvents and pesticides in association with glutathione S-transferase A1, M1, P1, and T1 polymorphisms increase the risk of bladder cancer? The Belgrade case-control study	2014	OBJECTIVE: We investigated the role of the glutathione S-transferase A1, M1, P1 and T1 gene polymorphisms and potential effect modification by occupational exposure to different chemicals in Serbian bladder cancer male patients. PATIENTS AND METHODS: A hospital-based case-control study of bladder cancer in men comprised 143 histologically confirmed cases and 114 age-matched male controls. Deletion polymorphism of glutathione S-transferase M1 and T1 was identified by polymerase chain reaction method. Single nucleotide polymorphism of glutathione S-transferase A1 and P1 was identified by restriction fragment length polymorphism method. As a measure of effect size, odds ratio (OR) with corresponding 95% confidence interval (95%CI) was calculated. RESULTS: The glutathione S-transferase A1, T1 and P1 genotypes did not contribute independently toward the risk of bladder cancer, while the glutathione S-transferase M1-null genotype was overrepresented among cases (OR = 2.1, 95% CI = 1.1-4.2, p = 0.032). The most pronounced effect regarding occupational exposure to solvents and glutathione S-transferase genotype on bladder cancer risk was observed for the low activity glutathione S-transferase A1 genotype (OR = 9.2, 95% CI = 2.4-34.7, p = 0.001). The glutathione S-transferase M1-null genotype also enhanced the risk of bladder cancer among subjects exposed to solvents (OR = 6,5, 95% CI = 2.1-19.7, p = 0.001). The risk of bladder cancer development was 5.3-fold elevated among glutathione S-transferase T1-active patients exposed to solvents in comparison with glutathione S-transferase T1-active unexposed patients (95% CI = 1.9-15.1, p = 0.002). Moreover, men with glutathione S-transferase T1-active genotype exposed to pesticides exhibited 4.5 times higher risk in comparison with unexposed glutathione S-transferase T1-active subjects (95% CI = 0.9-22.5, p = 0.067). CONCLUSION: Null or low-activity genotypes of the glutathione S-transferase A1, T1, and P1 did not contribute independently towards the risk of bladder cancer in males. However, in association with occupational exposure, low activity glutathione S-transferase A1 and glutathione S-transferase M1-null as well as glutathione S-transferase T1-active genotypes increase individual susceptibility to bladder cancer.	PLoS ONE [Electronic Resource]	9	6	e99448	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Serbia	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
773	M. G. Weisskopf, F. Moisan, C. Tzourio, P. J. Rathouz and A. Elbaz	Pesticide exposure and depression among agricultural workers in France	2013	Pesticides are ubiquitous neurotoxicants, and several lines of evidence suggest that exposure may be associated with depression. Epidemiologic evidence has focused largely on organophosphate exposures, while research on other pesticides is limited. We collected detailed pesticide use history from farmers recruited in 1998-2000 in France. Among 567 farmers aged 37-78 years, 83 (14.6%) self-reported treatment or hospitalization for depression. On the basis of the reported age at the first such instance, we used adjusted Cox proportional hazards models to estimate hazard ratios and 95% confidence intervals for depression (first treatment or hospitalization) by exposure to different pesticides. The hazard ratio for depression among those who used herbicides was 1.93 (95% confidence interval (CI): 0.95, 3.91); there was no association with insecticides or fungicides. Compared with nonusers, those who used herbicides for <19 years and >=19 years (median for all herbicide users, 19 years) had hazard ratios of 1.51 (95% CI: 0.62, 3.67) and 2.31 (95% CI: 1.05, 5.10), respectively. Similar results were found for total hours of use. Results were stronger when adjusted for insecticides and fungicides. There is widespread use of herbicides by the general public, although likely at lower levels than in agriculture. Thus, determining whether similar associations are seen at lower levels of exposure should be explored.	American Journal of Epidemiology	178	7	1051-8	Self-reported exposure	Expert case-by-case assessment		Cross-sectional	Type of pesticide	mental disorders	self-reported	France	hic
774	M. Gotoh, I. Saito, J. Huang, Y. Fukaya, T. Matsumoto, N. Hisanaga, E. Shibata, G. Ichihara, M. Kamijima and Y. Takeuchi	Changes in cholinesterase activity, nerve conduction velocity, and clinical signs and symptoms in termite control operators exposed to chlorpyrifos	2001	We have surveyed periodical medical examinations for pest and termite control operators (n=64) exposed to chlorpyrifos and other organophosphate pesticides. Distribution of serum butyrylcholinesterase (BuChE) activities of all workers ranged 0.01-1.18 (<U+0152><U+00EE>pH). Serum BuChE activities in 6 workers in one termite control company were severely depressed and ranged from 0.01 to 0.21 <U+0152><U+00EE>pH. Erythrocyte acetylcholinesterase (AChE) activities in 3 workers were lower than the normal range. Erythrocyte AChE activities and serum BuChE acitivities in chlorpyrifos sprayers were significantly correlated (r=0.720). In other clinical signs, blood urine nitrogen (BUN) in 4 workers and white blood cell (WBC) counts in 4 workers were abnormal. Sensory nerve conduction velocities in the sural nerve of all 6 workers were significantly reduced to 18.8-26.6 m/s in the left leg and 19.2-27.2 m/s in the right leg. In the results of ophthalmic examinations, accommodation time (both eyes) in 4 workers extended over the normal range and electroretinography (ERG) in 2 workers showed abnormal ERG including disappearance of oscillatory potential. Chlorpyrifos residue in blood in 4 operators whose serum BuChE activities ranged from 0.01 to 0.03 <U+0152><U+00EB>pH were detected in the range 2-8 ng/m/. They had sprayed chlorpyrifos daily for 5 d before every blood sampling. It is suggested that serum BuChE activity and sensory nerve conduction velocity are sensitive indicators to evaluate the effects of chlorpyrifos exposure, and may be used effectively to monitor exposure and the effects of chlorpyrifos on health.	Journal of Occupational Health	43	3	157-164	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	NA	self-reported	NA	NA
775	M. Guiguet, E. Baumelou and J. Y. Mary	A case-control study of aplastic anaemia: occupational exposures. The French Cooperative Group for Epidemiological Study of Aplastic Anaemia	1995	BACKGROUND: Based on the national register of new cases of aplastic anaemia (AA) begun in France in 1984, a case-control study was conducted to explore the aetiology of the disease. METHODS: Cases were all included in the French national register of AA. Two different groups of controls were derived with individual matching; one group from hospitalized patients in the same hospital; the other group from neighbours named by the case. A 15-year occupational history was collected through interview and then grouped into exposure categories by jobs done for one year or more. The study included 98 cases, 181 hospitalized controls, and 72 neighbours aged 18-70 years. RESULTS: No differences appeared between the cases and both groups of controls relative to any group of occupation investigated. However, a borderline non-significant small excess for exposure to pesticides was observed among the cases when compared to hospitalized controls. Whatever the control group, no association was found between AA and exposure to solvents, ionizing radiation, fuel, oils and grease. A positive relationship between exposure to glues and AA was observed, as well as a trend towards an increased risk after exposure to paints. CONCLUSIONS: This large-scale case-control study confirmed the vanishing role of previously known toxic substances in the aetiology of AA. However, a higher proportion of AA patients reported exposure to paints and to glues, a relationship which needs further investigation because of the diversity of compounds included in these products.	International Journal of Epidemiology	24	5	993-9	Self-reported job history			Case-control	Job title	circulatory	doctor-diagnosed	France	hic
776	M. H. Alavanja, J.; Lynch, C.; Hines, C.; Barry, K.; Barker, J.; Buckman, D.; Thomas, K.; Sandler, D.; Hoppin, J.; Koutros, S.; Andreotti, G.; Lubin, J.; Blair, A.; Freeman, L. B.	Occupational use of insecticides, fungicides and fumigants and risk of non-hodgkin lymphoma and multiple myeloma in the agricultural health Study0286 Occupational use of insecticides, fungicides and fumigants and risk of non-Hodgkin lymphoma and multiple myeloma in the agricultural health study	2014	Objectives Farming and exposure to pesticides have been linked to non-Hodgkin lymphoma (NHL), and multiple myeloma (MM) in previous studies. We evaluated use of insecticides, fungicides and fumigants and risk of NHL, including MM and other NHL sub-types in the Agricultural Health Study, a US-based prospective cohort study. Method A total of 527 cases occurred among 55 875 pesticide applicators from enrollment (1993-1997) through 2011 in Iowa and 2010 in North Carolina. Information on pesticide use, other agricultural exposures and other factors was obtained from questionnaires at enrollment and follow-up approximately five years later (1999-2005). Information from these questionnaires was used to create lifetime-days and intensity-weighted lifetime-days of pesticide use. Poisson regression and polytomous logit models were used to calculate relative risks (RR) and 95% confidence intervals (CI) to evaluate associations between 26 pesticides and NHL and five NHL-subtypes including multiple myeloma, while adjusting for potential confounding factors. Results Statistically significant positive exposure-response trends occurred between overall NHL risk and lindane (p-trend = 0.004) and DDT (p-trend = 0.02). In addition, ever use of terbufos was associated with NHL overall (RR=1.2; CI=1.0-1.5), but with no exposure-response trend. In sub-type analyses, terbufos and DDT were associated with small cell lymphoma/chronic lymphocytic leukaemia/marginal cell lymphoma. In addition, lindane and diazinon were associated with follicular lymphoma and permethrin with MM although tests of homogeneity did not show significant differences in exposure-response among NHL-subtypes for any chemical. Conclusions These findings are among the first to suggest links between DDT, lindane, permethrin, diazinon and terbufos and specific NHL subtypes.	Occupational and Environmental Medicine	71	NA	A36	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
777	M. H. B. Huisman, D. E. De Jong, P. T. C. Van Doormaa, R. Vermeulen, D. Heederick, H. Kromhout, H. J. Schelhaas, A. J. Van Der Kooi, V. M. De, J. H. Veldink and A. H. Van Den Berg	Exogenous risk factors in ALS: A population-based case-control study	2011	Background: Sporadic amyotrophic lateral sclerosis (ALS) is probably caused by multiple genetic and environmental factors causing motor neuron degeneration.Although environmental risk factors have been extensively studied in ALS, most environmental risk factors are still unknown.Systematic reviews of the literature suggest this may be due to limitations in study design: most risk factor studies had a hospital-based study design, which introduces the risk of referral bias. This source of bias can be eliminated in a population-based casecontrol study, which enables the provision of class I evidence according to the Armon criteria (1) for exogenous risk factor studies in ALS. Objectives: To determine the association between ALS and multiple exogenous factors: smoking; alcohol; education; medical history; medication use; nutrition; family history; hormonal factors; occupational history; occupational exposures (pesticides, metals, electrical accidents, etc.); physical activity. Methods: A population based study has been performed in the Netherlands between January 2006 and June 2011 (mean population 16,426,273; area 41,528 km2).Patients were ascertained from five sources.Diagnosis was made according to the El Escorial criteria.700 incident sporadic ALS patients and 2100 controls filled in questionnaires to obtain data about exogenous factors. Results: Multivariate analyses showed an increased risk of ALS in current smokers (OR 1.38; p = 0.04).Current smoking was also associated with shorter survival (hazard ratio of 1.51 (p = 0.02) adjusted for vital capacity, gender, age and site of onset).Current alcohol consumption was found to be an independent protective factor for ALS (OR = 0.52; p = 6.6<U+221A><U+00F3>10-5), but did not have an effect on survival.Relatives of sporadic ALS patients had a mildly elevated risk of dementia (recurrence risk <U+0152><U+00AA> 1.16; 95% CI: 1.01-1.33).The risk of Parkinson Disease (PD) was not elevated (<U+0152><U+00AA> 1.14; 95% CI: 0.83-1.55).A reduced risk of vascular diseases was found in relatives of sporadic ALS patients (stroke: <U+0152><U+00AA> 0.94; 95% CI: 0.82-1.07 and myocardial infarction: <U+0152><U+00AA> 0.87; 95% CI: 0.76-0.98).Longest job held in the agricultural sector is associated with an increased risk of developing ALS (OR 1.7; 95% CI: 1.01- 3.00, p = 0.045) (adjusted for smoking, use of alcohol, and age).Last job held in the agricultural sector is associated with ALS as well (OR 1.8; 95%CI: 1.1-3.1, p = 0.03).Subsequently a Job Exposure Matrix (JEM) was used, which enables the linking of occupations to profiles of environmental exposures by providing semi-quantitative assessments of exogenous exposures for each occupation.Mean lifetime occupational exposures to chromium, nickel, diesel motor exhaust, and mine dust were significantly higher	Amyotrophic Lateral Sclerosis	12	NA	23	Self-reported job history	Job exposure matrix		Case-control	Job title	neurological	doctor-diagnosed	Netherlands	hic
778	M. H. Hooiveld, D. J.; Kogevinas, M.; Boffetta, P.; Needham, L. L.; Patterson, D. G., Jr.; Bueno-de-Mesquita, H. B.	Second follow-up of a Dutch cohort occupationally exposed to phenoxy herbicides, chlorophenols, and contaminants	1998	A retrospective cohort study of workers exposed to phenoxy herbicides, chlorophenols, and contaminants (2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and other polychlorinated dioxins and furans) has been conducted in a chemical factory in the Netherlands. Male workers exposed to phenoxy herbicides or chlorophenols showed increased relative risks (adjusted for age, calendar period at end of follow-up, and time since first exposure/employment) for total mortality (relative risk (RR)=1.8, 95% confidence interval (CI) 1.2-2.5), cancer mortality (RR=4.1, 95% CI 1.8-9.0), respiratory cancer (RR=7.5, 95% CI 1.0-56.1), non-Hodgkin's lymphoma (RR=1.7, 95% CI 0.2-16.5), and ischemic heart diseases (RR=1.8, 95% CI 0.9-3.6) compared with an internal referent group of nonexposed workers. By using TCDD levels (predicted at the time of maximum exposure), based on extrapolated TCDD levels that were measured in a subset of the cohort, estimated relative risks for workers with medium and high TCDD levels were comparable with risks derived from the simple and earlier applied dichotomous exposure classification. In general, relative risks were highest in the highest category, indicating exposure-related increases in risk with TCDD level. In conclusion, results of this cohort study support the evidence of a high cancer risk in workers exposed to phenoxy herbicides, chlorophenols, and contaminants.	American Journal of Epidemiology	147	9	891-901	Self-reported exposure			Cohort (retrospective)	Pesticides in general	mortality (all cause)	doctor-diagnosed	Netherlands	hic
779	M. H. Ratner, D. H. Farb, J. Ozer, R. G. Feldman and R. Durso	Younger age at onset of sporadic Parkinson's disease among subjects occupationally exposed to metals and pesticides	2014	An earlier age at onset of Parkinson's disease (PD) has been reported to be associated with occupational exposures to manganese and hydrocarbon solvents suggesting that exposure to neurotoxic chemicals may hasten the progression of idiopathic PD. In this study the role of occupational exposure to metals and pesticides in the progression of idiopathic PD was assessed by looking at age at disease onset. The effects of heritable genetic risk factors, which may also influence age at onset, was minimized by including only sporadic cases of PD with no family history of the disease (n=58). Independent samples Student t-test revealed that subjects with occupational exposure to metals and/or pesticides (n=36) were significantly (p=0.013) younger than unexposed controls (n=22). These subjects were then divided into three groups [high (n=18), low (n=18), and unexposed (n=22)] to ascertain if duration of exposure further influenced age at onset of PD. One-way ANOVA revealed that subjects in the high exposure group were significantly (p=0.0121) younger (mean age: 50.33 years) than unexposed subjects (mean age: 60.45 years). Subjects were also stratified by exposure type (metals vs. pesticides). These results suggest that chronic exposure to metals and pesticides is associated with a younger age at onset of PD among patients with no family history of the disease and that duration of exposure is a factor in the magnitude of this effect.	Interdisciplinary Toxicology	7	3	122-133	Self-reported exposure			NA	Pesticides in general	neurological	doctor-diagnosed	USA	hic
780	M. K. Brouwer, T.; van den Brandt, P. A.; Kromhout, H.; Schouten, L. J.; Peters, S.; Huss, A.; Vermeulen, R.	Occupational exposures and Parkinson's disease mortality in a prospective Dutch cohort	2015	OBJECTIVES: We investigated the association between six occupational exposures (ie, pesticides, solvents, metals, diesel motor emissions (DME), extremely low frequency magnetic fields (ELF-MF) and electric shocks) and Parkinson's disease (PD) mortality in a large population-based prospective cohort study. METHODS: The Netherlands Cohort Study on diet and cancer enrolled 58,279 men and 62,573 women aged 55-69 years in 1986. Participants were followed up for cause-specific mortality over 17.3 years, until December 2003, resulting in 402 male and 207 female PD deaths. Following a case-cohort design, a subcohort of 5,000 participants was randomly sampled from the complete cohort. Information on occupational history and potential confounders was collected at baseline. Job-exposure matrices were applied to assign occupational exposures. Associations with PD mortality were evaluated using Cox regression. RESULTS: Among men, elevated HRs were observed for exposure to pesticides (eg, ever high exposed, HR 1.27, 95% CI 0.86 to 1.88) and ever high exposed to ELF-MF (HR 1.54, 95% CI 1.00 to 2.36). No association with exposure duration or trend in cumulative exposure was observed for any of the occupational exposures. Results among women were unstable due to small numbers of high-exposed women. CONCLUSIONS: Associations with PD mortality were observed for occupational exposure to pesticides and ELF-MF. However, the weight given to these findings is limited by the absence of a monotonic trend with either duration or cumulative exposure. No associations were found between PD mortality and occupational exposure to solvents, metals, DME or electric shocks.	Occupational & Environmental Medicine	72	6	448-55	Job exposure matrix			Cohort (prospective)	Pesticides in general	mortality (all cause)	doctor-diagnosed	Netherlands	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
781	M. K. F. Pathak, M.; Srivastava, A. K.; Pangtey, B. S.; Bihari, V.; Kuddus, M.; Kesavachandran, C.	Seasonal variations in cholinesterase activity, nerve conduction velocity and lung function among sprayers exposed to mixture of pesticides	2013	Pesticide spraying operation is associated with the increased risk of adverse health effects among sprayers who do not follow safe farm work practices. A study was conducted among pesticide sprayers in North India to evaluate the clinical and subclinical variations in their vital health parameters before and after the pesticide spraying season. Blood cholinesterase levels, pulmonary function test, nerve conduction velocity and self-reported symptoms were studied among 18 eligible and consenting male sprayers. Mean acetylcholinesterase activity was reduced by 55 % in the post-exposure assessment (P<0.001) as compared to pre-exposure levels. Mean forced expiratory volume in 1 s was 20 % lower in the post-exposure assessment as compared to the pre-exposure level (P<0.05). No significant change was observed in the motor and sensory nerve conduction velocity in the median nerve of sprayers before and after the spraying activity. Also, no significant variation was observed with respect to self-reported symptoms except weakness in arms and legs (P<0.05). The significant decline in lung function and acetylcholinesterase level after pesticide exposure reflects the strongly negative effect of exposure to pesticides during spraying activity. More longitudinal studies among pesticide sprayers must be undertaken to further substantiate the cause-effect relationship between pesticide exposure and its subclinical effects. There is a strong necessity to minimise the exposure through the use of personal protective equipment in pesticide sprayers.	Environmental Science & Pollution Research	20	10	7296-300	Job title			Cohort (prospective)	Job title	neurological	medical test result	India	lmic
782	M. K. McHugh, S. Kachroo, M. Liu, A. M. D'Amelio, Jr., Q. Dong, W. K. Hong, A. J. Greisinger, M. R. Spitz and C. J. Etzel	Assessing environmental and occupational risk factors for lung cancer in Mexican-Americans.[Erratum appears in Cancer Causes Control. 2011 Jun;22(6):943]	2010	BACKGROUND: We investigated environmental and occupational exposures and smoking history (while controlling for demographics) in a population of Mexican-American lung cancer cases and controls from the Houston metropolitan area. METHODS: Data were collected between 1991 and 2005 as part of an on-going multi-racial/ethnic, lung cancer case-control study. Cases included 212 Mexican-American lung cancer cases from UT MD Anderson Cancer Center. Controls (n = 328) were recruited from Houston's largest multispecialty group practice and frequency matched to the cases by age (+/- 5 years), sex, and ethnicity. Environmental and occupational factors were analyzed and odds ratios and 95% confidence intervals were calculated using logistic regression. RESULTS: We detected elevated risks of lung cancer associated with pesticide exposure and found conventional and antimicrobial (e.g., sterilizers, disinfectants, antiseptics) pesticides were associated with an increased risk of lung cancer in Mexican-Americans (conventional pesticides and antimicrobial pesticides combined: OR = 1.80, 95% CI 1.13-2.86; conventional pesticides: OR = 2.05, 95% CI 1.23-2.39; antimicrobial pesticides: OR = 2.48, 95% CI 1.46-4.21). CONCLUSIONS: Although we found over a two-fold increased risk of lung cancer among Mexican-Americans for pesticides, we could not identify individual pesticides. Our findings are an important preliminary step in identifying factors that are specifically associated with lung cancer risk among Mexican Americans.	Cancer Causes & Control	21	12	2157-64	Self-reported exposure			Case-control	Chemical class	cancer	doctor-diagnosed	USA	hic
783	M. K. Pathak, M. Fareed, V. Bihari, N. Mathur, A. K. Srivastava, M. Kuddus and K. C. Nair	Cholinesterase levels and morbidity in pesticide sprayers in North India	2011	BACKGROUND: Pesticide sprayers in North India use different application methods for different crops. AIMS: To compare cholinesterase activity and symptoms in knapsack and tractor-mounted pesticide sprayers. METHODS: Blood cholinesterase activity and symptoms were recorded for 42 knapsack and 66 tractor-mounted sprayers attending a health camp in North India in 2009 and for 30 controls. RESULTS: One hundred and eight of 197 (55%) eligible sprayers consented to participate. Mean acetylcholinesterase (AChE) and butyrylcholinesterase activity was 33 and 60% lower, respectively, in knapsack sprayers than in controls (P < 0.001) and 56 and 62% lower, respectively, in tractor-mounted sprayers than in controls (P < 0.001). AChE depletion was greater in tractor-mounted sprayers than in knapsack sprayers (P < 0.001). In knapsack sprayers compared to controls, odds ratios (OR) were significantly raised for musculoskeletal symptoms (OR 3.9, 95% CI 1.03-18) but not for other symptoms. In tractor-mounted sprayers compared to controls, ORs were significantly raised for neurological (OR 7, 95% CI 2-23), ocular (OR 8.7, 95% CI 2.7-32), respiratory (OR 5.14, 95% CI 1-29), cardiovascular (OR 7.5, 95% CI 2-42), gastrointestinal (OR 5.43, 95% CI 2-18) and musculoskeletal (OR 6.12, 95% CI 2-26) symptoms but not for dermal symptoms (OR 1.93, 95% CI 0.3-20). CONCLUSIONS: The risk of cholinesterase inhibition and symptoms is greater in tractor-mounted than in knapsack pesticide sprayers and in both groups compared to controls. Occupational exposure in pesticide sprayers in North India needs better control, perhaps through redesign of spraying equipment.	Occupational Medicine (Oxford)	61	7	512-4	Job title			Cross-sectional	Pesticides in general	morbidity	self-reported	India	lmic
784	M. Kamijima, H. Hibi, M. Gotoh, K. Taki, I. Saito, H. Wang, S. Itohara, T. Yamada, G. Ichihara, E. Shibata, T. Nakajima and Y. Takeuchi	A survey of semen indices in insecticide sprayers	2004	This study aims at clarifying the semen indices of insecticide sprayers who are exposed mainly to organophosphorus and pyrethroid insecticides. Eighteen male sprayers out of 54 working for 9 companies in central Japan and 18 age-matched students or medical doctors as unexposed controls participated in detailed reproductive check-ups conducted in summer and the following winter. The sprayers were exposed to insecticides more in summer, the busiest season, than winter, the off-season (p<0.05). Erythrocyte true cholinesterase activities in the sprayers were lower than in the controls in summer (p<0.05), and decreased in significant association with the increase in exposure frequency. Testicular volumes in the sprayers tended to be smaller than in the controls (p=0.06). The serum testosterone concentration in winter in the sprayers was higher than in the controls (p<0.05), though luteinizing hormone and follicle stimulating hormone concentrations were not significantly different. The sperm counts and vitality were comparable between the groups, but detailed sperm motility analysis in summer revealed that the percentages of slow progressive and nonprogressive motile sperm were twice as high in the sprayers (p<0.05), and that of rapid progressive sperm tended to be lower (p=0.06). Such differences were not observed in winter. Differential sperm morphology counts showed that interaction of group and abstinence effects were significant in sperm with normal morphology and with head deformity only in the summer check-up. Despite possible inherent differences between the groups, the above season-dependent differences suggested that the observed lower semen quality in the sprayers was associated with pesticide spraying work.	Journal of Occupational Health	46	2	109-18	Self-reported exposure			Cross-sectional	Pesticides in general	reproductive	medical test result	Japan	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
785	M. Karakosta, E. Delicha, G. Kouraklis and K. Manola	A retrospective case control study associating chronic lymphocytic leukemia and its specific aberrations with certain risk factors	2015	Background: The role of environmental or occupational genotoxic exposure in the development of Chronic Lymphocytic Leukemia (CLL) is limited and inconclusive. In addition, no investigation has been conducted to elucidate the putative role of lifestyle and occupational factors in the formation of CLL specific chromosomal aberrations. Aims: Regarding the above, the present study examines through detailed questionnaires the potential environmental and occupational chemical exposure as well as the lifestyle and cancer family history of cases and healthy controls to assess the contribution of specific risk factors to CLL incidence. Moreover, these postulated risk factors are evaluated for the first time in respect to CLL specific chromosomal abnormalities. Methods:A total of 138 unselected patients diagnosed with CLL and 141 unrelated healthy men and women, age and sex matched to CLL cases, were enrolled in this study. Face-to-face interviews were conducted on the study participants using a standardized and structured questionnaire to obtain a lifetime demographic, occupational and medical history as well as other risk factor information. In addition, cytogenetic analysis was performed on unstimulated and stimulated bone marrow cells of all CLL patients at the time of diagnosis so as to associate CLL chromosomal abnormalities with specific risk factors. Study results were analysed using univariate and multivariate statistical analysis to control the overall influence of risk factors. Results: CLL was positively associated with certain lifestyle and medical/clinical risk factors such as smoking (P=0.005), family history of CLL or other malignancy (P<0.0001), episodes of pneumonia (<U+201A><U+00E2><U+2022>1) within 5 years before CLL diagnosis (P=0.016) and exposure to medical radiation (P=0.003). Similarly positive associations were revealed between CLL and occupational/environmental chemical exposures including exposure to petroleum (P<0.0001), metals (P=0.024), pesticides/chemical fertilizers (P<0.0001) and detergents (P<0.0001). It was also observed that if someone is exposed to more than two risk factors in lifetime, he/she is at <U+201A><U+00E0><U+00BA>1.5 fold greater risk of developing CLL compared to those who have experienced only one toxic exposure (OR=1.42, 95% CI=1.17-1.73, P<0.0001). Analyses by specific risk factors and CLL chromosome abnormalities showed that del(11q) and del(13q) were found more frequent in patients having been exposed to pesticides (P=0.050) and rubber (P=0.044) respectively while patients who had a father suffering from CLL or other malignancies tended to carry more often del(11q), del(13q) and +12. Summary and Conclusions: Our study provides evidence for the involvement of genetic predisposition and exposure to specific occupational and lifestyle	Haematologica	100	NA	418	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Greece	hic
786	M. Khan and C. A. Damalas	Occupational exposure to pesticides and resultant health problems among cotton farmers of Punjab, Pakistan	2015	Occupational exposure to pesticides and resultant health problems were assessed among 318 randomly selected cotton farmers from the two districts of Punjab, Pakistan. Heavy dependence of farmers on pesticides for pest control was reported. A large part (23.3%) of the pesticides belonged to the category highly hazardous, whereas the largest part (54.7%) belonged to the category moderately hazardous. Some of them (8%) were reported to be used on vegetables. Common working practices of high exposure risk were: the confrontation of pesticide spills in the stage of spray solution preparation (76.4%), the use of low-technology and faulty sprayers (67.9%), and spraying under inappropriate weather (46.5%). A large proportion (34%) of the farmers reported multiple intoxication symptoms by pesticide use; the most common were irritation of skin and eyes, headache, and dizziness. Nevertheless, most farmers thought these symptoms were usual; only few reported visiting the doctor. Findings clearly indicated a high level of risk exposure to pesticides among farmers of the study area, calling upon immediate interventions toward increasing awareness about alternative pest control practices with less pesticide use.	International Journal of Environmental Health Research	25	5	508-21	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	Pakistan	lmic
787	M. Kirsch-Volders, R. A. Mateuca, M. Roelants, A. Tremp, E. Zeiger, S. Bonassi, N. Holland, W. P. Chang, P. V. Aka, M. Deboeck, L. Godderis, V. Haufroid, H. Ishikawa, B. Laffon, R. Marcos, L. Migliore, H. Norppa, J. P. Teixeira, A. Zijno and M. Fenech	The effects of GSTM1 and GSTT1 polymorphisms on micronucleus frequencies in human lymphocytes in vivo	2006	The influence of genetic polymorphisms in GSTM1 and GSTT1 genes on micronucleus frequencies in human peripheral blood lymphocytes was assessed through a pooled analysis of data from seven laboratories that did biomonitoring studies using the in vivo cytokinesis-block micronucleus assay. A total of 301 nonoccupationally exposed individuals (207 males and 94 females) and 343 workers (237 males and 106 females) occupationally exposed to known or suspected genotoxic substances were analyzed by Poisson regression. The results of the pooled analysis indicate that the GSTT1 null subjects had lower micronucleus frequencies than their positive counterparts in the total population (frequency ratio, 0.55; 95% confidence interval, 0.33-0.89). The protective effect of this genotype is reversed with increasing age, with a frequency ratio of 1.33 (95% confidence interval, 1.06-1.68) in subjects aged 60 years. A significant overall increase in micronucleus frequency with age and gender (P < 0.001 and P = 0.024, respectively) was observed, females having higher micronucleus frequencies than males, when occupationally exposed (P = 0.002). Nonoccupationally exposed smokers had lower micronucleus frequencies than nonsmokers (P = 0.001), whereas no significant difference in micronucleus level was observed between smokers and nonsmokers in the occupationally exposed group (P = 0.79). This study confirms that pooled analyses, by increasing the statistical power, are adequate for assessing the involvement of genetic variants on genome stability and for resolving discrepancies among individual studies.	Cancer Epidemiology, Biomarkers & Prevention	15	5	1038-42	Job title			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	SHIC	SHIC
788	M. Kishi, N. Hirschhorn, M. Djajadisastra, L. N. Satterlee, S. Strowman and R. Dilts	Relationship of pesticide spraying to signs and symptoms in Indonesian farmers.[Erratum appears in Scand J Work Environ Health 1995 Oct;21(5):400]	1995	OBJECTIVES: This study assessed correlations between exposure to pesticides and signs and symptoms of pesticide toxicity among Indonesian farmers. METHODS: Detailed observations were recorded of spray frequency and pesticide handling, dermal exposure, and the chemicals used. Symptoms of acute illness were reported by the farmers, and signs of poisoning were observed by the interviewers at the time of spraying or within a few hours after it. RESULTS: The spray practices substantially exposed the farmers to pesticides. Signs and symptoms occurred significantly more often during spraying than during nonspraying seasons. Twenty-one percent of the spray operations resulted in three or more neurobehavioral, respiratory, and intestinal signs or symptoms. The number of spray operations per week, the use of hazardous pesticides, and skin and clothes being wetted with the spray solution were significantly and independently associated with the number of signs and symptoms. A dose-effect relationship was found between the neurobehavioral signs and symptoms and the use of multiple organophosphates. CONCLUSIONS: For farmers in the tropics, fully protective garb is too hot and too costly to maintain; farmers thus accept illness as a necessity. Integrated pest management has previously been demonstrated to reduce pesticide use with no loss of crop yield. The frequency of spraying should be reduced through widespread training in integrated pest management, and also the licensing and sale of the most hazardous pesticides should be regulated.	Scandinavian Journal of Work, Environment & Health	21	2	124-33	Self-reported exposure			Cohort (prospective)	Pesticides in general	pesticide-related illness	self-reported	Indonesia	lmic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
789	M. Kogevinas, H. Becher, T. Benn, P. A. Bertazzi, P. Boffetta, H. B. Bueno-de-Mesquita, D. Coggon, D. Colin, D. Flesch-Janys, M. Fingerhut, L. Green, T. Kauppinen, M. Littorin, E. Lynge, J. D. Mathews, M. Neuberger, N. Pearce and R. Saracci	Cancer mortality in workers exposed to phenoxy herbicides, chlorophenols, and dioxins. An expanded and updated international cohort study	1997	The authors examined cancer mortality in a historical cohort study of 21,863 male and female workers in 36 cohorts exposed to phenoxy herbicides, chlorophenols, and dioxins in 12 countries. Subjects in this updated and expanded multinational study coordinated by the International Agency for Research on Cancer were followed from 1939 to 1992. Exposure was reconstructed using job records, company exposure questionnaires, and serum and adipose tissue dioxin levels. Among workers exposed to phenoxy herbicides contaminated with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) or higher chlorinated dioxins, mortality from soft-tissue sarcoma (6 deaths; standardized mortality ratio (SMR) = 2.03, 95% confidence interval (CI) 0.75-4.43) was higher than expected from national mortality rates. Mortality from all malignant neoplasms (710 deaths; SMR = 1.12, 95% CI 1.04-1.21), non-Hodgkin's lymphoma (24 deaths; SMR = 1.39, 95% CI 0.89-2.06), and lung cancer (225 deaths; SMR = 1.12, 95% CI 0.98-1.28) was slightly elevated. Risks for all neoplasms, for sarcomas, and for lymphomas increased with time since first exposure. In workers exposed to phenoxy herbicides with minimal or no contamination by TCDD and higher chlorinated dioxins, mortality from all neoplasms (398 deaths; SMR = 0.96, 95% CI 0.87-1.06), non-Hodgkin's lymphoma (9 deaths; SMR = 1.00), and lung cancer (148 deaths; SMR = 1.03) was similar to that expected, and mortality from soft-tissue sarcoma was slightly elevated (2 deaths; SMR = 1.35). In a Poisson regression analysis, workers exposed to TCDD or higher chlorinated dioxins had an increased risk for all neoplasms (rate ratio = 1.29, 95% CI 0.94-1.76) compared with workers from the same cohort exposed to phenoxy herbicides and chlorophenols but with minimal or no exposure to TCDD and higher chlorinated dioxins. These findings indicate that exposure to herbicides contaminated with TCDD and higher chlorinated dioxins may be associated with a small increase in overall cancer risk and in risk for specific cancers.	American Journal of Epidemiology	145	12	1061-75	Self-reported exposure	Biomonitoring (dermal)		NA	Specific active ingredient	mortality (all cause)	doctor-diagnosed	AHIC	AHIC
790	M. Kogevinas, T. Kauppinen, R. Winkelmann, H. Becher, P. A. Bertazzi, H. B. Bueno-de-Mesquita, D. Coggon, L. Green, E. Johnson, M. Littorin and e. al.	Soft tissue sarcoma and non-Hodgkin's lymphoma in workers exposed to phenoxy herbicides, chlorophenols, and dioxins: two nested case-control studies	1995	We examined the effect of exposure to chemicals present in the production and spraying of phenoxy herbicides or chlorophenols in two nested case-control studies of soft tissue sarcoma and non-Hodgkin's lymphoma. Eleven sarcoma and 32 lymphoma cases occurring within an international cohort were matched for age, sex, and country of residence with 55 and 158 controls, respectively. Exposures to 21 chemicals or mixtures were estimated by three industrial hygienists who were blind to the subject's case-control status. Excess risk of soft tissue sarcoma was associated with exposure to any phenoxy herbicide [odds ratio (OR) = 10.3; 95% confidence interval (CI) = 1.2-91] and to each of the three major classes of phenoxy herbicides (2,4-dichlorophenoxyacetic acid, 2,4,5-trichlorophenoxyacetic acid, and 4-chloro-2-methylphenoxyacetic acid), to any polychlorinated dibenzodioxin or furan (OR = 5.6; 95% CI = 1.1-28), and to 2,3,7,8-tetrachlorodibenzo-p-dioxin (OR = 5.2; 95% CI = 0.85-32). Sarcoma risk was not associated with exposure to raw materials or other process chemicals. In the non-Hodgkin's lymphoma study, associations were generally weaker than those found in the study on sarcoma. These findings indicate that workers exposed to phenoxy herbicides and their contaminants are at a higher risk of soft tissue sarcoma.	Epidemiology	6	4	396-402	Expert case-by-case assessment			Case-control	Specific active ingredient	cancer	doctor-diagnosed	AHIC	AHIC
791	M. Kokouva, M. Koureas, E. Dardiotis, P. Almpanidou, A. Kalogeraki, D. Kyriakou, G. M. Hadjigeorgiou and C. Hadjichristodoulou	Relationship between the paraoxonase 1 (PON1) M55L and Q192R polymorphisms and lymphohaematopoietic cancers in a Greek agricultural population	2013	The aim of this study was to investigate the association between Paraoxonase 1 (PON1) gene polymorphisms (M55L and Q192R) and lymphohaematopoietic cancers (LHC) in an agricultural region of Greece. A hospital-based case-control study was conducted. A structured questionnaire including information on demographics, residence, occupation, agricultural practices, pesticide exposure, family history, smoking, alcohol consumption and medical history, was used. Genotyping of 316 cases of LHC and 351 healthy controls by using standard laboratory methods was performed. To control for confounders, Binary and Multinomial Logistic Regression analyses were used. Possession of QQ genotype or presence of the Q allele were associated with increased risk of developing LHC (OR 1.94, 95% CI 1.42-2.66 and OR 1.72, 95% CI 1.33-2.23 respectively). The QQ genotype in the recessive model was independently associated with LHC (OR 1.92, 95% CI 1.40-2.65), leukaemia (OR 1.99, 95% CI 1.13-3.49), lymphoma (OR 2.17, 95% CI 1.21-3.90) and plasmacell disease (OR 1.92, 95% CI 1.40-2.65) even after controlling for age, sex, pesticide exposure, smoking and family history (cancers, LHC and immunological disorders) as confounders. Possession of QQ genotype was found to have a stronger association with LHC in the high and medium pesticide exposed groups(OR 2.15, 95% CI 1.35-3.40, P-value 0.001 and OR 2.25, 95% CI 1.21-4.19, P-value 0.010 respectively), compared with the Low/No exposed group where the association was not statistically significant (OR 1.51, 95% CI 0.76-3.00, P-value 0.224). We found no association between M55L polymorphism and LHC. PON1 polymorphisms may influence the risk for LHC in our agricultural area. The results encourage further investigation on the PON1 polymorphisms and their importance on the individual's susceptibility especially when exposure to pesticides occurs.	Toxicology	307	NA	43440	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Greece	hic
792	M. Kokouva, N. Bitsolas, G. M. Hadjigeorgiou, G. Rachiotis, N. Papadoulis and C. Hadjichristodoulou	Pesticide exposure and lymphohaematopoietic cancers: a case-control study in an agricultural region (Larissa, Thessaly, Greece)	2011	BACKGROUND: The causality of lymphohaematopoietic cancers (LHC) is multifactorial and studies investigating the association between chemical exposure and LHC have produced variable results. The aim of this study was to investigate the relationships between exposure to pesticides and LHC in an agricultural region of Greece. METHODS: A structured questionnaire was employed in a hospital-based case control study to gather information on demographics, occupation, exposure to pesticides, agricultural practices, family and medical history and smoking. To control for confounders, backward conditional and multinomial logistic regression analyses were used. To assess the dose-response relationship between exposure and disease, the chi-square test for trend was used. RESULTS: Three hundred and fifty-four (354) histologically confirmed LHC cases diagnosed from 2004 to 2006 and 455 sex- and age-matched controls were included in the study. Pesticide exposure was associated with total LHC cases (OR 1.46, 95% CI 1.05-2.04), myelodysplastic syndrome (MDS) (OR 1.87, 95% CI 1.00-3.51) and leukaemia (OR 2.14, 95% CI 1.09-4.20). A dose-response pattern was observed for total LHC cases (P = 0.004), MDS (P = 0.024) and leukaemia (P = 0.002). Pesticide exposure was independently associated with total LHC cases (OR 1.41, 95% CI 1.00 - 2.00) and leukaemia (OR 2.05, 95% CI 1.02-4.12) after controlling for age, smoking and family history (cancers, LHC and immunological disorders). Smoking during application of pesticides was strongly associated with total LHC cases (OR 3.29, 95% CI 1.81-5.98), MDS (OR 3.67, 95% CI 1.18-12.11), leukaemia (OR 10.15, 95% CI 2.15-65.69) and lymphoma (OR 2.72, 95% CI 1.02-8.00). This association was even stronger for total LHC cases (OR 18.18, 95% CI 2.38-381.17) when eating simultaneously with pesticide application. CONCLUSIONS: Lymphohaematopoietic cancers were associated with pesticide exposure after controlling for confounders. Smoking and eating during pesticide application were identified as modifying factors increasing the risk for LHC. The poor pesticide work practices identified during this study underline the need for educational campaigns for farmers.	BMC Public Health	11	NA	5	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Greece	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
793	M. Koureas, A. Tsezou, A. Tsakalof, T. Orfanidou and C. Hadjichristodoulou	Increased levels of oxidative DNA damage in pesticide sprayers in Thessaly Region (Greece). Implications of pesticide exposure	2014	The widespread use of pesticides substances nowadays largely guarantees the protection of crops and people from undesired pests. However, exposure to pesticides was related to a variety of human health effects. The present study was conducted in the region of Thessaly which is characterized by intensive agricultural activities and wide use of pesticides. The study aimed at estimating the oxidative damage to DNA in different subpopulations in Thessaly region (Greece) and investigating its correlation with exposure to pesticides and other potential risk factors. In total, the study involved 80 pesticide sprayers, 85 rural residents and 121 individuals, inhabitants of the city of Larissa. Demographic characteristics, habits, medical history and exposure history of the participants to pesticides were recorded by personal interviews. Blood and urine samples were collected from all participants. For the measurement of exposure to organophosphorus insecticides, dialkylphosphate (DAP) metabolites were quantified in urine, by gas chromatography-mass spectrometry. Genomic DNA was extracted from peripheral blood samples and the oxidation by-product 8-hydroxydeoxyguanosine (8-OHdG) was determined by Enzyme Immuno-Assay. Urinary metabolite concentrations were not associated with 8-OHdG levels but it was found that pesticide sprayers had significantly higher levels of 8-OHdG (p=0.007) in comparison to the control group. Last season's exposure to insecticides and fungicides, expressed as total area treated multiplied by the number of applications, showed a statistically significant association with the risk of having high 8-OHdG levels [RR: 2.19 (95%CI:1.09-4.38) and RR: 2.32 (95% CI:1.16-4.64) respectively]. Additionally, from the subgroups of pesticides examined, seasonal exposure to neonicotinoid insecticides [RR: 2.22 (95% CI:1.07-4.63)] and glufosinate ammonium [RR: 3.26 (95% CI:1.38-7.69)] was found to have the greater impact on 8-OHdG levels. This study produced findings that support the hypothesis that pesticide exposure is involved in the induction of oxidative damage to DNA and identified chemical groups of pesticides which should be given greater attention in future investigations.	Science of the Total Environment	496	NA	358-364	Self-reported exposure	Biomonitoring (urine)		Cross-sectional	Specific active ingredient	genetic (biomarkers)	medical test result	Greece	hic
794	M. Koureas, G. Rachiotis, A. Tsakalof and C. Hadjichristodoulou	Increased Frequency of Rheumatoid Arthritis and Allergic Rhinitis among Pesticide Sprayers and Associations with Pesticide Use	2017	Objective: The aim of this study was to identify diseases linked with the pesticide sprayer occupation and explore possible associations with exposure history data. Methods: A cross sectional study was conducted among pesticide sprayers (n = 80) and the general population (n = 90) in Thessaly (Greece). Medical history, demographic characteristics and detailed exposure history were recorded by conducting personal interviews. Lifetime exposure indicators were calculated for several pesticide chemical subclasses. Moreover, organophosphate metabolite levels were quantified in urine samples of all participants by using gas chromatography -mass spectrometry (GC-MS). Multinomial analysis was used to determine associations between occupational pesticide exposure and diseases or disorders. Results: In the pesticide sprayers group, significantly higher frequencies for rheumatoid arthritis (RA) and allergic rhinitis were observed compared with the control group (p = 0.002 and p = 0.024 respectively). Within the pesticide sprayers group, high lifetime pesticide exposure was associated with increased risk for reporting RA (OR: 43.07 95% CI: 3.09-600.67) and allergic rhinitis (OR: 9.72 95% CI: 2.31-40.89), compared with low pesticide exposure. Exposure to organophsphate, guanidine and quinone pesticides were associated with RA while organophosphates, pyrethroids and paraquat were associated with allergic rhinitis. Despite the higher levels of certain pesticide metabolites observed among participants with rheumatoid arthritis, the differences were not statistically significant. One metabolite (diethylthiophosphate) was found to be significantly increased in allergic rhinitis cases (p = 0.037). Conclusions: The results from the current study suggest a possible association of occupational pesticide exposure with RA and allergic rhinitis that should be further investigated.	International Journal of Environmental Research & Public Health [Electronic Resource]	14	8	1	Self-reported exposure			Cross-sectional	Specific active ingredient	muskuloskeletal	self-reported	Greece	hic
795	M. Kronqvist, E. Johansson, B. Kolmodin-Hedman, H. Oman, M. Svartengren and M. van Hage-Hamsten	IgE-sensitization to predatory mites and respiratory symptoms in Swedish greenhouse workers	2005	BACKGROUND: Predatory mites are used as biological pesticides worldwide for control of spider mites and other pests in greenhouses. The aim of this study was to evaluate the impact of occupational exposure to Phytoseiulus persimilis and Hypoaspis miles on IgE sensitization among a large group of Swedish greenhouse workers and to examine the relationship between exposure and allergic asthma and rhinoconjunctivitis. METHODS: A total of 96 greenhouse workers from the southern part of Sweden, who were using the predatory mites for control of pests, were investigated with a questionnaire and a medical examination including lung function test. Blood samples were taken to test for allergen-specific IgE antibodies to Phytoseiulus persimilis and Hypoaspis miles as well as to Tetranychus urticae, Dermatophagoides pteronyssinus/farinae and Tyrophagus putrescentiae. RESULTS: Seventeen of the 96 workers were positive in ImmunoCAP to predatory mites: 17 to P. persimilis (17.7%) and 14 to H. miles (14.6%). Subjects sensitized to predatory mites were significantly more often atopic (13/17), defined as a positive Phadiatop, than those who lacked IgE against these mite species (17/79) (P <0.01). IgE antibodies to the red spider mite T. urticae were present among 23 subjects. Thirty-five of the investigated subjects displayed a positive ImmunoCAP to at least one of the investigated mite species. Furthermore, sensitization to any of the mites tested was significantly associated with asthma (OR=9.3) and rhinoconjunctivitis (OR=4.3). CONCLUSIONS: IgE sensitization to predatory mites, P. persimilis and H. miles, is common among greenhouse workers. The findings stress the importance of improved allergen avoidance in greenhouse environments.	Allergy	60	4	521-6	Job title			Cross-sectional	Job title	respiratory	medical test result	Sweden	hic
796	M. L. Queiroz, M. D. Fernandes and M. C. Valadares	Neutrophil function in workers exposed to organophosphate and carbamate insecticides	1999	Neutrophil function in 40 workers occupationally exposed to carbamate and organophophate insecticides were examined and compared to those of non-exposed individuals. Phagocytosis and intracellular killing of Candida albicans and Candida pseudotropicalis by neutrophils were studied. Two species of Candida were used since in individuals with myeloperoxidase deficiency neutrophils are unable to kill Candida albicans, while Candida pseudotropicalis can be effectively lysed. Phagocytosis of both antigens was normal in all the workers studied. On the other hand, there was a considerable reduction in the ability of neutrophils from exposed workers to kill Candida albicans whereas Candida pseudotropicalis was effectively lysed. This finding indicates some interference with the myeloperoxidase activity in the exposed population. The levels of cholinesterase activity in all workers were normal. These results demonstrate that exposure to carbamates and organophophates insecticides may lead to changes in neutrophil function even in workers presenting no impairment in the cholinesterase activity.	International Journal of Immunopharmacology	21	4	263-70	Biomonitoring (blood)			Cross-sectional	Chemical class	immunological	medical test result	Brazil	umic
797	M. L. Queiroz, M. R. Quadros, M. C. Valadares and J. P. Silveira	Polymorphonuclear phagocytosis and killing in workers occupationally exposed to hexachlorobenzene	1998	Phagocytosis and intracellular killing of Candida albicans and Candida pseudotropicalis by neutrophils from 66 workers exposed to chlorinated compounds were studied. Phagocytosis with both antigens was normal in all the workers studied. However, lytic activity of the neutrophils in the presence of both antigens, C. albicans and C. pseudotropicalis was impaired. These findings might be related to a derangement in the antioxidant mechanisms and to some interference with GSH levels that might lead to the abnormal functions observed in neutrophils.	Immunopharmacology & Immunotoxicology	20	3	447-54	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	NA	NA	Brazil	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
798	M. L. Urban, S. Bonini, A. Mutti, C. Buzio and A. Vaglio	Occupational and environmental risk factors in chronic periaortitis: A case-control study	2013	Introduction.- Chronic periaortitis (CP) is a rare condition characterized by the presence of a fibro-inflammatory retroperitoneal periaortic and periiliac tissue. CP is usually considered an idiopathic disease, but an association between asbestos exposure and risk of CP has been reported. The aim of this study was to investigate the role of occupational and environmental exposure to asbestos, metals, pesticides, silica, organic solvents in CP; we also evaluated the possible interaction with tobacco smoking. Patients.- We enrolled 90 consecutive patients with CP diagnosed at or referred to our Department from all over Italy between 2004 and 2012; 270 subjects recruited from the general population and matched with the patients for age, sex and geographic origin served as controls. All the study subjects were asked to fill in a questionnaire in order to assess individual risk factors (such as cardiovascular disease, abdominal surgery, drug use and smoking) and occupational and environmental exposure to asbestos, organic solvents, metals, other industrial chemicals, and pesticides. Results.- Asbestos exposure was over-represented among cases [OR 4.05 (2.28-7.19), P < 0.00001]; exposure to other agents also tended to be more frequent in the patient group, but for none of them statistical significance was reached. Among cases, there was an excess prevalence of smokers [OR 3.16 (1.67-5.99), P = 0.0003]. The packyear index was also significantly higher in the patient group [median (IQR) 31(20-44) vs. 20(9-37), P < 0.0001]. Interestingly, we found a positive interaction between asbestos exposure and smoking [OR 10.10 (4.28-23.84), P < 0.0000001]. Conclusion.- Exposure to asbestos may be a significant risk factor for the development of CP. In addition, tobacco smoking also increases the risk of CP. Asbestos and tobacco smoking significantly interact and, together, substantially increase the risk of developing the disease.	Presse Medicale	42	4	675-676	Self-reported exposure			Case-control	Pesticides in general	muskuloskeletal	doctor-diagnosed	Italy	hic
799	M. L.-F. Lacasana, I.; Rodriguez-Barranco, M.; Aguilar-Garduno, C.; Blanco-Munoz, J.; Perez-Mendez, O.; Gamboa, R.; Gonzalez-Alzaga, B.; Bassol, S.; Cebrian, M. E.	Interaction between organophosphate pesticide exposure and PON1 activity on thyroid function	2010	Organophosphate pesticides are widely used in agricultural purposes. Recently, a few studies have demonstrated the ability of these chemicals to alter the function of the thyroid gland in human. Moreover, the paraoxonase-1 enzyme (PON1) plays an important role in the toxicity of some organophosphate pesticides, with low PON1 activity being associated with higher pesticide sensitivity. This study evaluates the interaction between exposure to organophosphate compounds and PON1 enzyme activity on serum levels of TSH and thyroid hormones in a population of workers occupationally exposed to pesticides. A longitudinal study was conducted on a population of floriculture workers from Mexico, during two periods of high and low-intensity levels of pesticide application. A structured questionnaire was completed by workers containing questions on sociodemographic characteristics and other variables of interest. Urine and blood samples were taken, and biomarkers of exposure (dialkylphosphates), susceptibility (PON1 polymorphisms and activity) and effect (thyroid hormone levels) were determined. Interaction between dialkylphosphates and PON1 polymorphisms or PON1 activity on hormone levels was evaluated by generalized estimating equation (GEE) models. A significant interaction was found between serum diazoxonase activity and total dialkylphosphates (SIGMADAP) on TSH levels. Thus, when PON1 activity was increased we observed a decrease in the percentage of variation of TSH level for each increment in one logarithmic unit of the SIGMADAP levels. This interaction was also observed with the PON1(192)RR genotype. These results suggest a stronger association between organophosphate pesticides and thyroid function in individuals with lower PON1 activity.	Toxicology & Applied Pharmacology	249	1	16-24	Job title			Cohort (prospective)	Job title	endocrine/nutritional/metabolical	medical test result	Mexico	umic
800	M. Lacasana, H. Vazquez-Grameix, V. H. Borja-Aburto, J. Blanco-Munoz, I. Romieu, C. Aguilar-Garduno and A. M. Garcia	Maternal and paternal occupational exposure to agricultural work and the risk of anencephaly	2006	AIMS: To evaluate the association between parental occupational exposure to agricultural work and the risk of anencephaly in three Mexican states. METHODS: A paired case control study (1:1) was done based on records of the Epidemiological Surveillance System of Neural Tube Defects in Mexico; 151 cases of anencephaly of more than 20 weeks' gestation were selected between March 2000 and February 2001. Controls were selected from the same maternity services as those of the cases and were born alive without congenital malformations. Information was obtained from both parents by means of a general questionnaire, a food frequency questionnaire, and a specific questionnaire on occupational exposure to pesticides. Exposures were analysed with emphasis on the three months before and one month after the last menstruation periods (acute risk period (ARP)), as well as exposure prior to the above mentioned period (non-acute risk period (NARP)). RESULTS: The children of mothers who worked in agriculture in the ARP had a greater risk of anencephaly (OR = 4.57, 95% CI 1.05 to 19.96). The risk of fathers having a child with anencephaly was greater in those who applied pesticides irrespective of whether it was done in the ARP or the NARP (OR = 2.50, 95% CI 0.73 to 8.64; and OR = 2.03, 95% CI 0.58 to 7.08, respectively). CONCLUSIONS: These results support the hypothesis of the effect of maternal exposure to agricultural work on anencephaly and suggest that exposure of the father to pesticides in the periconceptional period or prior to this can also increase the risk of having an anencephalic child.	Occupational & Environmental Medicine	63	10	649-56	Self-reported exposure			Case-control	Pesticides in general	offspring	doctor-diagnosed	Mexico	umic
801	M. Lacasana, I. Lopez-Flores, M. Rodriguez-Barranco, C. Aguilar-Garduno, J. Blanco-Munoz, O. Perez-Mendez, R. Gamboa, S. Bassol and M. E. Cebrian	Association between organophosphate pesticides exposure and thyroid hormones in floriculture workers	2010	The ability of organophosphate pesticides to disturb thyroid gland function has been demonstrated by experimental studies on animal, but evidence of such effects on human remains scarce. The aim of this study was to assess the association between exposure to organophosphate compounds and serum levels of thyroid hormones in floriculture workers. A longitudinal study was conducted on 136 male subjects from the State of Mexico and Morelos, Mexico, occupationally exposed to organophosphate pesticides, during agricultural periods of high (rainy season) and low (dry season) levels of pesticide application. Using a structured questionnaire, a survey was carried out on sociodemographic characteristics, anthropometry, clinical history, alcohol and tobacco consumption, residential chemical exposure, and occupational history. Urine and blood samples were taken the day after pesticide application to determine urine dialkylphosphate (DAP) levels, serum levels of TSH, total T(3), total T(4), serum PON1 activity, and serum p,p'-DEE levels. The analysis of the association between DAP levels and thyroid hormonal profile was carried out using multivariate generalized estimating equation (GEE) models. Our results showed an increase in both TSH and T(4) hormones in serum associated with a increase in total dimethylphosphate levels (SigmaDMP) in urine (p-trend<0.001) and a decrease in total T(3) serum levels with an increase of SigmaDMP levels in the urine (p-trend=0.053). These results suggest that exposure to organophosphate pesticides may be responsible of increasing TSH and T(4) serum hormone levels and decreasing T(3) serum hormone levels, therefore supporting the hypothesis that organophosphate pesticides act as endocrine disruptors in humans.	Toxicology & Applied Pharmacology	243	1	19-26	Biomonitoring (urine)			Cohort (prospective)	Chemical class	endocrine/nutritional/metabolical	medical test result	Mexico	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
802	M. Littorin, R. Attewell, S. Skerfving, V. Horstmann and T. Moller	Mortality and tumour morbidity among Swedish market gardeners and orchardists	1993	In order to investigate possible effects of exposure to pesticides, mainly fungicides and insecticides, we studied a cohort of 2370 subjects, who, during the period 1965-1982, had been members of a horticulturists' trade association (market gardeners and orchardists). Compared to a regional reference population, total mortality (542 deaths; standardized mortality morbidity ratio, SMR = 0.8; 95% confidence limits, CLs = 0.7, 0.9) and mortality due to malignant tumours (133 deaths, SMR = 0.9; CLs = 0.7, 1.0), and cardiovascular and respiratory deaths were somewhat decreased. Suggestive excesses in mortality were seen for mental disorders and tumours of the stomach, skin and nervous system. The tumours of the nervous system were in particular excess in the young and middle-aged horticulturists (below age 60; six cases, SMR = 2.9; CLs = 1.1, 6.2). During the period 1965-1986, the total tumour morbidity was slightly decreased (255 cases; SMR = 0.9; CLs = 0.8, 1.0), as were gastrointestinal and respiratory tract tumours. The incidence of melanomas was increased (15 cases, SMR = 2.1; CLs = 1.2, 3.5), and tumours of the female genital organs, myelomas, and brain tumours (12 cases, SMR = 1.5; CLs = 0.8, 2.7) were slightly numerically elevated. Brain tumours in the young and middle-aged horticulturists (11 cases, SMR = 3.2; CLs = 1.6, 5.7), including meningiomas (four observed, SMR = 6.8; CLs = 1.9, 17.4), were increased, especially in the period 1975-1979. The mortality and tumour morbidity patterns in gardeners and orchardists, analysed separately, were similar to the patterns in all the horticulturists.(ABSTRACT TRUNCATED AT 250 WORDS)	International Archives of Occupational & Environmental Health	65	3	163-9	Registers			Cohort (prospective)	Type of pesticide	mortality (all cause)	doctor-diagnosed	Sweden	hic
803	M. Luqman, M. M. Javed, S. Daud, N. Raheem, J. Ahmad and A. U. Khan	Risk factors for lung cancer in the Pakistani population	2014	BACKGROUND: Lung cancer is one of the most prevalent malignancies in the world and both incidence and mortality rates are continuing to rise in Pakistan. However, epidemiological studies to identify common lung cancer determinants in the Pakistani population have been limited. MATERIALS AND METHODS: In this retrospective case-control study, 400 cases and 800 controls were enrolled from different hospitals of all provinces of Pakistan. Information about socio-demographic, occupational, lifestyle and dietary variables was extracted by questionnaire from all subjects. Odd ratios (ORs) and 95% confidence intervals (CIs) were calculated. and dose-response associations were also assessed for suitable factors. RESULTS: Strong associations were observed for smoking (OR=9.4, 95%CI=6.9-12.8), pesticide exposure (OR=5.1, 95%CI=3.1-8.3), exposure to diesel exhaust (OR=3.1, 95%CI=2.1-4.5), red meat consumption (OR=2.9, 95%CI=1.8-4.7) and chicken consumption (OR=2.8, 95%CI=1.7-49). Other associated factors observed were welding fumes (OR=2.5, 95%CI=1.0-6.5), sedentary living (OR=2.0, 95%CI=1.6-2.6), family history (OR=2.0, 95%CI=0.8-4.9), wood dust (OR=1.9, 95%CI=1.2- 3.1), tea consumption (OR=1.8, 95%CI=1.2-2.6), coffee consumption (OR=1.8, 95%CI=1.1-2.8), alcoholism (OR=1.7, 95%CI=1.1-2.5) and asbestos exposure(OR=1.5, 95%CI=0.5-4.4). Consumption of vegetables (OR=0.3, 95%CI=0.2-0.4), juices (OR=0.3, 95%CI=0.3-0.4), fruits (OR=0.7, 95%CI=0.5-0.9) and milk (OR=0.6, 95%CI=0.5- 0.8) showed reduction in risk of lung cancer. Strongest dose-response relationships were observed for smoking (?2=333.8, p<=0.0000001), pesticide exposure (?2=50.9, p<=0.0000001) and exposure to diesel exhaust (?2=51.8, p<=0.0000001). CONCLUSIONS: Smoking, pesticide exposure, diesel exhaust and meat consumption are main lung cancer determinants in Pakistan. Consuming vegetables, fruits, milk and juices can reduce the risk of lung cancer risk, as in other countries.	Asian Pacific Journal of Cancer Prevention: Apjcp	15	7	414795	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Pakistan	lmic
804	M. M. Amr, E. Z. Abbas, M. El-Samra, M. El Batanuoni and A. M. Osman	Neuropsychiatric syndromes and occupational exposure to zinc phosphide in Egypt	1997	Eighty-six workers exposed to zinc phosphide (Zn3P2) pesticide were studied for evidence of neuropsychiatric manifestations. They were evaluated clinically, by electroencephalography (EEG), and, in some cases, by electromyography (EMG). All were males (mean age, 35.8 years; mean duration of exposure to zinc phosphide, 11.3 years). Most presented with one (or more) neuropsychiatric symptom(s), including fear of poisoning, anxiety, impotence, and easy fatigue. About half showed evidence of neuropsychiatric signs, including hyperreflexia, polyneuropathy, lumber radiculopathy, and cervical myelopathy, as well as anxious mood, impaired attention, and psychomotor stimulation. EEG recordings showed abnormal findings in 17.4% of the subjects. The mean age in that group was 39.1 years; mean duration of exposure to Zn3P2 was 15.1 years. EMG studies showed evidence of partial denervation of the anterior tibial group of muscles and flexor digiti minimi in 2 of the 30 workers (6.7%) who underwent EMG examination. Serum levels of zinc (Zn) and cadmium (Ca) were significantly higher in exposed workers than in controls (P < 0.005). Serum copper (Cu), iron (Fe), phosphorus (P), and magnesium (Mg) were significantly lower in exposed workers than in controls. Electrophoretic pattern of globulin showed that gammaglobulin fraction was significantly increased (P < 0.005); alpha2 and beta-globulin were decreased (P < 0.005) in exposed workers. Lipoprotein pattern showed that the total lipids, B-lipoprotein, and B/alpha ratio were significantly increased (P < 0.005) in exposed workers; the alpha1 lipoprotein was decreased. Triglycerides and cholesterol were significantly increased (P < 0.001), and phospholipids and phospholipid/cholesterol ratio were significantly decreased (P < 0.005) in exposed workers compared to controls. The study findings indicated that exposure to Zn3P2 not only caused mild acute and subacute liver cell damage, but also affected renal function and perhaps B-cells of the pancreas. A total of 68.6% of the exposed workers had chest symptoms; only 24.4% presented with chest or cardiac signs. Ventilatory functions were abnormal in 70% of the exposed workers; abnormal ECG findings were present in 12.8%.	Environmental Research	73	1	200-6	Biomonitoring (blood)			Case-control	Specific active ingredient	neurological	medical test result	Egypt	lmic
805	M. M. Bazilio, S. Frota, J. R. Chrisman, A. Meyer, C. I. Asmus and M. Camara Vde	Temporal auditory processing in rural workers exposed to pesticide	2012	PURPOSE: The objective of this research was to assess the ordering and temporal resolution auditory abilities in rural workers exposed to pesticides and compare them with laborers exposure index. METHODS: A sectional study assessed 33 individuals of both genders, aged 18-59 years, who were exposed to pesticides during their daily routine. The procedures were: questionnaire, meatoscopy, basic audiological evaluation and Temporal Auditory Processing tests: pattern test duration and Gaps-in-Noise. In order to analyse the results, a variable called 'index of exposure' was set up through a simple sum of variables present in the questionnaire. The tests' results on Temporal Auditory Processing were categorized according to the tercis of distribution, based on the results observed - in this study, tertile 1, tertile 2, and tertile 3 - and then compared with the exposure index. RESULTS: Difference was verified in all tertiles, with a dose-response relationship, i.e. increased average exposure was associated to worse performance on pattern test duration (p=0.001) and Gaps-in-Noise (p=0.001) in all tertiles. The highest correlation was observed between tertiles 3 and 1. CONCLUSION: Workers exposed to pesticide performed bellow average on Temporal Auditory Processing tests. There was association between the index of exposure to pesticides and worse performance in Temporal Auditory Processing tests, suggesting that the pesticides may be harmful to central auditory pathways.	Jornal da Sociedade Brasileira de Fonoaudiologia	24	2	174-80	Self-reported exposure			Cross-sectional	Pesticides in general	other	other	Brazil	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
806	M. M. Brouwers, H. Besselink, R. W. Bretveld, R. Anzion, P. T. Scheepers, A. Brouwer and N. Roeleveld	Estrogenic and androgenic activities in total plasma measured with reporter-gene bioassays: relevant exposure measures for endocrine disruptors in epidemiologic studies?	2011	Measurements of estrogenic and androgenic activities in total plasma with Chemically Activated LUciferase gene eXpression (CALUX) bioassays could provide biologically relevant measures for exposure to endocrine disruptors in epidemiologic studies. The objective of this study was to explore the effects of a variety of sources of potential endocrine disruptors on estrogenic and androgenic activities in total plasma measured by CALUX. Plasma samples and interview data on sources of potential endocrine disruptors were collected from 108 men with different exposures profiles. CALUX measurements (BioDetection Services) involved human U2-OS cell lines controlled by the estrogen receptor alpha and the androgen receptor. Mean differences (beta) in 17beta-estradiol equivalents (EEQs) and dihydrotestosterone equivalents (AEQs) between exposure groups were estimated using general linear models. Mean plasma AEQs and EEQs were 9.1x10(-1)ng/ml and 12.0pg/ml, respectively. Elevated AEQs were found in smokers (beta 1.9 (95%CI 0.1-3.6)x10(-1)ng/ml) and heavy drinkers (1.4 (0.2-3.1)x10(-1)ng/ml), and in men occupationally exposed to disinfectants (1.6 (0.3-3.5)x10(-1)ng/ml) or welding/soldering fumes (1.4 (-0.2-2.9)x10(-1)ng/ml). Occupational exposure to pesticides, disinfectants, and exhaust fumes seemed to be associated with increased plasma EEQs: 1.5 (-0.2-3.2)pg/ml, 2.1 (0.2-3.9)pg/ml, and 2.9 (0.6-5.2)pg/ml, respectively. Moderate to high plasma dioxin levels, measured in a subgroup by the dioxin-responsive CALUX, were accompanied by a 20% increase in AEQs. This is the first study in which CALUX was used to assess hormone activities in total plasma. Although the results are not yet readily interpretable, they indicate that these measurements can be valuable for epidemiologic studies on endocrine disruptors and give direction for further research.	Environment International	37	3	557-64	Self-reported exposure			Case-control	Pesticides in general	endocrine/nutritional/metabolical	medical test result	Netherlands	hic
807	M. M. Brouwers, W. F. Feitz, L. A. Roelofs, L. A. Kiemeney, R. P. de Gier and N. Roeleveld	Risk factors for hypospadias	2007	Despite being one of the most common congenital defects in boys, the etiology of hypospadias remains largely unknown. In this case-referent study, we evaluated a wide spectrum of potential risk factors for hypospadias. Cases were identified from the hospital information system, and referents were recruited through the parents of the cases. Both parents of cases and referents completed written questionnaires that they received through the mail. Logistic regression analyses were used to assess the independent contribution of different factors to the risk of hypospadias. The final database included 583 cases and 251 referents. Hypospadias more often occurred in children whose father had hypospadias (OR=9.7; 95%CI: 1.3-74.0) and in children with a low birth weight (OR=2.3; 95%CI: 1.2-4.2). Indications for elevated risks were found when mothers were DES-daughters (OR=3.5; 95%CI: 0.8-15.6), fathers were subfertile (OR=1.8; 95%CI: 0.7-4.5), the parents had undergone fertility treatment (OR=2.3; 95%CI: 0.9-5.8), and in twin or triplet pregnancies (OR=2.0; 95%CI: 0.8-5.1). Maternal use of iron supplements (OR=2.2; 95%CI: 0.8-6.0), maternal smoking (OR=1.5; 95%CI: 1.0-2.4), paternal prescriptive drug use (OR=2.6; 95%CI: 1.1-6.6), and paternal exposure to pesticides (OR=2.1; 95%CI: 0.6-7.1) during the 3 months immediately prior to conception or in the first trimester of pregnancy also appeared to increase the risk of hypospadias. The associations found in this study support the hypothesis that genetic predisposition, placental insufficiency, and substances that interfere with natural hormones play a role in the etiology of hypospadias.	European Journal of Pediatrics	166	7	671-8	Self-reported exposure			Case-control	Pesticides in general	offspring	doctor-diagnosed	Netherlands	hic
808	M. M. Crane, S. S. Strom, S. Halabi, E. L. Berman, J. J. Fueger, M. R. Spitz and M. J. Keating	Correlation between selected environmental exposures and karyotype in acute myelocytic leukemia	1996	Many bone marrow cytogenetic abnormalities in acute myelogenous leukemia (AML) are tumor specific, clonal, nonrandom, and related to prognosis; it has been hypothesized that they may be markers of exposure to etiological agents. A previous report from our institution revealed several such associations; the purpose of the current study was to determine whether previous findings were present in a new group of patients. Subjects included 84 newly diagnosed AML patients (French-American-British M1 and M2); exposure data were gathered using self-report questionnaires at the time of registration. Two sets of comparisons were made: (a) patients with all (AA) or some (AN) cytogenetically abnormal cells versus those with normal karyotypes (NN) and (b) patients with specific abnormalities [-5/5q-, -7/7q-, +8, t(8;21)] versus all others. Odds ratios (ORs) were 4.64 for the association between prior cytotoxic therapy and -5/5q- and 6.38 for the association with -7/7q-, but were <1.00 for +8 and t(8;21). There were no ORs > 2.0 for specific abnormalities in any of the other exposures evaluated (cigarette smoking, alcohol use, occupational exposure to organic chemicals, paints, or pesticides/herbicides), with the exception of exposure to paints and -7/7q- (OR, 7.50). The ORs for AA/AN versus NN patients were 1.43 and 3.81 for smoking and alcohol use, and weak dose-response trends were present. The most consistent positive associations between the two series were for prior cytotoxic therapy (-5/5q-; -7/7q-), cigarette smoking (AA/AN versus NN) and alcohol use (AA/AN versus NN). Reasoning from the known association between prior cytotoxic therapy and -7/7q-, we would have predicted relatively high ORs (> 4.0) if specific abnormalities acted as markers for the exposures assessed, but none were present. However, in both series, AA/AN patients were more likely to smoke and use alcohol than were NN patients, and weak dose-response patterns were present for both. This finding suggests that both smoking and alcohol use may play a role in the pathogenesis of cytogenetic abnormalities in AML-M1/M2; however, the mechanism by which they work and whether they are involved in the etiology of these diseases remain unclear.	Cancer Epidemiology, Biomarkers & Prevention	5	8	639-44	Self-reported exposure			Cross-sectional	Pesticides in general	cancer	doctor-diagnosed	AHIC	AHIC
809	M. M. M. Beshwari, A. Bener, A. Ameen, A. M. Al-Mehdi, H. Z. Ouda and M. A. H. Pasha	Pesticide-related health problems and diseases among farmers in the United Arab Emirates	1999	The aim of this study is to determine the effect of pesticides on farm workers and to identify some risk factors associated with pesticide conditions may cause adverse health effects in farm workers in the United Arab Emirates. This case-control study consisted of 103 farm workers (case) and 105 non-farm workers (control), matched for age, sex and nationality selected from Al-Ain city, Dubai, Sharjah and Fujairah Emirates. Indian-subcontinent workers represented the majority among farmers (90.3%) and non-farmers (82.9%). While the majority of farmers were illiterate and had low level of education, the non-farmers slightly shifted towards a higher level of education ($p < 0.0001$). Most of the farmers were living in prefabricated houses (50.5%) and were washing the harvested product (72.8%) before eating. Farmers had higher prevalence of symptoms than non-farmers, being significantly greater for diarrhoea ($p < 0.016$), nausea/vomiting ($p < 0.003$), rash ($p < 0.002$), red/irritated eye/blurred vision ($p < 0.024$), increased anxiety ($p < 0.003$), dizziness ($p < 0.0001$), headache ($p < 0.024$), muscular symptoms ($p < 0.015$), memory loss ($p < 0.0001$), drowsiness ($p < 0.003$), fatigue ($p < 0.001$), dyspnoea ($p < 0.005$), and insomnia ($p < 0.001$). Also, farm workers had higher prevalence respiratory symptoms than non-farm workers being significantly greater for cough, phlegm, breathlessness, sinusitis, throat discomfort, chronic bronchitis, asthma diagnosis by doctor, allergic rhinitis, skin pruritus (tinea, contact dermatitis) and eczema. In conclusion, this study determined possible exposure and associated risk factors with pesticides among farmers and there is evidence that some of the illnesses obtained in this study could be related to excessive exposure to pesticides.	International Journal of Environmental Health Research	9	3	213-221	Self-reported exposure			Case-control	Pesticides in general	pesticide-related symptoms	self-reported	UAE	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
810	M. M. M. Beshwari, A. Bener, A. M. Almehdi, A. Ameen, A. Ibrahim, M. A. H. Pasha and H. Z. Ouda	Aminoacid profiles in farm workers	1999	The aim of the present study was to determine the effect of pesticides on the plasma levels of amino acids and serum liver enzymes in farm workers in the United Arab Emirates. This case-control study consisted of 103 farm workers (case) and 105 non-farm workers (control), matched for age, sex, and nationality selected from Al-Ain City, Dubai, Sharjah, and Fujairah Emirates. The Indian-subcontinent workers represented the majority among farmers (90.3%) and non-farmers (82.9%). Seventy percent of the subjects reported working in a field with an obvious chemical smell and 60% of the farm workers reported mixing pesticides and spraying with chemical pesticides. Amino acid analysis showed higher values among farmers than non-farmers for histidine, threonine, lysine, and arginine as essential amino acids (p<0.0001). Ornithine, taurine, glutamic, serine glycine, and tryptophan as non-essential amino acids showed significantly higher values in farmers when compared with the non-farmers (p<0.0001).	Environment International	25	4	411-416	Self-reported exposure			Case-control	Pesticides in general	hematological	medical test result	UAE	hic
811	M. M. McClean, L. , A. , W. , K. , R. Rubio, R. S<U+221A><U+00B0>nchez and B.	Investigating occupational factors and biomarkers of kidney function among Nicaraguan workers	2013	Objective In Nicaragua, an epidemic of chronic kidney disease (CKD) with unknown aetiology has been described primarily among young, male sugarcane workers. Our goals were to characterise the type of kidney damage and evaluate the potential role of occupational factors. Methods Our study population included 284 sugarcane workers, 51 miners, 60 construction workers, and 53 port workers in Western Nicaragua. For sugarcane workers in seven jobs (e.g. cane cutters, pesticide applicators, etc.), blood and urine samples were collected at the beginning and end of the 6-month sugarcane harvest. One round of samples were also collected from workers who were employed in the other three industries (but had never worked in the sugarcane industry). Biomarkers of kidney injury included serum creatinine, urinary albumin, and urinary neutrophil gelatinase-associated lipocalin (NGAL). Linear regression models were used to determine whether biomarkers of kidney injury increased during the harvest and/or varied by job. Results Biomarkers of kidney injury were significantly different by sugarcane job and estimated glomerular filtration rate (eGFR) declined significantly during the harvest among those engaged in the most strenuous work tasks, while urine albumin remained low in all groups. Compared to factory workers, eGFR was lowest among cane cutters (p = 0.006) and urinary NGAL was highest among cane cutters (p = 0.04). Workers in other industries also had higher than expected prevalence of eGFR <60 mL/min/1.73 m2. Conclusions Our results provide evidence that the type of kidney damage occurring in sugarcane workers, as well as among workers in other industries, is primarily tubulointerstitial (and not glomerular) in nature. Biomarkers of kidney injury varied by job and were highest among workers engaged in more strenuous physical labour. If acute kidney damage is on the causal pathway to CKD, heat or other work-related exposures may be contributing to this epidemic.	Occupational and Environmental Medicine	70	NA	NA	Job title			Cohort (prospective)	Job title	genitourinary	doctor-diagnosed	Nicaragua	lmic
812	M. M. Morales-Suarez-Varela, J. Olsen, P. Johansen, L. Kaerlev, P. Guenel, P. Arveux, G. Wingren, L. Hardell, W. Ahrens, A. Stang, A. Llopis, F. Merletti, J. J. Aurrekoetxea and G. Masala	Occupational exposures and mycosis fungoides. A European multicentre case-control study (Europe)	2005	OBJECTIVES: Mycosis Fungoides (MF) is a rare disease with an occurrence indicating that occupational exposures may play a role. To estimate the association between MF and occupational exposures as measured by means of an job-exposure matrix (JEM). METHODS: A European multicenter case-control study was conducted from 1995 to 1997 and included seven rare cancers, one of which was MF. Patients between 35 and 69 years of age, diagnosed with MF (n=140), were recruited and the diagnoses were checked by a reference pathologist who classified 83 cases as definite, 35 cases as possible and 22 cases as not accepted. Among the 118 accepted cases, 104 cases were interviewed, of which 76 were definite cases. We selected population controls and colon cancer controls to serve all seven case groups. Altogether 833 colon cancer controls and 2071 population controls were interviewed. Based on the reported occupational experiences, a team of industrial hygiene specialists identified five potential exposures and developed an JEM. This JEM was used to estimate the odds ratios (OR) for MF as a function of these exposures. The JEM included aromatic and/or halogenated hydrocarbons (AAHs), chrome (VI) and its salts, electromagnetic radiations, silica and pesticides. RESULTS: Exposures to AHHs (OR 6.3, C.I 2.4-16.7 for male) were associated with a high MF risk. CONCLUSIONS: The study supports the hypothesis that some MFs have an occupational etiology but only a small fraction of exposed workers are apparently susceptible since the disease is so rare.	Cancer Causes & Control	16	10	1253-9	Self-reported job history	Job exposure matrix		Case-control	Job title	cancer	doctor-diagnosed	AHIC	AHIC
813	M. M. Simescu, C. C. Podia Igna, E. Nicolaescu, A. Caragheorgheopol, I. Ion, A. C. Ion, C. Neagu, M. Negru, M. Pribu, A. Kochanska Dziurowicz and A. Stanjek-Cichoracka	Multiple pesticides exposure of greenhouses workers and thyroid parameters	2012	Objective: The persistence of high prevalence of thyroid pathology, despite the correction of iodine deficiency in our population, determined the evaluation of impact of factors different than iodine intake on the thyroid gland as environmental endocrine disruptors. We studied the potential correlation between pesticide exposure and parameters of the function, autoimmunity and morphology of the thyroid in a group of greenhouses workers (GHW) exposed to multiple uncontrolled pesticides across agricultural season. Materials and methods: 108 GHW, aged 18-78 y.o, with normal iodine intake, from a plain village, were enrolled voluntary in this study. They were exposed to multiple pesticides, as confirmed by toxicological investigations. In biological samples (urine, blood) collected across 2 agricultural seasons were determined thyroid parameters (TSH; free T4; antibody to thyroid peroxidase and thyroid echography) and pesticide concentrations for chlorpyrifos (CPF), its metabolite trichlopyridinol (TCP), dimetoat, cypermetrin and carbofurane. Urinary iodine concentration (UIC) was determined in 104 schoolchildren. Results: Median TSH 1.72<U+00AC><U+00B1>2.71 mcUI/mL, range 0.051 - 14.97; TSH higher than 4.2 in 13,92% of subjects. Median FT4 16.68 pmol/l. Positive ATPO in 18,51% of subjects. Thyroid nodules were found in 35,51% and echographic pattern suggestive for chronic thyroiditis in 14,81% of subjects. Median UIC was 135,20<U+00AC><U+00B1>59,28 <U+0152><U+00BA>g/l. TCP was detectable in 12,5%- 100% (mean 1<U+0152><U+00BA>g/l-57,28<U+0152><U+00BA>g/l) of samples, in different time season exposure. Carbofurane in serum was present in 50%-85,7% (mean0,125 <U+0152><U+00BA>g/ml- 0,24 <U+0152><U+00BA>g/ ml) of samples. Cypermetrin and dimetoat concentration in the majority of samples was under the quantification limit. Conclusions: The incidence of thyroid pathology in studied group, in conditions of normal iodine intake, was at the upper limit of known epidemiology of thyroid disease. The most frequently encountered pesticides were chlorpyrifos and carbofurane in the same samples which can have an additive effect. There are data that thyroid gland may be a sensitive target for CPF.	European Thyroid Journal	1	NA	172	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	endocrine/nutritional/metabolical	medical test result	NA	NA

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
814	M. M. Yassin, T. A. Abu Mourad and J. M. Safi	Knowledge, attitude, practice, and toxicity symptoms associated with pesticide use among farm workers in the Gaza Strip.[Erratum appears in Occup Environ Med 2002 Sep;59(9):650]	2002	AIMS: To assess knowledge, attitude, practice, and toxicity symptoms associated with pesticide use and exposure among 189 farm workers in the Gaza Strip. METHODS: A cross section of agricultural farm workers in the Gaza Strip were asked to fill in a questionnaire on knowledge, attitudes, practice towards pesticide use, and associated toxicity symptoms. RESULTS: Farm workers reported high levels of knowledge on the health impact of pesticides (97.9%). Moderate to high levels of knowledge were recorded on toxicity symptoms related to pesticides. Most farm workers were aware of the protective measures to be used during applying pesticides. However, no one took precautions unless they knew about the measures. Burning sensation in eyes/face was the commonest symptom (64.3%). The prevalence of self reported toxicity symptoms was dependent on mixing and use of high concentrations of pesticides. The highest percentage of self reported toxicity symptoms was found among the farm workers who returned to sprayed fields within one hour of applying pesticides. CONCLUSIONS: Farm workers in the Gaza Strip used pesticides extensively. Despite their knowledge about the adverse health impact of the pesticides, the use of protective measures was poor. Most had self reported toxicity symptoms, particularly the younger workers. It would be useful to minimise the use of pesticides and encourage alternative measures. Prevention and intervention programmes regarding the use of protective measures and monitoring the health status of farm workers should be implemented.	Occupational & Environmental Medicine	59	6	387-93	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	Palestine	lmic
815	M. N. Araoud, F.; Douki, W.; Hfaiedh, H. B.; Akrout, M.; Najjar, M. F.; Kenani, A.	Variations in clinical symptoms and plasma cholinesterase activity in agricultural workers exposed to pesticides	2014	The objective of this study is to examine variations in plasma cholinesterase activity (PChE) and their clinical manifestations in order to assess the chronic effects of occupational exposure to pesticides. The study involved 110 agricultural workers and 97 healthy control subjects from the Sahel region of Tunisia. Each individual underwent a clinical examination to look for functional symptoms related to chronic pesticide intoxication. PChE activity was determined by a kinetic method adapted to the Konelab 30 (Thermo Clinical LabsystemsTM). Neurological signs were the symptoms reported most often among workers, followed by musculoskeletal and dermatological symptoms; all are clinical manifestations potentially related to chronic pesticide exposure. A significant association was found between the neurological symptoms reported by workers and exposure to organophosphates (OP) or carbamates (CB) (p = 0.013). Mean PChE activity was significantly lower in workers than in controls (p < 0.001). Moreover, it was also significantly lower in workers exposed simultaneously to OP-CB mixtures than in those who used only OP (p = 0.030) or CB (p = 0.031). Decreased PChE activity was significantly associated with exposure to OP and/or CB (p < 0.001). The variation of PChE activity was also related to the duration of application and the chronicity of exposure. Thus, PChE activity is a useful effect biomarker of pesticide exposure. Nonetheless, its interpretation in agricultural workers must take other factors into consideration, especially the nature of the pesticides used and the duration and chronicity of exposure. Copyright <U+00AC><U+00A9> 2007 John Libbey Eurotext.	Environnement, Risques et Sante	13	1	60-66	Biomonitoring (blood)			Cohort (prospective)	Chemical class	pesticide-related symptoms	medical test result	Tunisia	lmic
816	M. Nasterlack, G. Hoffmann, P. Messerer, M. G. Ott, D. Pallapies, M. Wrede and A. Zober	Epidemiological and clinical investigations among employees in a former herbicide production process	2007	OBJECTIVES: To evaluate cancer incidence among employees assigned to a benzothiadiazin herbicide production facility between 1974 and 1984. METHODS: Retrospective cohort study including 185 employees who had worked at least 3 months in the facility. Cancers were identified by review of occupational medical records and interview. Standardized incidence ratios (SIRs) were computed using comparison data provided by the Saarland Cancer Registry. Separately, a medical examination including sonography of the prostate and thyroid and PSA testing was offered to all cohort members including retirees. RESULTS: Between 1975 and 2002, 12 cancers were observed compared with 10.3 expected cases (SIR 1.2; 95% confidence interval 0.6-2.0). Cancer types (including two prostate, two colon and one rectal cancer) were distributed unremarkably with no clustering of rare cancers. Medical screening and subsequent specialist referrals led to detection of three prostate cancers among 117 participants in the screening examination. CONCLUSIONS: Because of the limited study power, a link between former employment in this herbicide production process and the occurrence of cancer cannot be ruled out with confidence, although the observed incidence and distribution of cancers in this small cohort may be consistent with that expected in the general population. Detection of three prostate cancers via the examination program is also consistent with the experience of cancer screening programs that include PSA testing. Enhanced screening for prostate cancer among men over age 50 can lead to detection of cancers at earlier ages than would otherwise be the case. This likelihood needs to be planned for and addressed in communications with the study population prior to undertaking such initiatives.	International Archives of Occupational & Environmental Health	80	3	234-8	Job title			Cohort (retrospective)	Chemical class	cancer	doctor-diagnosed	Germany	hic
817	M. Neghab, M. D. Moemenbellah-Fard, R. Nazianghdam, N. Salahshour, M. Kazemi and H. Alipour	The effects of exposure to pesticides on the fecundity status of farm workers resident in a rural region of Fars province, southern Iran	2014	Objective: To investigate the prevalence of fecundity and other reproductive problems among a group of farmers in Kavar district of Fars province, southern Iran. Methods: A total of 268 randomly selected married male farm workers were investigated. A questionnaire was devised and validated [Cronbach's a-coefficient (0.81)]. Subjects were directly interviewed and the questionnaire forms were completed for them. Results: The prevalence of current primary infertility among the studied population was about 7.4% (P=0.001). Similarly, 6.3% of farm workers had offsprings with congenital malformations. Finally, 1.5% and 9% of farmers' wives had a history of stillbirth and abortion, respectively. It was concluded that the prevalence of current primary infertility were higher among farm workers families than in the normal population (P < 0.05). Additionally, stillbirth and spontaneous abortion were more common in the wives of farm workers than in the normal population, although the difference did not reach statistical significance. Conclusions: These effects are likely to be attributed to the exposure of farm workers to pesticides. <U+00AC><U+00A9> 2014 by the Asian Pacific Journal of Tropical Biomedicine.	Asian Pacific Journal of Tropical Biomedicine	4	4	324-328	Self-reported exposure			Cross-sectional	Pesticides in general	reproductive	self-reported	Iran	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
818	M. Neuberger, C. Rappe, S. Bergek, H. Cai, M. Hansson, R. Jager, M. Kundi, C. K. Lim, H. Wingfors and A. G. Smith	Persistent health effects of dioxin contamination in herbicide production	1999	A total of 159 cases of chloracne reported in 1969-1975 in TCDD-contaminated production of the herbicide 2,4,5-T have been followed for mortality and morbidity up to 1996 when blood and urine tests were performed on 50 survivors of these exposed chemical workers and matched controls. In exposed, the most frequent cause of sick leave was chloracne which persisted in 32%. Neurological symptoms were reported frequently (44% sleep disturbance, 32% headache, 30% neuralgia). BSR, leucocytes, gamma-GT, SGOT, and SGPT were significantly higher in exposed than in controls. The effects of exposure (P= 0.002) and alcohol (P= 0.002) on gamma-GT were found to be independent of each other. Comparisons within the chloracne cohort showed significantly exposed TCDD per gram blood lipid in patients with a history of liver disease (mean 801 pg/g) than without (mean 407 pg/g). Other congeners were not found elevated but some higher chlorinated furans and PCBs were found reduced in patients with liver disease. In multiple regression analysis with the factors age, alcohol, and log TCDD, the effects of TCDD and its interaction with age were found significant, indicative of chronic liver damage after high TCDD exposure at a young age. The prevalence of neurological symptoms and signs of chronic liver disease were related to TCDD in blood and abnormal poryphyrins in urine. In 48% coproporphyrin I > III ratio was elevated, this group showing increased TCDD (mean 719 pg/g). These results contribute to the evidence that chloracne is not the only chronic disease which can be related to TCDD exposure, even 23 years after exposure and despite high intersubject variability of TCDD half-life and other exposures.	Environmental Research	81	3	206-14	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	pesticide-related symptoms	self-reported	Austria	hic
819	M. Nordstrom, L. Hardell, A. Magnuson, H. Hagberg and A. Rask-Andersen	Occupational exposures, animal exposure and smoking as risk factors for hairy cell leukaemia evaluated in a case-control study	1998	To evaluate occupational exposures as risk factors for hairy cell leukaemia (HCL), a population-based case-control study on 121 male HCL patients and 484 controls matched for age and sex was conducted. Elevated odds ratio (OR) was found for exposure to farm animals in general: OR 2.0, 95% confidence interval (CI) 1.2-3.2. The ORs were elevated for exposure to cattle, horse, hog, poultry and sheep. Exposure to herbicides (OR 2.9, CI 1.4-5.9), insecticides (OR 2.0, CI 1.1-3.5), fungicides (OR 3.8, CI 1.4-9.9) and impregnating agents (OR 2.4, CI 1.3-4.6) also showed increased risk. Certain findings suggested that recall bias may have affected the results for farm animals, herbicides and insecticides. Exposure to organic solvents yielded elevated risk (OR 1.5, CI 0.99-2.3), as did exposure to exhaust fumes (OR 2.1, CI 1.3-3.3). In an additional multivariate model, the ORs remained elevated for all these exposures with the exception of insecticides. We found a reduced risk for smokers with OR 0.6 (CI 0.4-1.1) because of an effect among non-farmers.	British Journal of Cancer	77	11	2048-52	Self-reported exposure			Case-control	Type of pesticide	cancer	doctor-diagnosed	Sweden	hic
820	M. P. H. Purdue, J. A.; Blair, A.; Dosemeci, M.; Alavanja, M. C.	Occupational exposure to organochlorine insecticides and cancer incidence in the Agricultural Health Study	2007	Organochlorine (OC) insecticides have been regulated as possible human carcinogens primarily on the basis of animal studies. However, the epidemiologic evidence is inconsistent. We investigated the relationship between cancer incidence and OC insecticide use among pesticide applicators enrolled in the Agricultural Health Study, a prospective cohort study of 57,311 licensed applicators in Iowa and North Carolina enrolled between 1993 and 1997. Information on ever use of 7 OC insecticides (aldrin, chlordane, DDT, dieldrin, heptachlor, lindane, toxaphene) was collected from a self-administered questionnaire at enrollment. Lifetime exposure-days to OC insecticides were calculated using additional data from a take-home questionnaire completed by 25,291 participants (44% of total). We found no clear evidence of an association between use of OC insecticides and incident cancers (N = 1,150) ascertained through December, 2002. When we focused on individual insecticides and structurally similar groups (aldrin and dieldrin; chlordane and heptachlor), significantly increased relative risks of some cancers were observed for use of some chemicals (rectal cancer and chlordane, lung cancer and dieldrin, non-Hodgkin lymphoma (NHL) and lindane, melanoma and toxaphene, leukemia and chlordane/heptachlor). Some significant decreased relative risks were also observed (colon cancer and aldrin; overall cancer and heptachlor). In conclusion, we did not observe any clear relationship between cancer risk and the use of OC insecticides. Our chemical-specific findings are based on small numbers and multiple comparisons, and should be interpreted with caution; however, some observed associations (lindane and NHL, chlordane/heptachlor and leukemia) are supported by previous evidence.	International Journal of Cancer	120	3	642-9	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
821	M. P. K. Montgomery, F.; Saldana, T. M.; Alavanja, M. C.; Sandler, D. P.	Incident diabetes and pesticide exposure among licensed pesticide applicators: Agricultural Health Study, 1993-2003	2008	Exposure to certain environmental toxicants may be associated with increased risk of developing diabetes. The authors' aim was to investigate the relation between lifetime exposure to specific agricultural pesticides and diabetes incidence among pesticide applicators. The study included 33,457 licensed applicators, predominantly non-Hispanic White males, enrolled in the Agricultural Health Study. Incident diabetes was self-reported in a 5-year follow-up interview (1999-2003), giving 1,176 diabetics and 30,611 nondiabetics for analysis. Lifetime exposure to pesticides and covariate information were reported by participants at enrollment (1993-1997). Using logistic regression, the authors considered two primary measures of pesticide exposure: ever use and cumulative lifetime days of use. They found seven specific pesticides (aldrin, chlordane, heptachlor, dichlorvos, trichlorfon, alachlor, and cyanazine) for which the odds of diabetes incidence increased with both ever use and cumulative days of use. Applicators who had used the organochlorine insecticides aldrin, chlordane, and heptachlor more than 100 lifetime days had 51%, 63%, and 94% increased odds of diabetes, respectively. The observed association of organochlorine and organophosphate insecticides with diabetes is consistent with results from previous human and animal studies. Long-term exposure from handling certain pesticides, in particular, organochlorine and organophosphate insecticides, may be associated with increased risk of diabetes.	American Journal of Epidemiology	167	10	1235-46	Self-reported exposure			Cohort (prospective)	Specific active ingredient	endocrine/nutritional/metabolical	doctor-diagnosed	USA	hic
822	M. P. Longnecker and J. E. Michalek	Serum dioxin level in relation to diabetes mellitus among Air Force veterans with background levels of exposure	2000	Data from several epidemiologic studies suggest that exposure to unusually high amounts of dioxin (2,3,7,8-tetrachlorodibenzo-p-dioxin) increases the risk of diabetes mellitus, and experimental data suggest that the mechanism for this is decreased cellular glucose uptake. To investigate the dose-response relation more closely, we examined the association of serum dioxin level with prevalence of diabetes mellitus and with levels of serum insulin and glucose among 1,197 veterans in the Air Force Health Study who never had contact with dioxin-contaminated herbicides and whose serum dioxin level was within the range of background exposure typically seen in the United States (< or =10 ng/kg lipid). Compared with those whose serum dioxin level was in the first quartile (<2.8 ng/kg lipid), the multivariate-adjusted odds of diabetes among those in the highest quartile (> or =5.2 ng/kg lipid) was 1.71 (95% confidence interval = 1.00-2.91). The association was slightly attenuated after adjustment for serum triglycerides. Whether adjustment for serum triglycerides was appropriate, however, cannot be determined with available data. The association of background-level dioxin exposure with the prevalence of diabetes in these data may well be due to reasons other than causality, although a causal contribution cannot be wholly dismissed.	Epidemiology	11	1	16285	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	endocrine/nutritional/metabolical	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
823	M. P. Montgomery, E. Postel, D. M. Umbach, M. Richards, M. Watson, A. Blair, H. Chen, D. P. Sandler, S. Schmidt and F. Kamel	Pesticide Use and Age-Related Macular Degeneration in the Agricultural Health Study	2017	BACKGROUND: Age-related macular degeneration (AMD) is a leading cause of blindness in developed countries. Few studies have investigated its relationship to environmental neurotoxicants. In previous cross-sectional studies, we found an association between pesticide use and self-reported retinal degeneration. OBJECTIVE: We evaluated the association of pesticide use with physician-confirmed incident AMD. METHODS: The Agricultural Health Study (AHS) is a prospective cohort of pesticide applicators and their spouses enrolled from 1993-1997 in Iowa and North Carolina. Cohort members reported lifetime use of 50 specific pesticides at enrollment. Self-reports of incident AMD during follow-up through 2007 were confirmed by reports from participants' physicians and by independent evaluation of retinal photographs provided by the physicians. Confirmed cases (n=161) were compared with AHS cohort members without AMD (n=39,108). We estimated odds ratios (ORs) and 95% confidence intervals (CIs) by logistic regression with adjustment for age, gender, and smoking. RESULTS: AMD was associated with ever use of organochlorine [OR=2.7 (95% CI:1.8,4.0)] and organophosphate [OR=2.0 (95% CI: 1.3, 3.0)] insecticides and phenoxyacetate herbicides [OR=1.9 (95% CI:1.2,2.8)]. Specific pesticides consistently associated with AMD included chlordane, dichlorodiphenyltrichloroethane (DDT), malathion, and captan; others with notable but slightly less consistent associations were heptachlor, diazinon, phorate, 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), and 2,4-dichlorophenoxyacetic acid (2,4-D). Results were similar for men and women. Some specific pesticides were associated with both early- and late-stage AMD, but others were associated with only one stage. CONCLUSIONS: Exposures to specific pesticides may be modifiable risk factors for AMD. https://doi.org/10.1289/EHP793.	Environmental Health Perspectives	125	7	77013	Self-reported exposure			Cross-sectional	Specific active ingredient	other	self-reported	USA	hic
824	M. Pahwa, S. A. Harris, K. Hohenadel, J. R. McLaughlin, J. J. Spinelli, P. Pahwa, J. A. Dosman and A. Blair	Pesticide use, immunologic conditions, and risk of non-Hodgkin lymphoma in Canadian men in six provinces	2012	Pesticide exposures and immune suppression have been independently associated with the risk of non-Hodgkin lymphoma (NHL), but their joint effect has not been well explored. Data from a case-control study of men from six Canadian provinces were used to evaluate the potential effect modification of asthma, allergies, or asthma and allergies and hay fever combined on NHL risk from use of: (i) any pesticide; (ii) any organochlorine insecticide; (iii) any organophosphate insecticide; (iv) any phenoxy herbicide; (v) selected individual pesticides [1,1'-(2,2,2-trichloroethylidene)bis[4-chlorobenzene]; 1,1,1-trichloro-2,2-bis(4-chlorophenyl) ethane (DDT), malathion, (4-chloro-2-methylphenoxy)acetic acid (MCPA), mecoprop, and (2,4-dichlorophenoxy)acetic acid (2,4-D); and (vi) from the number of potentially carcinogenic pesticides. Incident NHL cases (n = 513) diagnosed between 1991 and 1994 were recruited from provincial cancer registries and hospitalization records and compared to 1,506 controls. A stratified analysis was conducted to calculate odds ratios (ORs) adjusted for age, province, proxy respondent, and diesel oil exposure. Subjects with asthma, allergies, or hay fever had non-significantly elevated risks of NHL associated with use of MCPA (OR = 2.67, 95% confidence interval [CI]: 0.90-7.93) compared to subjects without any of these conditions (OR = 0.81, 95% CI: 0.39-1.70). Conversely, those with asthma, allergies, or hay fever who reported use of malathion had lower risks of NHL (OR = 1.25, 95% CI: 0.69-2.26) versus subjects with none of these conditions (OR = 2.44, 95% CI: 1.65-3.61). Similar effects were observed for asthma and allergies evaluated individually. Although there were some leads regarding effect modification by these immunologic conditions on the association between pesticide use and NHL, small numbers, measurement error and possible recall bias limit interpretation of these results.	International Journal of Cancer	131	11	274177	Self-reported exposure			Case-control	Specific active ingredient	cancer	doctor-diagnosed	Canada	hic
825	M. Pavuk, A. J. Schecter, F. Z. Akhtar and J. E. Michalek	Serum 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) levels and thyroid function in Air Force veterans of the Vietnam War	2003	PURPOSE: We assessed potential health effects of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) concentration in serum on thyroid function in US Air Force veterans involved in Operation Ranch Hand, the unit responsible for the aerial spraying of herbicides, including TCDD-contaminated Agent Orange, during the Vietnam War from 1962 to 1971. Other Air Force veterans who were not involved with spraying herbicides were included as Comparisons.	NA	NA	NA	NA	Biomonitoring (blood)			Cohort (prospective)	Chemical class	endocrine/nutritional/metabolical	medical test result	USA	hic
826	M. Pavuk, J. E. Michalek and N. S. Ketchum	Prostate cancer in US Air Force veterans of the Vietnam war	2006	US Air Force veterans of Operation Ranch Hand sprayed herbicides contaminated with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in Vietnam from 1962 to 1971. Comparisons served in Southeast Asia (SEA) during the same time period but did not spray herbicides. Here we investigate a potential association between exposure to TCDD and prostate cancer. Data were available for 2516 veterans (1019 Ranch Hand and 1497 Comparison) who participated in at least one of six physical examinations starting in 1982 and had a measurement of serum TCDD. We assigned Ranch Hands to two exposure categories: Lower and Higher, based on their median 20-year cumulative TCDD level. In total, 81 Comparison and 59 Ranch Hand prostate cancers were identified between 1 January 1982 and 31 December 2003. We found no overall increase in the risk of prostate cancer in Ranch Hand veterans versus the Comparisons. There was a positive association in Ranch Hand veterans in the Higher TCDD category who served in SEA before 1969 (RR=2.27, 95% CI 1.11<U+2013>4.66) when more contaminated herbicides were used, but the number of cases was small (n=15). A within-group comparison found that in Comparison veterans, time served in SEA was associated with an increased risk of prostate cancer (RR=2.18, 95% CI 1.27<U+2013>3.76, >789 days versus <U+2264>789 days). No increase in the risk of prostate cancer was observed within the Ranch Hand group in association with TCDD or time served in SEA. These analyses suggest that a longer service in SEA and exposures other than TCDD may have increased the risk of prostate cancer in Comparison veterans.	Journal of Exposure Science & Environmental Epidemiology	16	2	184-90	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
827	M. Peluso, F. Merlo, A. Munnia, C. Bolognesi, R. Puntoni and S. Parodi	(32)P-postlabeling detection of DNA adducts in peripheral white blood cells of greenhouse floriculturists from western Liguria, Italy	1996	Pesticides are widely used in agriculture to enhance crop yields and to control disease vectors. Floriculturists work frequently in greenhouses and may be exposed to high levels of pesticides, which may result in adverse health effects. To evaluate the relationship between exposure to pesticides and DNA adduct formation in peripheral WBCs of Italian floriculturists, the nuclease P1 modification of a (32)P-postlabeling assay was used to analyze WBC DNA from floriculturists (n = 26) and matched controls (n = 22). DNA adduct-positive samples were more frequent in floriculturists (11/26; 42%) than in matched controls (2/22; 9%) (P < 0.01). Slightly higher frequencies of DNA adduct-positive samples were observed in floriculturists > or = 44 years of age (53%) and in female floriculturists (57%). Floricultural practice was found to be associated with a significantly higher DNA adduct-positive rate in WBCs (rate ratio, 5.12; 95% confidence interval, 1.1-23.7) after allowing for the effects of age and gender. These two latter covariates were not significantly associated with DNA adduct-positive rates. The quantitative levels of DNA adducts were significantly higher in floriculturists than in matched controls according to the Mann-Whitney nonparametric statistic (P = 0.0052). The median adduct level for positive samples among floriculturists was 1.5/10(8) bases. A specific, well-visible spot, named alpha adduct, was detected in 7 out of the 11 DNA adduct-positive samples from floriculturists but in none of the (22 + 20) referent samples (P = 0.0004). The presence of pesticide-related DNA adducts was confirmed clearly using the butanol extraction procedure. Six of 8 floriculturists and 0 of 10 referents were found positive with this method. The median adduct level for positive samples was 6.0/10(8) bases. Two strong spots close to the origin could be identified in all six positive floriculturists, using the butanol extraction procedure. No association between DNA adducts and use of specific pesticides was observed.	Cancer Epidemiology, Biomarkers & Prevention	5	5	361-9	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Italy	hic
828	M. Porta, N. Malats, M. Jariod, J. O. Grimalt, J. Rifa, A. Carrato, L. Guarner, A. Salas, M. Santiago-Silva, J. M. Corominas, M. Andreu and F. X. Real	Serum concentrations of organochlorine compounds and K-ras mutations in exocrine pancreatic cancer. PANKRAS II Study Group	1999	BACKGROUND: Organochlorine compounds such as 1,1,1-trichloro-2,2-bis(p-chlorophenyl)-ethane (p,p'-DDT), 1,1-dichloro-2,2-bis(p-chlorophenyl) ethylene (p,p'-DDE), and some polychlorinated biphenyls (PCBs) are carcinogenic to animals and possibly also to human beings. Occupational exposure to DDT may increase the risk of pancreas cancer. The high frequency of K-ras mutations in pancreatic cancer remains unexplained. We analysed the relation between serum concentrations of selected organochlorine compounds and mutations in codon 12 of the K-ras gene in patients with exocrine pancreatic cancer. METHODS: Cases were prospectively identified in five hospitals. Mutations in K-ras were analysed by PCR and artificial restriction fragment length polymorphism. Cases of pancreatic cancer with wild-type K-ras (n=17) were frequency matched for age and sex to cases of pancreatic cancer with a K-ras mutation (n=34, case-case study). These 51 cases were further compared with 26 hospital controls (case-control comparison). Serum organochlorine concentrations were measured by high-resolution gas chromatography with electron-capture detection and negative ion chemical ionisation mass spectrometry. FINDINGS: Serum concentrations of p,p'-DDT were significantly higher in pancreatic cancer cases with a K-ras mutation than in cases without a mutation (odds ratio for upper tertile 8.7 [95% CI 1.6-48.5], p for trend=0.005). For p,p'-DDE the corresponding figures were 5.3 (1.1-25.2, p for trend=0.031). These estimates held after adjusting for total lipids, other covariates, and total PCBs. A specific association was observed between a glycine to valine substitution at codon 12 and both p,p'-DDT and p,p'-DDE concentrations (odds ratio 15.9, p=0.044 and odds ratio 24.1, p=0.028; respectively). A similar pattern was shown for the major di-ortho-chlorinated PCBs (congeners 138, 153, and 180), even after adjustment for p,p'-DDE, but without a specific association with spectrum. Concentrations of p,p'-DDT and p,p'-DDE were similar among wild-type cases and controls, but significantly higher for K-ras mutated cases than for controls (p<0.01). INTERPRETATION: Organochlorine compounds such as p,p'-DDT, p,p'-DDE, and some PCBs could play a part in the pathogenesis of exocrine pancreatic cancer through modulation of K-ras activation. The results require replication, but they suggest new roles for organochlorines in the development of several cancers in human beings.	Lancet	354	9196	43368	Biomonitoring (blood)			Case-control	Chemical class	cancer	doctor-diagnosed	Spain	hic
829	M. R. Bonner, F. Farahat, J. Olson, D. Rohlman, R. Fenske and W. K. Anger	Chlorpyrifos exposure and the prevalence of wheeze among egyptian cotton workers	2011	Pesticide exposure, including organophosphate insecticides (OP), has been associated with wheezing in agricultural settings. Chlorpyrifos (CPF), an OP, has been linked with airway hyperreactivity in experiments with guinea pigs, supporting this hypothesis. We conducted a cross-sectional study to investigate CPF exposure and the prevalence of wheeze among 159 CPFexposed cotton workers and 122 non-agricultural workers. Male cotton workers, aged 18-55 years, were recruited from the Ministry of Agriculture field stations near Shebin El-Kom, Egypt. Male non-agricultural workers, aged 18-55 years, were recruited from Shebin El-Kom. All participants completed a questionnaire that queried demographics, occupational and medical histories, including the number of wheezing episodes in the past year. Unconditional logistic regression was used to estimate prevalence odds ratios (PORs) and 95% confidence intervals (CIs), adjusted for age, pack-years of smoking, asthma, and body mass index. Workers exposed to CPF had a 3-fold higher prevalence of wheezing (POR = 3.2; 95% CI = 1.2-8.4) as compared with the non-exposed. When categorized by job title, the PORs for applicators, technicians, and engineers were 4.7 (95% CI = 1.5-15.4), 2.3 (95% CI = 0.7-7.9), and 2.0 (95% CI = 0.5-7.6), respectively. Applicators have been demonstrated to have higher occupational CPF exposure than either technicians or engineers. In summary, our results are consistent with the hypothesis that CPF exposure is positively associated with wheezing, although interpretation is complicated by the crosssectional study design, the self-reported assessment of wheezing, and the small sample size.	American Journal of Epidemiology	173	NA	S11	Self-reported exposure			Cross-sectional	Specific active ingredient	respiratory	self-reported	Egypt	lmic
830	M. R. Bonner, W. J. Lee, D. P. Sandler, J. A. Hoppin, M. Dosemeci and M. C. Alavanja	Occupational exposure to carbofuran and the incidence of cancer in the Agricultural Health Study.[Erratum appears in Environ Health Perspect. 2005 May;113(5):A297]	2005	Carbofuran is a carbamate insecticide registered for use on a variety of food crops including corn, alfalfa, rice, and tobacco. An estimated 5 million pounds of carbofuran is used annually in the United States, and 45% of urban African-American women have detectable levels of carbofuran in their plasma. Nitrosated carbofuran has demonstrated mutagenic properties. We examined exposure to carbofuran and several tumor sites among 49,877 licensed pesticide applicators from Iowa and North Carolina enrolled in the Agricultural Health Study. We obtained information regarding years of use, frequency of use in an average year, and when use began for 22 pesticides using self-administered questionnaires. Poisson regression was used to calculate rate ratios (RR) and 95% confidence intervals (CIs) adjusting for potential confounders. Lung cancer risk was 3-fold higher for those with > 109 days of lifetime exposure to carbofuran (RR = 3.05; 95% CI, 0.94-9.87) compared with those with < 9 lifetime exposure days, with a significant dose-response trend for both days of use per year and total years of use. However, carbofuran use was not associated with lung cancer risk when nonexposed persons were used as the referent. In addition, carbofuran exposure was not associated with any other cancer site examined. Although carbamate pesticides are suspected human carcinogens, these results should be interpreted cautiously because there was no a priori hypothesis specifically linking carbofuran to lung cancer.	Environmental Health Perspectives	113	3	285-9	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
831	M. R. C. Bonner, J.; Blair, A.; Beane Freeman, L. E.; Hoppin, J. A.; Sandler, D. P.; Alavanja, M. C.	Malathion exposure and the incidence of cancer in the agricultural health study	2007	Malathion is the most common organophosphate insecticide applied in the United States, and while some studies suggest that it may be clastogenic, its carcinogenicity has not been demonstrated in rodents. However, malathion has been associated with non-Hodgkin's lymphoma in several epidemiologic studies. The authors investigated associations between malathion exposure and cancer among 19,717 pesticide applicators enrolled in the Agricultural Health Study between 1993 and 1997. Information on lifetime years and days per year of use and intensity of malathion exposure was obtained with self-administered questionnaires prior to the onset of any cancer. The average follow-up time was 7.5 years (1993-2002). Rate ratios and 95% confidence intervals were calculated using Poisson regression, adjusting for potential confounders. Overall, lifetime days of malathion use (top tertile of exposure, >39 days) was not associated with all cancers combined (rate ratio = 0.97, 95% confidence interval: 0.81, 1.15). The risk of non-Hodgkin's lymphoma was not associated with malathion use, although the number of cases was small. The risk of melanoma with more than 39 lifetime exposure-days was 0.39 (95% confidence interval: 0.14, 1.03). In summary, malathion exposure was not clearly associated with cancer at any of the sites examined. Although the rate ratios for melanoma were reduced, small numbers and lack of experimental evidence suggest that the observed reductions may have arisen by chance.	American Journal of Epidemiology	166	9	1023-34	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
832	M. R. F. Bonner, L. E.; Hoppin, J. A.; Koutros, S.; Sandler, D. P.; Lynch, C. F.; Hines, C. J.; Thomas, K.; Blair, A.; Alavanja, M. C.	Occupational Exposure to Pesticides and the Incidence of Lung Cancer in the Agricultural Health Study	2017	BACKGROUND: Occupational pesticide use is associated with lung cancer in some, but not all, epidemiologic studies. In the Agricultural Health Study (AHS), we previously reported positive associations between several pesticides and lung cancer incidence. OBJECTIVE: We evaluated use of 43 pesticides and 654 lung cancer cases after 10 years of additional follow-up in the AHS, a prospective cohort study comprising 57,310 pesticide applicators from Iowa and North Carolina. METHODS: Information about lifetime pesticide use and other factors was ascertained at enrollment (1993-1997) and updated with a follow-up questionnaire (1999-2005). Cox proportional hazards models were used to calculate hazard ratios (HRs) and 95% confidence intervals (CIs), adjusting for smoking (smoking status and pack-years), sex, and lifetime days of use of any pesticides. RESULTS: Hazard ratios were elevated in the highest exposure category of lifetime days of use for pendimethalin (1.50; 95% CI: 0.98, 2.31), dieldrin (1.93; 95% CI: 0.70, 5.30), and chlorimuron ethyl (1.74; 95% CI: 1.02, 2.96), although monotonic exposure-response gradients were not evident. The HRs for intensity-weighted lifetime days of use of these pesticides were similar. For parathion, the trend was statistically significant for intensity-weighted lifetime days (p = 0.049) and borderline for lifetime days (p = 0.073). None of the remaining pesticides evaluated was associated with lung cancer incidence. CONCLUSIONS: These analyses provide additional evidence for an association between pendimethalin, dieldrin, and parathion use and lung cancer risk. We found an association between chlorimuron ethyl, a herbicide introduced in 1986, and lung cancer that has not been previously reported. Continued follow-up is warranted.	Environmental Health Perspectives	125	4	544-551	Self-reported exposure	Algorithm/model		NA	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
833	M. R. Hansen, E. Jors, F. Lander, G. Condarco and V. Schlunssen	Is cumulated pyrethroid exposure associated with prediabetes? A cross-sectional study	2014	Pyrethroids are a class of insecticides used widely for vector control programs. Acute pyrethroid poisoning is rare, but well documented, whereas effects of cumulative exposure are insufficiently described, including possible negative effect on glucose regulation. The objective of this study was to investigate an association between exposure to pyrethroids and abnormal glucose regulation (prediabetes or diabetes). A cross-sectional study was performed among 116 pesticide sprayers from public vector control programs in Bolivia and 92 nonexposed controls. Pesticide exposure (duration, intensity, cumulative exposure) was assessed from questionnaire data. Participants were asked about symptoms of diabetes. Blood samples were analyzed for glycosylated hemoglobin (HbA1c), a measure of glucose regulation. No association was found between pyrethroid exposure and diabetes symptoms. The prevalence of abnormal glucose regulation (defined as HbA1c >= 5.6%) was 61.1% among sprayers and 7.9% among nonexposed controls, corresponding to an adjusted odds ratio (OR [95% confidence interval]) for all sprayers of 11.8 [4.2-33.2] and 18.5 [5.5-62.5] for pyrethroid-exposed only. Among sprayers who had only used pyrethroids, a significant positive trend was observed between cumulative pesticide exposure (total number of hours sprayed) and adjusted OR of abnormal glucose regulation, with OR 14.7 [0.9-235] in the third exposure quintile. The study found a severely increased prevalence of prediabetes among Bolivian pesticide sprayers compared with a control group, but the relevance of the control group is critical. Within the spraying group, an association between cumulative exposure to pyrethroids and abnormal glucose regulation was seen. Further studies are needed to confirm this association.	Journal of Agromedicine	19	4	417-26	Self-reported exposure			Cross-sectional	Chemical class	endocrine/nutritional/metabolical	doctor-diagnosed	Bolivia	lmic
834	M. R. W. Bonner, B. A.; Rusiecki, J. A.; Blair, A.; Beane Freeman, L. E.; Hoppin, J. A.; Dosemeci, M.; Lubin, J.; Sandler, D. P.; Alavanja, M. C.	Occupational exposure to terbufos and the incidence of cancer in the Agricultural Health Study	2010	OBJECTIVE: Terbufos is the fourth most commonly used organophosphate insecticide (OP) in the United States. Terbufos has not been demonstrated to be carcinogenic in rodents, although non-arsenical insecticides, including OPs, have been associated with excess cancer in epidemiologic studies. We investigated associations between use of terbufos and the incidence of cancer. METHODS: The Agricultural Health Study is a prospective cohort study of 57,310 licensed pesticide applicators from Iowa and North Carolina. Detailed information about 50 pesticides, including terbufos, and potential confounders was obtained from self-administered questionnaires. Terbufos intensity-weighted lifetime exposure-days were defined as (lifetime exposure-days) x (exposure intensity score). Cases include all first primary cancers diagnosed between enrollment and December 31, 2005. Hazard ratios (HR) and 95% CI were calculated with Cox proportional hazards models, adjusting for potential confounders. RESULTS: Overall cancer risk was slightly increased among terbufos users [HR 1.21 (1.06-1.37)]. Suggestive associations were observed between terbufos use and cancers of the prostate (HR{highest tertile) = 1.21; 95% CI = 0.99-1.47) and lung (HR{middle tertile) = 1.45; 95% CI = 0.95-2.22) and leukemia (HR{middle tertile) = 2.38; 95% CI = 1.35-4.21) and non-Hodgkin's lymphoma (HR{middle tertile) = 1.94; 95% CI = 1.16-3.22), although the exposure-response gradients were non-monotonic and p for trends were not significant. CONCLUSION: We found suggestive associations between occupational terbufos use and several cancer sites. However, cautious interpretation of these results is warranted by the lack of existing experimental and epidemiologic evidence to support carcinogenic effects of terbufos.	Cancer Causes & Control	21	6	871-7	Algorithm/model	Self-reported exposure		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
835	M. RafiqKhan, G. Tharangad Krishnan, R. Keezhekalam, S. Natarajan Suresh, U. Pongiya and Y. Rama Rao	Micronucleus assessment as a biomarker and susceptibility to DNA damage in workers occupationally exposed to pesticides	2014	Occupational exposures to hazardous chemicals are common in industries using solvent based materials as well as in indoor environments where people are exposed to volatile organic compounds from various sources. The health of the workers has several determinants, including risk factors at the workplace leading to cancer. The aim of the present investigation was to assess the potential cytogenetic damage associated with occupational exposure among pesticide workers by using micronuclei and other nuclear abnormalities as a biomarker. The micronucleus assay on exfoliated buccal cells is a useful and minimally invasive method for monitoring genetic damage in humans. To determine the genotoxic effects of pesticide workers, Micronucleus assay was carried out in exfoliated buccal cells of 50 pesticide workers and 50 controls. For each individual, 2,000 exfoliated buccal cells were analyzed. Micronucleus and other nuclear abnormalities frequencies in exposed were significantly higher than those in control groups (P<0.05) and also significantly related to smoking, tobacco chewing and alcohol drinking habit (P<0.05). Increased frequency of these nuclear abnormalities in buccal epithelial cells of exposed workers indicates adverse cellular reaction and/or a surveillance mechanism to eliminate cells with genetic damage. The present studied individuals may be at a higher risk of developing cancer and therefore monitored for any long term adverse effects of the exposure. Genotoxic studies are foremost for any occupational exposure studies. Evaluation based on genotoxic parameters is often useful in warranting environmental endowment and occupational health. Genotoxicity biomarkers have received a considerable interest as tools for detecting human genotoxic exposure and effects, especially in health surveillance programs dealing with chemical carcinogens.	Biomedical Research and Therapy	1	3	NA	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	India	lmic
836	M. Rojas, M. Fernandez, L. De Sousa, R. Perez, E. Rivero and J. Burguera	Toxicological evaluation of organophosphate pesticides use at the Colonia Tovar, Venezuela	1994	An investigation was made on an agricultural population to evaluate the effects of the occupational exposure to pesticides, mainly organophosphates. A study was made of 46 fumigators by applying an 'occupational questionnaire'. Blood samples were analyzed for erythrocytic and plasmatic cholinesterase. There were 2 samplings: one, 25 to 30 days previous to the fumigation period and the second, at the peak of the fumigation period. The results were compared to a Control group. The frequency of insecticides use was 91,3% and within them 84,4% were Organophosphates. The symptoms more related to Organophosphates exposure and that merit more attention due to their frequency were: muscular weakness and memory deficiencies (26,1%), cephalea (21,7%), anxiety (19,6%) and insomnia (17,4%). The average erythrocytic and plasmatic cholinesterase levels, were within the normal range described for the method used. However, an individual basal level was determined (pre-exposure), and results are presented as a percentage of it. The difference between erythrocytic and plasmatic cholinesterase averages were significant (p < 0,01). The control group had normal values for both of these parameters. The correlation between symptoms, cholinesterase activity, working years and use of protective measures were analyzed. The recommendations to improve the effectiveness of medical surveillance are discussed, monitoring frequencies are suggested as well as further investigations to the problem to evaluate more precisely the relationship between exposure and effect.	Revista de Toxicologia	11	1	36-40	Self-reported exposure			Cohort (prospective)	Specific active ingredient	pesticide-related symptoms	self-reported	Venezuela	umic
837	M. S. Pearce and L. Parker	Paternal employment in agriculture and childhood kidney cancer	2000	This paper explores the hypothesis that there is an association between risk of childhood kidney cancer and paternal employment in occupations that have potential for exposure to herbicides and/or pesticides. In contrast to a previous study using paternal occupations at the time of the child's death, no significant association was found between such potential paternal exposures (using paternal occupations at the time of the child's birth) and the risk of cancer of the kidney in childhood (OR 0.88, 95% CI 0.20-3.84). In addition, this paper quantifies the extent to which paternal occupational information on death certificates can be used as a proxy for paternal occupation at birth and how such misclassification could affect risk estimates. An example is given showing how a recently reported association between kidney cancer and paternal agricultural employment may have been overestimated as a result of the use of death certificate information.	Pediatric Hematology & Oncology	17	3	223-30	Job title			Case-control	Chemical class	offspring	doctor-diagnosed	UK	hic
838	M. S. Pearce, D. M. Hammal, M. T. Dorak, R. J. McNally and L. Parker	Paternal occupational exposure to pesticides or herbicides as risk factors for cancer in children and young adults: a case-control study from the North of England	2006	Researchers in numerous studies have suggested that preconception paternal occupational exposures to various substances, including pesticides and herbicides, may be involved in the etiology of childhood cancers. Using data from the Northern Region Young Persons' Malignant Disease Registry, the authors investigated whether paternal occupations likely to involve such exposures, as recorded at the time of a child's birth, were associated with children's cancer risk. The authors matched cases (n = 4,723), on sex and year of birth, to controls from 2 independent sources: (1) all other patients from the registry with a different cancer and (2) 100 cancer-free individuals per case from the Cumbrian Births Database. An inverse association existed, particularly in males, between lymphoid leukemia and paternal occupations with likely exposures to pesticides and/or herbicides. However, this was not significant after stratifying by residential status (urban versus rural). Results do not support a role for preconception paternal occupational exposures to pesticides or herbicides in the etiology of childhood cancer.	Archives of Environmental & Occupational Health	61	3	138-44	Job title			Case-control	Job title	offspring	doctor-diagnosed	UK	hic
839	M. Salehcheh, H. Kalantari, M. J. Khodayar, A. Jahangiri, H. Gallehdari, A. Rahmani and R. Tangestani	Genotyping paraoxonase polymorphisms in iranian farmers exposed to organophosphate pesticides	2014	Paraoxonase 1 is an esterase that associates with other enzymes to detoxify organophosphate pesticides. The expression and activity of paraoxonase is due to polymorphisms of the paraoxonase gene. Thus, the present study aimed to determine the activity of paraoxonase and paraoxonase genotypes along with their relationships, the risks and medical conditions in Iranian workers that were occupationally exposed to organophosphates. Workers (n = 80) exposed to organophosphates and controls (n = 160) that were not exposed to Organophosphates gave a blood sample in order to have two polymorphisms of paraoxonase, paraoxonase activity buth)'IYlcholinesterase activity and their interactions investigated. The results showed that the exposed group had significantly (p<0.05) less paraoxomse activity than the controls (90.04<U+00AC><U+00B1>4.632 and 149.8<U+00AC><U+00B1>5.236 nmol min-' mL, respectively). The Q/Q, QIR and RIR genotypes (highest to lowest rates, respectively) significantly hydrolyzed paraoxon (i.e., paraoxomse activity) in both groups (p<0.00l). Paraoxonase activity was higher in subjects with L/L genotypes and was the lowest in individuals with MlJ\.1 genotypes in the exposed and control groups. The results indicate that individuals with paraoxonase RIR and M/M genotypes may be more susceptible toward organophosphate toxicity. Enzymatic activities were widely varied and it appears that the differences in genotypes can cause the changes in this activity. Thus, these different genotypes may be important biomarkers in protecting individuals and identifying individual risk factors in workers exposed to organophosphates.	International Journal of Pharmacology	10	8	513-518	Biomonitoring (blood)			Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	Iran	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
840	M. Sallmen, J. Liesivuori, H. Taskinen, M. L. Lindbohm, A. Anttila, L. Aalto and K. Hemminki	Time to pregnancy among the wives of Finnish greenhouse workers	2003	OBJECTIVES: This study investigated the possibility of men's work in greenhouses and their exposure to pesticides being associated with reduced fertility. METHODS: A study on time to pregnancy was conducted among the families of Finnish male greenhouse employers and employees. Exposure to pesticides was assessed on the basis of questionnaire information and data gathered from the enterprises. Fecundability density ratios (FDR) for occupational exposure were calculated with discrete proportional hazards regression analyses. RESULTS: After three mailings, 578 (43%) couples participated. Fecundability was suggestively decreased for exposed greenhouse workers who were inefficiently protected, with FDR values of 0.67 [95% confidence interval (95% CI) 0.33-1.35], 0.92 [95% CI 0.45-1.88] and 0.77 [95% CI 0.46-1.29] for high exposure, moderate exposure and low exposure, respectively, as compared with unexposed greenhouse workers. The exposed men who efficiently used personal protective equipment were as fertile as the unexposed greenhouse workers. Exposure to pyrethroids (FDR 0.40, 95% CI 0.19-0.85) was related to decreased fecundability. Suggestive associations were observed for organophosphates (FDR 0.70, 95% CI 0.42-1.17) and carbamates (FDR 0.55, 95% CI 0.27-1.11). CONCLUSIONS: The findings of the study provide limited support for the hypothesis that exposure to pesticides is associated with reduced fertility. The findings for pyrethroids, organophosphates, and carbamates can serve as a basis for a hypothesis for future studies.	Scandinavian Journal of Work, Environment & Health	29	2	85-93	Self-reported exposure			Cohort (prospective)	Pesticides in general	reproductive	self-reported	Finland	hic
841	M. Santiba<U+221A><U+00B1>ez, J. Alguacil, M. G. De La Hera, E. M. Navarrete-Mu<U+221A><U+00B1>oz, J. Llorca, N. Aragon<U+221A><U+00A9>s, T. Kauppinen and J. Vioque	Occupational exposures and risk of stomach cancer by histological type	2012	Objective: To explore the relationship between stomach cancer (SC), by histological type, and occupations and occupational exposures. Methods: The authors conducted a hospital-based case - control study in south-east Spain. Subjects were 399 incident histological confirmed SC cases (241 intestinal and 109 diffuse adenocarcinomas) and 455 controls frequency matched by sex, age and province of residence. Occupation was coded according to the Spanish National Classification of Occupations 1994. Occupational exposures were assessed by the FINJEM Job Exposure Matrix. ORs were estimated by unconditional logistic regression adjusting for matching variables and education, smoking, alcohol and diet. Results: In men, statistically significant increased risk of the diffuse subtype was found for 'cooks' (OR 8.02), 'wood-processing-plant operators' (OR 8.13) and 'food and related products machine operators' (OR 5.40); for the intestinal subtype, a borderline association was found for 'miners and quarry workers' (OR men 4.22, 95% CI 0.80 to 22.14). Significant increased risk was observed between the diffuse subtype of SC and the highest level of exposure to 'pesticides' (ORH both sexes 10.39, 95% CI 2.51 to 43.02, ptrend=0. 02) and between the intestinal subtype and asbestos (ORH men 3.71, 95% CI 1.40 to 9.83, ptrend=0.07). Restricted analyses of exposures of 15 years and longer showed significant associations between the diffuse subtype and the exposure to 'wood dust' (OR men 3.05). Conclusions: This study supports the relationship previously suggested between SC and occupational exposure to dusty and high temperature environments. Several occupations may also increase the risk of diffuse SC but not the intestinal subtype.	Occupational and Environmental Medicine	69	4	268-275	Job exposure matrix			Case-control	Pesticides in general	cancer	doctor-diagnosed	Spain	hic
842	M. Santibanez, J. Vioque, J. Alguacil, M. G. de la Hera, E. Moreno-Osset, A. Carrato, M. Porta and T. Kauppinen	Occupational exposures and risk of pancreatic cancer	2010	The objective was to analyze the relationship between occupation (and specific occupational exposures) and risk of exocrine pancreatic cancer (EPC). We conducted a multicenter hospital-based case-control study in Eastern Spain. We included 161 incident cases of EPC (59.6% men, 94 with histological confirmation, of whom 80% had ductal adenocarcinoma). Cases were frequency-matched with 455 controls by sex, age and province of residence. Information was elicited using structured questionnaires. Occupations were coded according to the Spanish version of the International Standard Classification of Occupations 1988. Occupational exposure to a selection of carcinogenic substances was assessed with the Finnish Job-Exposure Matrix (FINJEM). Odds ratios (OR) and 95% confidence intervals (CI) were estimated by multiple logistic regression, adjusting for sex, age, province, education, alcohol and smoking. A higher risk of EPC was associated with having worked as 'Miners, shotfirers, stone cutters and carvers', 'Machinery mechanics and fitters', 'Building trades workers' and 'Motor vehicle drivers' in men, 'Office Clerks' in women, and 'Waiters' in both sexes. Cases with ductal adenocarcinomas were more likely to have been exposed to chlorinated hydrocarbon solvents (OR = 4.1, 95% CI: 1.1-15.2, p-trend = 0.04). We also observed significant associations with exposure to 'synthetic polymer dust exposure' and 'ionizing radiation'. Suggestive increases in risk were observed for 'pesticides', 'diesel and gasoline engine exhaust', and 'hydrocarbon solvents'. Results support the hypothesis that occupational exposure to chlorinated hydrocarbon solvents is associated with exocrine pancreatic cancer.	European Journal of Epidemiology	25	10	721-30	Job exposure matrix	Self-reported job history		Case-control	Pesticides in general	cancer	doctor-diagnosed	Spain	hic
843	M. Sekiyama, M. Tanaka, B. Gunawan, O. Abdoellah and C. Watanabe	Pesticide usage and its association with health symptoms among farmers in rural villages in West Java, Indonesia	2007	The improper handling of pesticides in agriculture has caused serious health problems in many developing countries. In this study, we report the pesticide usage condition among Indonesian farmers and its association with symptoms of pesticide toxicity. A questionnaire survey on personal history regarding agricultural labor, pesticide storage and disposal, pesticide use and health history was conducted using a structured questionnaire in rural Sundanese villages in West Java, Indonesia. The most frequently used pesticides included dithiocarbamates, pyrethroids and organophosphates. In approximately 80% of sprayings, category II pesticides (World Health Organization (WHO) categorization; "moderately hazardous") were used. Many of the subject farmers worked in a highly unsafe occupational environment; protective measures and safe handling were rarely observed, whereas smoking and drinking during spraying were frequently practiced. Correlation analysis revealed that farmers who wore a long sleeve shirt and headgear showed health symptoms less frequently. Moreover, farmers who had skin contact with the spray solution during measuring or mixing (excluding the hands), who wore wet clothing (skin exposure to pesticide), and who smoked and rubbed their eyes during spraying showed more symptoms. Among these factors, headgear use, wearing wet clothing (skin exposure to pesticide), and smoking during spraying were the significant determining factors for developing health symptoms. Preventing such behaviors will be an effective method of reducing health problems among the subject farmers.	Environmental Sciences	14	NA	23-33	Self-reported exposure			Cross-sectional	Pesticides in general	pesticide-related symptoms	self-reported	Indonesia	lmic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
844	M. Sharma, J. A. Lawson, R. Kanthan, C. Karunanayake, L. Hagel, D. Rennie, J. A. Dosman, P. Pahwa and G. Saskatchewan Rural Cohort Study	Factors Associated With the Prevalence of Prostate Cancer in Rural Saskatchewan: The Saskatchewan Rural Health Study	2016	PURPOSE: Prostate cancer is the most commonly diagnosed cancer in Canadian males, and it is the third most common cause of cancer-related deaths in men. Some studies suggest that occupational exposure may be associated with prostate cancer. However, the etiology of prostate cancer is ambiguous. The purpose of this study was to assess the rural occupational exposure, including farming, as a determinant of prostate cancer in rural men. We investigated the prevalence of prostate cancer and its putative relationship between rural exposures in the Saskatchewan province of Canada. METHODS: In 2010, a baseline mailed survey was conducted of 11,982 households located in 4 geographic regions (southwest, southeast, northwest, and northeast) of rural Saskatchewan, Canada. The questionnaires collected information on individual and contextual determinants from a rural population of men. In total 2,938 males older than 45 years were included in the logistic regression analysis. FINDINGS: The age-standardized prevalence of prostate cancer was 3.32%. Farm residence was a significant risk factor associated with prevalence of prostate cancer while farming occupation and duration were not. Men who were exposed to insecticides and fungicides together (OR [95% CI] = 2.23 [1.15-4.33], P = .02) at work showed an increased potential risk compared to the nonexposed. The effect of farm/nonfarm residence on prevalence of prostate cancer differed depending on personal smoking history and family history of cancer. CONCLUSION: Workplace exposure to insecticides and fungicides together were statistically significantly associated with prevalence of prostate cancer.	Journal of Rural Health	32	2	125-35	Self-reported exposure			Cross-sectional	Type of pesticide	cancer	doctor-diagnosed	Canada	hic
845	M. Shen, Y. Wang, S. Yang, Y. Du, H. Xiang and L. Stallones	Agricultural exposures and farm-related injuries among adolescents in rural China	2013	This cross-sectional study explored the incidence of farm injuries and the relationship between agricultural exposures and injury among 2053 adolescents aged 13-19 years in Macheng, China. A comprehensive self-administered questionnaire was given to adolescents. The cumulative incidence rate of farm injury was 19.8%. Adolescents who were male, aged 10-15 years, left behind, working more days each month and living on the plains, reported higher rates. Specific agricultural exposures, such as large animals, pesticides and operating farm machinery were associated with higher injury rates. Prevention programmes are needed to reduce farm injuries.	Injury Prevention	19	3	214-7	Self-reported exposure			Cross-sectional	Pesticides in general	other	self-reported	China	umic
846	M. Spano, G. Toft, L. Hagmar, P. Eleuteri, M. Rescia, A. Rignell-Hydbom, E. Tyrkiel, V. Zvyezday, J. P. Bonde and I.	Exposure to PCB and p, p'-DDE in European and Inuit populations: impact on human sperm chromatin integrity	2005	BACKGROUND: Persistent organochlorine pollutants (POP), such as polychlorinated biphenyls (PCB) and dichlorodiphenyldichloroethylene (p, p'-DDE), are widely found in the environment and considered potential endocrine-disrupting compounds (EDC). Their impact on male fertility is still unknown. METHODS: To explore the hypothesis that POP is associated with altered sperm chromatin integrity, a cross-sectional study involving 707 adult males (193 Inuits from Greenland, 178 Swedish fishermen, 141 men from Warsaw, Poland, and 195 men from Kharkiv, Ukraine) was carried out. Serum levels of 2,2',4,4',5,5'-hexachlorobiphenyl (CB-153), as a proxy of the total PCB burden, and of p,p'-DDE were determined. Sperm chromatin structure assay (SCSA) was used to assess sperm DNA/chromatin integrity. RESULTS: We found a strong and monotonically increasing DNA fragmentation index with increasing serum levels of CB-153 among European but not Inuit men, reaching a 60% higher average level in the highest exposure group. No significant associations were found between SCSA-derived parameters and p, p'-DDE serum concentrations. CONCLUSION: These results suggest that human dietary PCB exposure might have a negative impact on the sperm chromatin integrity of adult males but additional issues, including differences in the genetic background and lifestyle habits, still need to be elucidated.	Human Reproduction	20	12	3488-99	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	reproductive	medical test result	SHIC	SHIC
847	M. T. B. Stoecklin-Marois, C. W.; Bennett, D.; Tancredi, D. J.; Schenker, M. B.	Occupational exposures and migration factors associated with respiratory health in California Latino farm workers: the MICASA study	2015	OBJECTIVE: To evaluate associations of agricultural work and migration on self-reported respiratory symptoms in a Latino farm worker sample. METHODS: Work history and respiratory symptoms were assessed in 702 workers through interviews in a community-based cohort. RESULTS: Prevalence was 6% for asthma, 5% for chronic cough, 3% for chronic bronchitis, and 7% for persistent wheeze. The total number of years in agriculture was associated with asthma; however, time-weighted average dust exposure, use of protective equipment, and pesticide use in the past 12 months were not associated with respiratory outcomes. Living 15 years or more in the United States (adjusted odds ratio = 3.60; 95% confidence interval = 1.16 to 11.16) and medium/high acculturation (adjusted odds ratio = 6.06; 95% confidence interval = 1.40 to 26.29) were associated with increased odds of asthma in women. CONCLUSIONS: Analysis of this community-based Latino farm worker cohort identified associations with asthma, particularly with migration factors in women.	Journal of Occupational & Environmental Medicine	57	2	152-8	Self-reported exposure			Cross-sectional	Pesticides in general	respiratory	self-reported	USA	hic
848	M. T. Boulanger, S.; Lemarchand, C.; Guizard, A. V.; Velten, M.; Marcotullio, E.; Baldi, I.; Clin, B.; Lebailly, P.	Agricultural exposure and risk of bladder cancer in the AGRIculture and CANcer cohort	2017	PURPOSE: Literature on agricultural activities and bladder cancer risk is scarce. However, farmers can be subjected to carcinogenic exposure (e.g. arsenic, previously used as a pesticide in France). This study aimed at assessing the role of a large range of agricultural activities and tasks on bladder cancer risk. METHODS: The study population was the AGRIculture and CANcer cohort, a large prospective cohort of individuals affiliated to the agricultural health insurance scheme (MSA) in France. Incident bladder cancers were identified by cancer registries from enrolment (2005-2007) to 2009. Data on agricultural exposure during professional lifetime (5 animals, 13 crops, specific tasks) were obtained from the enrolment questionnaire. Associations between bladder cancer and agricultural exposure were analysed using a Cox model, adjusted for gender and smoking history. RESULTS: Among the 148,051 farm owners and workers included in this analysis, 179 incident bladder cancers were identified. We observed an elevated risk among field-grown vegetable workers [HR 1.89, 95% CI (1.20-2.99)], with an exposure-response relationship with duration of work [>=30 years: HR 2.54, 95% CI (1.11-5.83), p-trend = 0.02], and higher risk among women [HR 3.82, 95% CI (1.58-9.25), p-interaction = 0.05]. Non-significantly increased risks were also observed in greenhouse farmers (HR = 1.95), pea sowing (HR = 1.84), rape sowing (HR = 1.64); several tasks involving pesticide use, especially seed treatment (HR = 1.24); and in activities and tasks potentially exposing to arsenic compounds via pesticide use (HR = 1.49) or re-entry tasks (HR = 1.63). CONCLUSIONS: Our analyses raise the question of a possible link between agricultural activity, especially field-grown vegetables, and greenhouse cultivation and bladder cancer.	International Archives of Occupational & Environmental Health	90	2	169-178	Self-reported exposure			Cohort (prospective)	Type of pesticide	cancer	doctor-diagnosed	France	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
849	M. T. Munoz-Quezada, B. Lucero, V. Iglesias, K. Levy, M. P. Munoz, E. Achu, C. Cornejo, C. Concha, A. M. Brito and M. Villalobos	Exposure to organophosphate (OP) pesticides and health conditions in agricultural and non-agricultural workers from Maule, Chile	2017	The objective was to evaluate the characteristics of exposure to OP pesticides and health status in Chilean farm workers from the Maule Region. An occupational health questionnaire was administered in 207 agricultural and non-agricultural workers. For the group of agricultural workers, we asked about specific occupational exposure history and symptoms of OP pesticide poisoning. The main health problem of the exposed group was previous OP pesticide poisoning ($p < 0.001$). Fifty-six percent of agricultural workers reported symptoms consistent with acute OP pesticide poisoning. The use of respiratory personal protective equipment and younger age were protective against these symptoms, and number of years of OP pesticide exposure was positively associated with reporting symptoms of poisoning. Of the pesticide applicators 47 % reported using chlorpyrifos. The regulations regarding use and application of pesticides should be strengthened, as should training and intervention with workers to improve the use of personal protective equipment.	International Journal of Environmental Health Research	27	1	82-93	Self-reported exposure			Cross-sectional	Chemical class	pesticide-related symptoms	self-reported	Chile	hic
850	M. T. Munoz-Quezada, B. Lucero, V. Iglesias, M. P. Munoz, E. Achu, C. Cornejo, C. Concha, A. Grillo and A. M. Brito	[Organophosphate pesticides and neuropsychological and motor effects in the Maule Region, Chile]	2016	OBJECTIVE: To evaluate organophosphate pesticide exposure and neuropsychological and motor performance in agricultural and non-agricultural workers in the Maule Region in Chile. METHOD: Analytic cross-sectional study in 93 exposed farm workers and 84 unexposed non-agricultural workers. A battery of four neuropsychological tests was administered together with a neuro-motor physical examination. RESULTS: On the Weschler adult intelligence scale (WAIS-IV), exposed agricultural workers exhibited poorer performance than non-agricultural workers in verbal comprehension (beta=-3.2; p=0.034) and processing speed (beta=-4.4; p=0.036) and in the full scale (beta=-4; p=0.016), as well as in discrimination sensitivity (beta=1, p=0,009), adjusted by years of schooling and/or age. CONCLUSIONS: We suggest the development of policies and regulations for the control, sale and use of organophosphate pesticides and intervention strategies on safety measures aimed at the exposed population.	Gaceta Sanitaria	30	3	227-31	Job title			Cross-sectional	Job title	neurological	medical test result	Chile	hic
851	M. T. Wu	Occupational risks of esophageal cancer in taiwanese men	2011	Background/Aims: To explore the relationship between occupation and the risk of esophageal squamous cell carcinoma (ESCC) in Taiwan. Methods: In a hospital-based case-control study, we collected 326 incident patients with ESCC and 386 matched controls. All subjects completed a questionnaire regarding occupation, substance use and demographic information. Thirty-three different common occupations whose environments are known to present potential exposure to hazards related to cancer development in Taiwan were asked. Relative risks for ESCC were estimated by odds ratios (OR). Results: Concrete and construction workers and farm and garden workers were found to be at significant risk for ESCC (OR 5.14, 95% CI 2.34 -11.33; P < 0.0001, respectively). After adjusting for other covariates, it remained significant for farm and garden workers (AOR = 2.18; 95% CI: 1.07-4.44). Conclusion: Work in farm and garden, potentially exposed to pesticides, may increase the risk of ESCC in Taiwan.	Epidemiology	22	NA	S108	Self-reported job history			Case-control	Job title	cancer	doctor-diagnosed	Taiwan	hic
852	M. Tokarska-Rodak, S. Tos-Luty and A. Haratym-Maj	Selected parameters of immunological response in hop growers during the period of intensive application of pesticides	2004	The aim of the study was determination of selected parameters of immunological response among hop growers and farmers in conditions of intensive exposure to means of plant protection. Survey data was collected from 238 males aged 25-70 living in the area of Wilkow near Pulawy (Lublin Region). Control group were males from the area of Witoszyn (Lublin Region)--53 people aged 25-70 occupied mainly with land cultivation. Based on an environmental survey conducted among hop growers and farmers, the respondents were divided into 3 age groups: 25-40, 41-55 and 56-70. Laboratory tests covered the determination of selected morphological parameters, phagocytic test, NBT test, and myeloperoxidasis (MPO) concentration in blood serum of hop growers and farmers.A significant decrease was noted in the number of platelets in the general population of hop growers and in individual age groups, compared to the control groups of farmers. Analysis of individual sub-populations of leukocytes showed a significantly higher number statistically of basophils and lymphocytes among hop growers, compared to farmers. A detailed analysis of the degree of phagocytic and bactericidal activity of neutrophils allowed us to presume that during the period of spraying there occurred a mobilisation of the granulocytic system, manifested by the presence of over 90% of neutrophils of intensified phagocytic activity, and 20% of neutrophils of intensified bactericidal activity. The preparations prepared by the routine NBT test method were analysed with the use of LUCIA computer programme (version 4.51). The analysis of the level of MPO in blood serum in the populations examined showed the presence of statistically significant differences. In hop growers, the MPO level was significantly higher statistically (60.0 ng/ml), compared to the control group of farmers (43.4 ng/ml).	Annals of Agricultural & Environmental Medicine	11	2	227-31	Biomonitoring (blood)			Cross-sectional	Type of pesticide	immunological	medical test result	Poland	hic
853	M. Tondel, J. Lindh, P. Jonsson, M. Vrethem and B. Persson	Occupational determinants of cryptogenic polyneuropathy	2006	OBJECTIVES: The aim was to investigate different occupational and leisure time exposures as determinants for cryptogenic polyneuropathy. METHODS: A case-referent study was conducted in Sweden including 232 cases of cryptogenic polyneuropathy 40-79 years of age at diagnosis who were enrolled from the out-patient neurology departments of 3 hospitals. From the population register 853 referents were randomly selected. Information on occupational and leisure time exposure was obtained from a postal questionnaire. The response rate was 71% for cases and for referents. Crude odds ratios (CORs) and logistic regression odds ratios (LORs) were calculated for exposures with 5 or more exposed cases and referents taken together. The reference category was defined as individuals unexposed to any of the occupational or leisure time risk factors in the questionnaire. RESULTS: As expected, male sex and increasing age were significant determinants for cryptogenic polyneuropathy. Occupational exposures in men to Stoddard solvent, petrol exhausts, herbicides or hand and foot vibrations generated significantly increased CORs. LORs >3.50 were found in men for occupational exposure to sulphur dioxide, xylene, methyl ethyl ketone, herbicides and in women for occupational exposure to lead, nitrous oxide and insecticides. Only solvent exposure in leisure time remained significant in the regression analysis indicating that not only occupational exposures were of importance. Interactions between occupational and leisure time exposure were seen for several agents. CONCLUSIONS: Several known determinants for polyneuropathy, from animal studies and case reports, were confirmed. New determinants were also indicated, i.e. sulphur dioxide, xylene and methyl ethyl ketone.	Neuroepidemiology	26	4	187-94	Self-reported exposure	Self-reported exposure		Case-control	Type of pesticide	neurological	doctor-diagnosed	Sweden	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
854	M. Valcin, P. K. Henneberger, G. J. Kullman, D. M. Umbach, S. J. London, M. C. Alavanja, D. P. Sandler and J. A. Hoppin	Chronic bronchitis among nonsmoking farm women in the agricultural health study	2007	OBJECTIVE: The purpose of this study was to examine agricultural risk factors for chronic bronchitis among nonsmoking farm women. METHODS: We used self-reported enrollment data from the 21,541 nonsmoking women in the Agricultural Health Study to evaluate occupational risk factors for prevalent chronic bronchitis among farm women. Odds ratios (ORs) for chronic bronchitis for occupational exposures were adjusted for age, state, and related agricultural exposures. RESULTS: Applying manure and driving combines were independently associated with chronic bronchitis. Off-farm job exposures associated with chronic bronchitis were organic dusts, asbestos, gasoline, and solvents. Five pesticides were associated with chronic bronchitis after multivariate adjustment and sensitivity analyses: dichlorvos (OR=1.63, 95% CI=1.01, 2.61), DDT (OR=1.67, 95% CI=1.13, 2.47), cyanazine (OR=1.88, 95% CI=1.00, 3.54), paraquat (OR=1.91, 95% CI=1.02, 3.55), and methyl bromide (OR=1.82, 95% CI=1.02, 3.24). CONCLUSION: Pesticides as well as grain and dust exposures were associated with chronic bronchitis among nonsmoking farm women.	Journal of Occupational & Environmental Medicine	49	5	574-83	Self-reported exposure			Cross-sectional	Specific active ingredient	respiratory	self-reported	USA	hic
855	M. Valikhani, S. Kavusi, C. Chams-Davatchi, M. Daneshpazhoob, M. Barzegari, M. Ghiasi and R. Abedini	Pemphigus and associated environmental factors: a case-control study	2007	BACKGROUND: Recent reports have revealed the relatively high incidence of pemphigus in Iran. Occupational exposure and personal habits have been suggested to play a role in the aetiopathogenesis of this life-threatening disease. AIM: In order to analyse the association of environmental factors with pemphigus, we conducted a case-control study to evaluate the possible role of smoking, pesticide exposure and hormonal factors in Iran. METHODS: This study was conducted in Iran using a structured questionnaire. Questions included information on patients' smoking habits, occupational exposure to pesticides, use of oral contraception (OC) and number of pregnancies. RESULTS: We enrolled 210 patients with pemphigus and 205 control subjects. Fewer of patients with pemphigus (17.1%) reported a current or past history of smoking, which was statistically different from the control group (27.3% smokers). The duration of smoking and the number of cigarettes smoked daily was also significantly lower in patients. Although OC use was significantly higher in women with pemphigus, the mean number of pregnancies was not different between the two groups. Occupational exposure to pesticides was significantly higher in patients with pemphigus (14.8%) than in controls (5.4%); patients with pemphigus were exposed to pesticides three times more often than were healthy subjects. CONCLUSION: As a positive history of smoking was lower in patients with pemphigus compared with healthy subjects, it seems that smoking is a protective factor in pemphigus. This should encourage further investigations, searching for novel therapies. If pesticides and OC are confirmed as triggering factors, their cessation might reduce the need for pharmacological therapy.	Clinical & Experimental Dermatology	32	3	256-60	Self-reported exposure			Case-control	Pesticides in general	dermatological	doctor-diagnosed	Iran	umic
856	M. van der Mark, R. Vermeulen, P. C. Nijssen, W. M. Mulleners, A. M. Sas, T. van Laar, M. Brouwer, A. Huss and H. Kromhout	Occupational exposure to pesticides and endotoxin and Parkinson disease in the Netherlands	2014	OBJECTIVES: Previous research has indicated that occupational exposure to pesticides and possibly airborne endotoxin may increase the risk of developing Parkinson disease (PD). We studied the associations of PD with occupational exposure to pesticides, specifically to the functional subclasses insecticides, herbicides and fungicides, and to airborne endotoxin. In addition we evaluated specific pesticides (active ingredients) previously associated with PD. METHODS: We used data from a hospital-based case-control study, including 444 patients with PD and 876 age and sex matched controls. Exposures to pesticides from application and re-entry work were estimated with the ALOHA+job-exposure matrix and with an exposure algorithm based on self-reported information on pesticide use. To assess exposure to specific active ingredients a crop-exposure matrix was developed. Endotoxin exposure was estimated with the DOM job-exposure matrix. RESULTS: The results showed almost no significant associations. However, ORs were elevated in the higher exposure categories for pesticides in general, insecticides, herbicides and fungicides, and below unity for endotoxin exposure. The analyses on specific active ingredients showed a significant association of PD risk with the fungicide benomyl. CONCLUSIONS: This study did not provide evidence for a relation between pesticide exposure and PD. However, the consistently elevated ORs in the higher exposure categories suggest that a positive association may exist. The possible association with the active ingredient benomyl requires follow-up in other studies. This study did not provide support for a possible association between endotoxin exposure and PD.	Occupational & Environmental Medicine	71	11	757-64	Job exposure matrix	Crop exposure matrix		Case-control	Type of pesticide	neurological	doctor-diagnosed	Netherlands	hic
857	M. W. Ruijten, H. J. Salle, M. M. Verberk and M. Smink	Effect of chronic mixed pesticide exposure on peripheral and autonomic nerve function	1994	In a cross-sectional study involving 131 flower bulb farmers (mean age = 43 y) and 67 well-matched controls, peripheral and autonomic nerve functions were examined. The study group had been exposed during a period of 20 y (standard deviation = 7) and applied a similar pesticide package. Lifetime cumulative exposure was estimated based on exposure levels for specific application methods and duration of exposure. Exposure-related decreased conduction velocities were found in the motor fibers of the median (-1.1 m/s) and peroneal (fast fibers: -1.2 m/s, slow fibers: -1.3 m/s) nerves, and in the sensory fibers of the median (-1.4 m/s) and sural (-0.9 m/s) nerves. In addition, the refractory period was determined and found to be increased in the sural and peroneal nerves. With regard to the autonomic nerve function, a decrease was found in resting sinus arrhythmia (-10%).	Archives of Environmental Health	49	3	188-95	Algorithm/model			Cross-sectional	Pesticides in general	neurological	medical test result	Netherlands	hic
858	M. Zakerinia, M. Namdari and S. Amirghofran	The relationship between exposure to pesticides and the occurrence of lymphoid neoplasm	2012	Background: The etiology of malignant lymphoma is still largely unknown. This study determines the relationship between exposure to pesticides and the occurrence of lymphoid neoplasms in Shiraz, Southern Iran. Methods: Between 2007 and 2008, in a case control study conducted in Nemazee Hospital in Shiraz, Southern Iran, 200 subjects diagnosed with lymphoma according to the World Health Organization (WHO) classification were enrolled. Controls (n=200) were frequency matched to the cases by sex, age, and center. Subjects who were a farmer were compared with all other occupations. Results: Out of the 200 cases that were diagnosed as lymphoid neoplasms, 100 were non-Hodgkin's lymphoma, 54 Hodgkin's lymphoma and 46 multiple myeloma. Seventy two percent of the NHL's were of the B-cell type, 15% of the T-cell type and the rest were not classified. Furthermore, subjects exposed to pesticides were at an increased risk of non-Hodgkin lymphoma and MM, but not Hodgkin lymphoma. Conclusion: Risk of non-Hodgkin lymphoma and MM was highest for exposure to pesticides, among them, insecticide's risk was confirmed. <U+00AC><U+00A9> Iranian Red Crescent Medical Journal.	Iranian Red Crescent Medical Journal	14	6	337-344	Job title			Case-control	Job title	cancer	doctor-diagnosed	Iran	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
859	M. Zhang, X. Fang, L. Zhou, L. Su, J. Zheng, M. Jin, H. Zou and G. Chen	Pesticide poisoning in Zhejiang, China: A retrospective analysis of adult cases registration by occupational disease surveillance and reporting systems from 2006 to 2010	2013	Objective: Despite the rapid industrialisation and urbanisation over the past 30 years, agriculture is one of the largest economic sectors in China and the unregulated use of pesticides result in extensive pesticide poisoning. The objective of this study was to analyse pesticide poisoning cases registration received by Zhejiang Provincial Center for Disease Control and Prevention, China. Design: Register-based study. Setting: Cases registered regarding pesticide poisoning. Data were obtained from the Occupational Disease Surveillance and Reporting Systems in Zhejiang province from 2006 to 2010, which contains anonymous records representing general population of Zhejiang province, China. Participants: All cases registered as pesticide poisoning were identified. Primary outcome: Monthly and age-group pesticide poisoning death rates were calculated. Results: A total of 20 097 pesticide poisoning cases with 1413 deaths were recorded during the study period. There were 10 513 male pesticide poisoning cases with 782 deaths, and 9584 females with 631 deaths. Pesticide poisoning occurred mostly in non-occupational exposure (79.86%), in which the majority (85.77%) of the cases was of intentional pesticide poisoning. The occupational exposure was most common in men during the farming season. The death rate increased stepwise with age, and the pesticide suicide rate was higher in the older age group. Conclusions: Pesticide poisoning remains a major health problem in China, and further recommendations to reduce the pesticide poisoning are required.	BMJ Open	3	11	NA	Registers			Cohort (prospective)	Job title	pesticide-related illness	doctor-diagnosed	China	umic
860	M. Zorzon, L. Capus, A. Pellegrino, G. Cazzato and R. Zivadinov	Familial and environmental risk factors in Parkinson's disease: a case-control study in north-east Italy	2002	BACKGROUND AND OBJECTIVE: The aetiology of Parkinson's disease remains unknown, although both genetic susceptibility and environmental factors are considered putative contributors to its origin. We performed a case-control study to investigate the association of familial and environmental risk factors with Parkinson's disease (PD). METHODS: We studied 136 patients with neurologist confirmed PD and 272 age- and sex-matched controls, affected by neurological diseases not related to PD. The risk of developing idiopathic PD associated with the following familial and environmental factors: positive family history of PD, positive family history of essential tremor (ET), age of mother at subject's birth, rural birth, rural living, well water use, farming as an occupation, exposure to pesticides, head tremor, exposure to general anaesthesia and to ionizing radiations, food restriction, concentration camp imprisonment and smoking has been assessed by using univariate and multivariate statistical techniques. RESULTS: In the conditional multiple logistic regression analysis, positive family history of PD (OR 41.7, 95% CI 12.2-142.5, P < 0.0001), positive family history of ET (OR 10.8, 95% CI 2.6-43.7, P < 0.0001), age of mother at subject's birth (OR 2.6, 95% CI 1.4-3.7, P=0.0013), exposure to general anaesthesia (OR 2.2, 95% CI 1.3-3.8, P=0.0024), farming as an occupation (OR 7.7, 95% CI 1.4-44.1, P=0.0212) and well water use (OR 2.0, 95% CI 1.1-3.6, P=0.0308) exhibited a significant positive association with PD, whereas smoking showed a trend toward an inverse relationship with PD (OR 0.7, 95% CI 0.4-1.1, P < 0.06). CONCLUSIONS: We conclude that both familial and environmental factors may contribute to PD aetiology.	Acta Neurologica Scandinavica	105	2	77-82	Self-reported exposure			Case-control	Pesticides in general	neurological	doctor-diagnosed	Italy	hic
861	N. A. Dalager, H. K. Kang, V. L. Burt and L. Weatherbee	Hodgkin's disease and Vietnam service	1995	Earlier studies that showed an association between exposure to phenoxy herbicides and the risk of malignant lymphomas have sparked concerns among Vietnam veterans over Agent Orange exposure. The Department of Veterans Affairs (VA) undertook a hospital-based case-control study to examine the association between military service in Vietnam and several histologic types of malignant lymphomas. This is a report of 283 Vietnam-era veteran patients who were treated in one of 172 VA hospitals from 1969 to 1985 with a diagnosis of Hodgkin's Disease (HD). Four hundred and four Vietnam-era veteran patients with diagnosis other than malignant lymphoma served as a comparison group. Military service in Vietnam was not associated with any significant increase in the risk of HD (adjusted odds ratio = 1.28; 95% confidence interval = 0.94, 1.76). Surrogate measures of potential Agent Orange exposure such as service in a specific military branch, in a certain region within Vietnam, in a combat role, or extended Vietnam service time were not associated with any significant increased risk of HD.	Annals of Epidemiology	5	5	400-6	Job title			Cross-sectional	Chemical class	cancer	doctor-diagnosed	USA	hic
862	N. B. Cherry, I.; Beach, J.; Senthilselvan, A.	Mental health in Alberta grain farmers using pesticides over many years	2012	BACKGROUND: Exposure to organophosphates and certain other pesticides has been related to symptoms of mental ill-health. There is particular interest in whether exposure over many years may result in chronic ill-health. AIMS: To relate lifetime history of pesticide exposure to symptoms and medical records of mental ill-health in elderly grain farmers in Alberta. METHODS: Two populations of grain farmers were identified for study: cohort A (n = 5986), members of an Alberta farm organization in 1983; cohort B (n = 4781), grain farmers registered with the provincial department of agriculture. In 2002-03 both groups completed a questionnaire on lifetime history of pesticide use, physician diagnosed disease and recent neuropsychological symptoms. Durations of exposure to seven pesticide components were calculated and a factor score extracted from responses to the symptom questionnaire. For a sub-cohort surviving to 2009 medical records for mental ill-health were identified. Records and symptom scores were related to pesticide exposures allowing for confounding. RESULTS: From cohort A, 1348 and cohort B, 1078 were alive and interviewed (median age 63 years; median duration in farming 40 years): 1371 were linked to the medical records database. Mental ill-health symptom scores were related to duration of exposure to phenoxy compounds (but not to other pesticides) and to mental ill-health in medical records. Those with mental ill-health in hospital discharge records were more likely to have been exposed to phenoxy compounds for >=35 years. CONCLUSIONS: The relationship of long-term exposure to phenoxy herbicides and neuropsychiatric symptoms was unexpected but not explained by measured confounders.	Occupational Medicine (Oxford)	62	6	400-6	Self-reported exposure			Cohort (prospective)	Chemical class	mental disorders	doctor-diagnosed	USA	hic
863	N. C. Briggs, R. S. Levine, H. I. Hall, O. Cosby, E. A. Brann and C. H. Hennekens	Occupational risk factors for selected cancers among African American and White men in the United States	2003	OBJECTIVES: This study examined occupational risks for non-Hodgkin's lymphoma, Hodgkin's disease, and soft-tissue sarcoma among African American and White men. METHODS: Race-specific multivariate logistic regression analyses were conducted using data from a large US population-based case-control study. RESULTS: Significant occupational risks were limited to African Americans; chromium was associated with non-Hodgkin's lymphoma (odds ratio [OR] = 3.9, 95% confidence interval [CI] = 1.2, 12.9) and wood dust was associated with Hodgkin's disease (OR = 4.6, 95% CI = 1.6, 13.3) and soft-tissue sarcoma (OR = 3.7, 95% CI = 1.6, 8.6). CONCLUSIONS: Race-specific occupational risk factors for cancer were evident only among African American men. This may reflect racial disparities in levels of exposure to occupational carcinogens.	American Journal of Public Health	93	10	1748-52	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
864	N. C. Cherry, F.; Silman, A.; Dunn, G.; Baxter, D.; Smedley, J.; Taylor, S.; Macfarlane, G. J.	Health and exposures of United Kingdom Gulf war veterans. Part II: The relation of health to exposure	2001	OBJECTIVES: To investigate whether, in personnel who served with the United Kingdom forces in the Gulf war, self reported exposures were related to symptoms in a way that was consistent, specific, and credible. METHODS: Responses to symptom and exposure questionnaires, completed 7 or more years after the war, were collected from 7971 subjects deployed in the Gulf, from two exposed cohorts, in a study with an overall response rate of 85.5%. Exposures were considered in three groups, those outside the control of the subjects, the use of prophylaxis, and indicators of susceptibility. Health indices derived from symptom questionnaires were related to reports of 14 exposures in these three groups in a series of multiple regression analyses to allow for confounding. The relation of exposure to complaints of widespread pain and to symptoms suggesting peripheral neuropathy were examined by logistic regression. RESULTS: Consistent but weak correlations between exposures and with health effects were found in independent analyses of the two (main and validation) cohorts. Three exposures outside the control of the subject, the number of inoculations, the number of days handling pesticides, and the days exposed to smoke from oil fires, were consistently and independently related to severity. The number of inoculations was also associated with higher scores on a factor weighted on symptoms associated with skin and musculoskeletal complaints. The number of days handling pesticides related particularly to scores on a neurological factor and to symptoms consistent with toxic neuropathy. CONCLUSION: The relations between exposures and ill health were generally weak. Consistent, specific, and credible relations, warranting further investigation, were found between health indices and two exposures, the reported number of inoculations and days handling pesticides.	Occupational & Environmental Medicine	58	5	299-306	Self-reported exposure			Cohort (prospective)	Pesticides in general	pesticide-related symptoms	self-reported	USA	hic
865	N. Castro-Gutierrez, R. McConnell, K. Andersson, F. Pacheco-Anton and C. Hogstedt	Respiratory symptoms, spirometry and chronic occupational paraquat exposure	1997	OBJECTIVES: A cross-sectional study was conducted to evaluate the relationship between respiratory health and paraquat exposure. METHODS: The study population was selected from among workers at 15 Nicaraguan banana plantations which relied on paraquat for the control of weeds. All the workers were interviewed after they received their job assignment for the day of the survey, and all who reported never having applied paraquat and all who reported more than 2 years of cumulative exposure as applicators of paraquat with knapsack sprayers were invited for medical evaluation. One hundred and thirty-four exposed workers and 152 unexposed workers were administered a questionnaire interview asking about exposure and respiratory symptoms, and they underwent spirometric testing of forced expiratory volume in 1 s (FEV1.0) and forced vital capacity (FVC). RESULTS: In the exposed group 53% reported having experienced a skin rash or burn resulting from paraquat exposure, 25% reported epistaxis, 58% nail damage, and 42% paraquat splashed in the eyes. There was a consistent dose-response relationship between intensity of exposure (as indicated by a history of skin rash or burn) and the prevalence of dyspnea. This relationship was more marked for more severe dyspnea. There was a 3-fold increase in episodic wheezing accompanied by shortness of breath among the more intensely exposed workers. There was no relationship between exposure and FEV1.0 or FVC. CONCLUSIONS: The high prevalence of respiratory symptoms associated with exposure, in the absence of spirometric abnormalities associated with exposure, could be a result of unmeasured gas exchange abnormalities among workers with long-term exposure to paraquat.	Scandinavian Journal of Work, Environment & Health	23	6	421-7	Self-reported exposure			Cross-sectional	Specific active ingredient	respiratory	self-reported	Nicaragua	lmic
866	N. Cherry, M. Mackness, P. Durrington, A. Povey, M. Dippnall, T. Smith and B. Mackness	Paraoxonase (PON1) polymorphisms in farmers attributing ill health to sheep dip	2002	Human serum paraoxonase (PON1) hydrolyses diazinonoxon, the active metabolite of diazinon, which is an organophosphate used in sheep dip. In a case-referent study, 175 farmers with ill health that they attributed to sheep dip nominated 234 referent farmers who also dipped sheep and whom they believed to be in good health. We calculated odds ratios for polymorphisms in PON1 at positions 192 and 55, and for PON1 activity with diazinonoxon as substrate. Cases were more likely than referents to have at least one R allele at position 192 (glutamine to arginine aminoacid substitution; odds ratio 1.93, 95% CI 1.24-3.01), both alleles of type LL (1.70, 1.07-2.68) at position 55, and to have diazoxonase activity below normal median (1.77, 1.18-2.67). Our results support the hypothesis that organophosphates contribute to the reported ill health of people who dip sheep.	Lancet	359	9308	763-4	Self-reported exposure			Case-control	Chemical class	genetic (biomarkers)	medical test result	UK	hic
867	N. E. A. Sharaf, N. M.; Ibrahim, K. S.; El-Tahlawy, E. M.; Abdelgelil, K. S.	Pesticides usage in agriculture among rural women in Egypt: Association between serum organo-chlorine pesticide residues and occurrence of diabetes	2013	Organochlorine pesticides were widely used in Egypt; large quantities had been released into the environment, where they became persistent substances both in the environment and in the food chain. The non organized use of pesticides in Egypt has caused immense damage to the environment and human health. Recent studies have reported an association between exposure to organo-chlorines pesticides (OCPs) and impaired blood-glucose regulation. The study aimed to investigate the relation between exposure to specific agricultural pesticides and diabetes incidence among some Egyptian women. The population study consisted of 51 rural women, who help their families in agriculture. For all participants in the study, questionnaires were filled up and, blood samples were obtained for determination of blood glucose levels and of OC pesticides residues. The dieldrin and DDD residues were found almost in all samples, followed by the heptachlor, heptachlor-epoxide and the aldrin respectively and finally the DDE. There was only a significant positive correlation between the heptachlor residue and the blood glucose level of the participants. Evaluation of the attitudes and behavior of the studied population showed a significant association between the heptachlor and DDE residues in the sera of women who didn't use or have pesticides in their home. This can confirm that the presence of OC pesticides in several environmental compartment like food and soil, may pose another risk factor for the human health. These findings may have relevance to the general population, who suffer greatly from environmentally persistent compounds and the increasing prevalence of diabetes and a further extended study is needed. <U+00AC><U+00A9> IDOSI Publications, 2013.	World Journal of Medical Sciences	9	1	43327	Biomonitoring (blood)			Cohort (prospective)	Chemical class	endocrine/nutritional/metabolical	doctor-diagnosed	Egypt	lmic
868	N. Fiedler, H. Kipen, K. Kelly-McNeil and R. Fenske	Long-term use of organophosphates and neuropsychological performance	1997	This study evaluated neuropsychological effects due to chronic organophosphate use among farmers with no history of acute poisoning. Fifty-seven male tree fruit farmers (exposed) were compared with 42 age-matched male cranberry/blueberry growers and hardware store owners (unexposed). Univariate analyses of covariance (reading test as covariate) comparing exposed and unexposed subjects revealed significantly slower reaction time. No other significant differences were noted on tests of concentration, visuomotor skills, memory, expressive language, or mood. Based on an exposure metric derived from detailed exposure histories, farmers were divided into high exposure (n = 40) and low exposure (n = 59) groups, and their neuropsychological performance was compared. Analysis of covariance with age and reading test score as covariates revealed that the high exposure group had significantly slower reaction time, dominant hand. Long-term use of organophosphates without evidence of an acute poisoning episode appears to produce, at most, subtle changes in neuropsychological performance.	American Journal of Industrial Medicine	32	5	487-96	Algorithm/model	Self-reported job history	Metric	Cross-sectional	Pesticides in general	neurological	medical test result	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
869	N. J. Awadalla, A. Hegazy, R. A. Elmetwally and I. Wahby	Occupational and environmental risk factors for idiopathic pulmonary fibrosis in Egypt: a multicenter case-control study	2012	BACKGROUND: Despite the advances in medical therapy and technology, the prognosis of idiopathic pulmonary fibrosis (IPF) remains poor and the need for disease prevention based on identifying the risk factors becomes mandatory. Occupational and environmental exposures were studied in several countries and found to play important role in the disease development. However, in Egypt, a little attention has been paid to study the effect of these factors in the disease development. OBJECTIVE: To identify the occupational and environmental risk factors associated with the development of IPF in Egypt. METHODS: A multicenter hospital-based case-control study was carried out in chest hospitals affiliated to three Egyptian cities-Cairo, Tanta and Mansoura. Subjects were 201 patients with confirmed IPF (cases) and 205 age-, sex- and residence-matched controls. Data on occupational and environmental factors were obtained from a questionnaire. Multiple logistic regression analysis was used to determine the independent risk factors of IPF in both sexes for single factors with adjustment for age, residence and smoking status. RESULTS: Compared with the controls, the risk of IPF in male workers was observed to increase significantly in chemical and petrochemical industries and carpentry and wood working (OR = 2.56, 95% CI: 1.02-7.01), and with occupational exposures to wood dust and wood preservatives. Among female workers, a significant increase was observed in farming (OR = 3.34, 95% CI: 1.17-10.12), raising birds and occupational exposures to animal feeds, products and dusts and pesticides. Risk of IPF decreased significantly in male workers and insignificantly among female workers in sales and clerical related activities. The environmental exposures to birds and cats were significantly associated with elevated risk of IPF development in both sexes. CONCLUSION: In Egypt, farming, raising birds and wood working are important risk factors for the development of IPF.	International Journal of Occupational & Environmental Medicine	3	3	107-16	Self-reported job history			Case-control	Pesticides in general	respiratory	doctor-diagnosed	Egypt	lmic
870	N. Kalfa, P. Philibert, S. Broussous, T. Chouikh, M. Masmoudi, F. Audran, F. Paris, N. Servant, C. Sultan, M. Orsini, A. Zahhaf, J. P. Daures, H. Lehors, J. M. Guys, R. Reynaud, P. Alessandrini, F. Bastiani, J. Y. Kurzenne, K. Wagner and G. M. Lacombe	Isolated hypospadias and exposure to endocrine disrupting chemicals during pregnancy: A multi-institutional controlled study in a high prevalence area	2014	Background: Numerous studies focused on the association between hypospadias and Endocrine Disrupting Chemicals (EDC) exposures. The wide variability of phenotypes included in these studies, the absence of comparison groups representative of the populations and the absence of concomitant genetic testing to rule out another cause make the results questionable. Objective and hypotheses: We performed a prospective phenotype-specific analysis of patients with Isolated Hypospadias (IH) after exclusion of genetic defects to identify the role of EDC exposures. Method: 700 boys were prospectively included in a multi-institutional study. After exclusion of genetic defects (androgen receptor and 5-areductase genes) and familial forms (vertical transmission), 300 IH were included and 302 normal children were used as controls. The parents' domestic and professional exposures to EDC were evaluated by a standardized detailed questionnaire and by a previously validated job-exposure matrix for EDC. The environmental exposition was estimated through the zip code of the pregnancy, type of surrounding hazards and straight distance from it. Results: Maternal occupational exposition to EDC was more frequent during pregnancy in case of IH (35.11 vs 17.55%, P<0.001) mainly to paints/solvents/adhesive (16.05%), detergents (11.04%), pesticides (9.03%), cosmetics (5.69%). Exposed jobs (cleaners, hairdressers, beauticians, laboratory) were more frequently performed by hypospadiac boys' mothers than controls' one (19.73 vs 10.26%, P=0.0019). The paternal professional exposition around the time of fertilization was more frequent in IH (40.13 vs 27.48%, P=0.02). Regarding environmental exposure, industrial or intensive agriculture area were more frequently encountered in a 3 km radius around the place of pregnancy giving birth to a hypospadiac boy (13.31 vs 6.46%, P<0.0001) or (19.47 vs 14.64%, P=0.0137) respectively. Conclusion: In an homogenous cohort of patients with IH and no genetic defect, the maternal exposure to EDC during pregnancy is more frequent compared to controls. Both occupational and environmental exposure may be considered as risk factors.	Hormone Research in Paediatrics	82	NA	107	Self-reported job history	Job exposure matrix		Case-control	Job title	offspring	doctor-diagnosed	France	hic
871	N. L. G. LaVerda, D. F.; Alavanja, M. C.; Hunting, K. L.	Pesticide Exposures and Body Mass Index (BMI) of Pesticide Applicators From the Agricultural Health Study	2015	Endocrine-disrupting chemicals, including pesticides, may be associated with weight gain. This is the first longitudinal study to examine a potential association between weight gain and pesticides using data on 8,365 male pesticide applicators from the Agricultural Health Study (AHS) cohort established in 1993. The relationship between total cumulative days of exposure to pesticide functional/chemical classes and to the four most frequently used individual pesticides was studied in relation to body mass index (BMI) at the time of 5-yr follow-up (beginning in 1998) with the length of the exposure period dating back to age 20 yr. Multiple regression, Spearman correlation, ordinal logistic regression, and logistic regression models all utilized a Bonferroni-adjusted p value, were adjusted for relevant covariates, and were stratified by state of residence (Iowa/North Carolina) and presence/absence of weight-related health conditions. Adjusted multiple regression yielded statistically significant positive parameter estimates for the study sample and Iowa subgroups with consistent findings for triazine herbicides and atrazine: Change in BMI per 100 cumulative pesticide exposure days ranged from 0.07 to 0.11 for triazine herbicides and from 0.10 to 0.19 for atrazine. Ordinal logistic regression compared normal weight with overweight and with obese using the zero exposure category as referent. Statistically significant adjusted odds ratios identified for the study sample and both state subgroups for the highest level of atrazine exposure ranged from 1.4 to 1.7. Further investigation is warranted to evaluate the associations identified here.	Journal of Toxicology & Environmental Health Part A	78	20	1255-76	Self-reported exposure			Cohort (prospective)	Specific active ingredient	endocrine/nutritional/metabolical	medical test result	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
872	N. L. Hudson, E. J. Kasner, J. Beckman, L. Mehler, A. Schwartz, S. Higgins, J. Bonnar-Prado, M. Lackovic, P. Mulay, Y. Mitchell, L. Larios, R. Walker, J. Waltz, S. Moraga-McHaley, R. Roisman and G. M. Calvert	Characteristics and magnitude of acute pesticide-related illnesses and injuries associated with pyrethrin and pyrethroid exposures--11 states, 2000-2008	2014	BACKGROUND: Excluding disinfectants, pyrethrins and pyrethroids are the pesticides used most commonly in and around homes. Respiratory effects and paresthesia are among the concerns about pyrethrin/pyrethroid exposures. METHODS: Acute pesticide-related illness/injury cases were identified from the Sentinel Event Notification System for Occupational Risks-Pesticides Program and the California Department of Pesticide Regulation from 2000-2008. Characteristics and incidence rates were determined for acute pyrethrin/pyrethroid-related illness/injury cases. Logistic regression analyses were performed to determine odds of respiratory and dermal symptoms in persons with illness/injury following pyrethrin/pyrethroid exposure compared to persons with illness/injury following exposure to other pesticides. RESULTS: A total of 4,974 cases of acute pyrethrin/pyrethroid-related illness were identified. Incidence rates increased over time, reaching 8 cases/million population in 2008. The majority of cases were low severity (85%) and 34% were work-related. Respiratory effects were the most common symptoms reported (48%). Risk of acute respiratory effects were significantly elevated among persons exposed only to pyrethrins (adjusted odds ratio [aOR] 1.79; 95% confidence interval [95% CI]: 1.49-2.16), only to pyrethroids (aOR 1.99 95% CI: 1.77-2.24), to a mixture of pyrethroids (aOR 2.36; 95% CI: 1.99-2.81) or to a mixture containing both pyrethrins and pyrethroids (aOR 2.99; 95% CI: 2.33-3.84) compared to those with illness arising from exposure to other pesticides. The most common factors contributing to pyrethrin/pyrethroid-related illness included exposure from spills/splashes, improper storage, and failure to evacuate during pesticide application. CONCLUSIONS: The magnitude of acute pyrethrin/pyrethroid-related illness/injury is relatively low but is increasing. As such, additional measures to prevent them are needed.	American Journal of Industrial Medicine	57	1	15-30	Registers			Cohort (prospective)	Chemical class	pesticide-related illness	doctor-diagnosed	USA	hic
873	N. L. Sprince, M. Q. Lewis, P. S. Whitten, S. J. Reynolds and C. Zwerling	Respiratory symptoms: associations with pesticides, silos, and animal confinement in the Iowa Farm Family Health and Hazard Surveillance Project	2000	BACKGROUND: Farmers are at risk for airways diseases resulting from exposures which include organic agents and chemicals on the farm. Few data on airways disease and farm exposures are available from population-based studies. The Iowa Farm Family Health and Hazard Surveillance Project provided the opportunity to assess associations between symptoms of airway disease and several farm exposures, including pesticides, grain dust, animal confinement, and exposures from silos, in a population-based study. METHODS: A stratified two-stage cluster sample was used to provide a representative farmer sample from the state. Participants provided questionnaire responses concerning demographic, respiratory symptoms, smoking, and exposure information. Associations between farm exposures and airways disease symptoms were assessed in the 385 farmer participants using chi(2) analysis and logistic regression analysis adjusting for age and smoking. RESULTS: The most frequently reported respiratory symptoms were flu-like symptoms in connection with dusty work (22%), dyspnea (21%), and phlegm (15%). Current smoking was uncommon (13%). Among farmers, applying pesticides to livestock was associated with significantly increased odds of phlegm (OR = 1.91, 95% CI 1.02-3.57), chest ever wheezy (OR = 3.92, 95% CI 1.76-8.72), and flu-like symptoms (OR = 2.93, 95% CI 1.69-5.12) in models adjusting for age and smoking. Conventional vertical silos were significantly associated with increased odds of chest ever wheezy (OR = 2.75, 95% CI 1.23-6.12) and flu-like symptoms (OR = 2.40, 95% CI 1.31-4.37). There were also significant associations between several respiratory symptoms and the presence of animal confinement facilities on the farm. CONCLUSIONS: The association between insecticide application to livestock and symptoms of airways disease is a new finding that could lead to further study of specific airway responses and exposures associated with this practice. Results confirming associations between respiratory symptoms and conventional vertical silos may be important in future studies aimed at prevention and control of exposures in those farm buildings.	American Journal of Industrial Medicine	38	4	455-62	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	USA	hic
874	N. Lebas, L. Nadon, M. Rhazi, H. Richard, M. Desy and M. E. Parent	Exposure to occupational and domestic pesticides, and prostate cancer risk: Preliminary findings from a case-control study in Montreal, Canada	2011	Objectives To report on the association between pesticides exposure and prostate cancer (PC) risk from PROTEuS (Prostate Cancer & Environment Study), a case-control study on-going in Montreal. Methods Incident, histologically confirmed cases aged <U+201A><U+00E2><U+00A7>75 were ascertained across major hospitals in Greater Montreal. Population controls from the same area, frequency-matched on age, were identified from electoral lists. This analysis is based on the first 820 cases and 661 controls interviewed to date. Subjects provided a detailed description of each job held over their lifetime; potential exposure to pesticides was assigned using the expert-based approach. Use of domestic pesticides was elicited. ORs and 95% CI were assessed, adjusting for age, family history of PC, body mass index and ethnicity. Results Exposure to pesticides was often seasonal. Pesticides exposure was most often assigned to farmers, carpenters and cooks. The OR for men with probable or definite occupational exposure to pesticides was 0.79 (95% CI 0.51 to 1.22). Domestic exposure to pesticides was associated with an OR of 0.83 (95% CI 0.66 to 1.05). Regular golfers had an OR of 0.75 (95% CI 0.59 to 0.96). Restricting analyses to controls who reported recent PC screening, or to cases with aggressive PC, yielded similar results. Conclusions We observed no association between pesticides exposure and PC cancer risk. However, the prevalence of exposure to pesticides was low (7%), limiting the ability to detect associations. As the study progresses towards its aim of 2000 cases and 2000 controls, results will be updated.	Occupational and Environmental Medicine	68	NA	A121	Self-reported job history			Case-control	Job title	cancer	doctor-diagnosed	Canada	hic
875	N. M. Faria, L. A. Facchini, A. G. Fassa and E. Tomasi	Pesticides and respiratory symptoms among farmers	2005	OBJECTIVE: Despite the intensive use of pesticides in agriculture there are few studies assessing the risk of respiratory conditions from this exposure. The study aimed at quantifying the prevalence of respiratory symptoms among farmers and evaluating its relationship with occupational use of pesticides and the prevalence of respiratory symptoms. METHODS: A cross-sectional study was conducted among 1,379 farmers from two municipalities of Southern Brazil in 1996. Frequency and type of chemical exposure and pesticide poisoning were recorded for both sexes. All subjects aged 15 years or older with at least 15 weekly hours of agricultural activity were interviewed. An adapted questionnaire developed by the American Thoracic Society was used for the assessment of respiratory symptoms. Multivariate logistic regression analysis was carried out. RESULTS: More than half (55%) of interviewees were male. The prevalence of asthma symptoms was 12% and chronic respiratory disease symptoms was 22%. Higher odds ratios for both asthma (OR=1.51; 95% CI: 1.07-2.14) and chronic respiratory disease (OR=1.34; 95% CI 1.00-1.81) symptoms were found in women. Logistic regression analysis identified associations between many forms of exposure to pesticides and increased respiratory symptoms. Occurrence of pesticide poisoning was associated with higher prevalence of asthma symptoms (OR=1.54; 95% CI: 1.04-2.58) and chronic respiratory disease symptoms (OR=1.57; 95% CI: 1.08-2.28). CONCLUSIONS: In spite of causality limitations, the study results provide evidence that farming exposure to pesticides is associated with higher prevalence of respiratory symptoms, especially when the exposure is above two days per month.	Revista de Saude Publica	39	6	973-81	Job title			Cross-sectional	Job title	NA	self-reported	Brazil	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
876	N. M. Hashemi, M.; Shakeri, M. T.; Varasteh, A. R.	Prevalence of work-related respiratory symptoms in Iranian farmers	2006	BACKGROUND: Animal exposure may be an important trigger for work-related symptoms among farmers. OBJECTIVE: To estimate the prevalence of work-related respiratory symptoms (WRS) in sheep breeders and agricultural farmers and to determine work-related risk factors. METHODS: A family doctor used a questionnaire to interview a cohort of 173 farmers comprised of 127 sheep breeders and 46 agricultural farmers in the rural area of Rokh (northeast Iran). The questionnaire pertained to recurrent wheezing, cough, breathlessness or chronic phlegm while at work (these symptoms define WRS), flu-like illness and physician-diagnosed asthma. RESULTS: There were 71 subjects (41%) with WRS: 10 of 46 agricultural farmers (21.7%) and 61 of 127 sheep breeders (48.0%). The proportions of sheep breeders with wheezing (16.5%), asthma (14%), cough (29%), breathlessness (31.5%) and flu-like illness (38%) were higher than in agricultural farmers. A significant dose-response relationship among the daily hours worked with animals, the number of animals and the prevalence of symptoms was established for sheep farmers. Sheep shearing and the use of pesticide were associated with an increased risk of wheezing and phlegm. CONCLUSIONS: The results suggest that sheep farmers in general have higher rates of work-related symptoms than agricultural farmers. The severity of work-related symptoms will increase with an increase in frequency of animal contact; therefore, these results may underestimate the impact of this exposure.	Canadian Respiratory Journal	13	4	198-202	Job title			Cross-sectional	Job title	respiratory	self-reported	Iran	umic
877	N. M. X. Faria, A. G. Fassa, R. D. Meucci, N. S. Fiori and V. I. Miranda	Occupational exposure to pesticides, nicotine and minor psychiatric disorders among tobacco farmers in southern Brazil	2014	Introduction: Exposure to pesticides has been associated with psychiatric problems among farm workers, although there is still controversy as to chemical types, intensity and forms of exposure that represent risk factors for neuropsychological problems. Furthermore, tobacco workers are exposed to dermal absorption of nicotine, although its effect on mental health has not yet been studied. Objectives: To identify the prevalence of minor psychiatric disorders (MPD) among tobacco farmers and associated factors, paying special attention to pesticide and nicotine exposure. Methods: This is a cross-sectional study with a representative sample of tobacco growers, characterizing economic indicators of the farms, socio-demographic factors, lifestyle habits and occupational exposures. Multivariate analysis was performed using a hierarchical Poisson regression model. Results: A total of 2400 tobacco farmers were assessed and MPD prevalence was 12%. MPD was higher among women (PR 1.4), workers aged 40 or over, tenants/employees (PR 1.8) and those who reported having difficulty in paying debts (PR 2.0). Low socioeconomic status was inversely associated with MPD prevalence. Tasks involving dermal exposure to pesticides showed risk varying between 35% and 71%, whereas tobacco growers on farms using organophosphates had 50% more risk of MPD than those not exposed to this kind of pesticide. The number of pesticide poisoning and green tobacco sickness episodes showed linear association with MPD. Conclusions: The study reinforces the evidence of the association between pesticide poisoning and mental health disorders. It also points to increased risk of MPD from low socioeconomic status, dermal pesticide exposure as well as from exposure to organophosphates. Furthermore, the study reveals intense nicotine exposure as a risk for tobacco farmers' mental health. <U+00AC><U+00A9> 2014 The Authors.	NeuroToxicology	NA	NA	NA	Self-reported exposure			Cross-sectional	Pesticides in general	mental disorders	doctor-diagnosed	Brazil	umic
878	N. Nosrati, J. Han, R. Flores, R. Sood and S. S. Tholpady	The effect of Agent Orange on nonmelanoma skin cancer regression rates	2014	NA	JAMA Surgery	149	11	1205-6	Registers			Cohort (retrospective)	Pesticides in general	cancer	doctor-diagnosed	USA	hic
879	N. Perez-Herrera, H. Polanco-Minaya, E. Salazar-Arredondo, M. J. Solis-Heredia, I. Hernandez-Ochoa, E. Rojas-Garcia, J. Alvarado-Mejia, V. H. Borja-Aburto and B. Quintanilla-Vega	PON1Q192R genetic polymorphism modifies organophosphorous pesticide effects on semen quality and DNA integrity in agricultural workers from southern Mexico	2008	Pesticide exposure, including organophosphorous (OP) insecticides, has been associated with poor semen quality, and paraoxonase (PON1), an enzyme involved in OP deactivation, may have a role on their susceptibility, due to PON1 polymorphisms. Our objective was to evaluate the role of PON1Q192R polymorphism on the susceptibility to OP toxicity on semen quality and DNA integrity in agricultural workers. A cross-sectional study was conducted in farmers with Mayan ascendancy from southeastern Mexico chronically exposed to pesticides; mostly OP. Fifty four agricultural workers (18-55 years old) were included, who provided semen and blood samples. Semen quality was evaluated according to WHO, sperm DNA damage by in situ-nick translation (NT-positive cells), PON1Q192R polymorphism by real-time PCR and serum PON1 activity by using phenylacetate and paraoxon. Two OP exposure indexes were created: at the month of sampling and during 3 months before sampling, representing the exposure to spermatids-spermatozoa and to cells at one spermatogenic cycle, respectively. PON1 192R and 192Q allele frequencies were 0.54 and 0.46, respectively. Significant associations were found between OP exposure at the month of sampling and NT-positive cells and sperm viability in homozygote 192RR subjects, and dose-effect relationships were observed between OP exposure during 3 months before sampling and sperm quality parameters and NT-positive cells in homozygote 192RR farmers. This suggests that cells at all stages of spermatogenesis are target of OP, and that there exists an interaction between OP exposure and PON1Q192R polymorphism on these effects; farmers featuring the 192RR genotype were more susceptible to develop reproductive toxic effects by OP exposure.	Toxicology & Applied Pharmacology	230	2	261-8	Self-reported exposure			Cross-sectional	Pesticides in general	reproductive	medical test result	Mexico	umic
880	N. Prihartono, D. Kriebel, S. Woskie, A. Thetkathuek, N. Sripaung, C. Padungtod and D. Kaufman	Risk of aplastic anemia and pesticide and other chemical exposures	2011	Risk of aplastic anemia (AA) from occupational exposures to pesticides and industrial chemicals was evaluated in a hospital-based case control study in Thailand (541 cases of AA and 2261 controls). Exposure data were obtained via participants' self-reports and by experts' assessments and the data from these 2 exposure assessment methods were compared. There was an increased risk of AA associated with several classes of pesticides measured by either self-report or expert assessment. The strongest associations were seen in those whose exposures were identified both by self-report and by expert assessment. Comparing very high/high to no exposure, odds ratios (95% confidence intervals) were as follows: for organophosphates 3.20 (1.87-5.46), carbamates 4.75 (1.92-11.75), organochlorines 6.04 (1.31-27.84), and paraquat 2.17 (1.11-4.25). There were correlations among the pesticides because many types were used in the same job, so it was not possible to determine whether these risks were independent or because of confounding of one by another.	Asia-Pacific Journal of Public Health	23	3	369-77	Self-reported exposure	Expert case-by-case assessment		Case-control	Specific active ingredient	circulatory	doctor-diagnosed	Thailand	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
881	N. Raafat, M. A. Abass and H. M. Salem	Malathion exposure and insulin resistance among a group of farmers in Al-Sharkia governorate	2012	OBJECTIVES: Exposure to certain environmental toxins may be associated with increased risk of developing diabetes mellitus. The aim of the present study was to investigate the relation between chronic exposure to malathion and insulin resistance among farmers. DESIGN AND METHODS: The study included 98 non diabetic farmers who handle agricultural insecticides during their field work. The range of the exposure period for agricultural pesticides was 15-20 years. All farmers were males with mean age 39+/-12 years. Another 90 administrative employees at Zagazig University Hospitals, non diabetic males age matched were selected as controls. History taking including family history for diabetes, assessment of blood pressure, height, weight, waist circumference and body mass index was done for all participants. Blood samples were withdrawn for measurement of malathion concentration, fasting blood glucose level and fasting insulin level for calculation of homeostasis model assessment of insulin resistance (HOMA-IR). RESULTS: 24.5% had positive family history for diabetes. It was observed that there was a significant increase in the mean values of malathion blood concentration among studied farmers compared to corresponding controls. There was a positive correlation between malathion blood concentration, waist circumference and insulin resistance. It was also observed that the increase in the mean values of waist circumference and body mass index was accompanied by a significant increase in the mean values of malathion blood concentration. CONCLUSION: The current results suggested that chronic exposure of non diabetic farmers to organophosphorus malathion pesticides may induce insulin resistance. This effect tended to strengthen as waist circumference increases.	Clinical Biochemistry	45	18	1591-5	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	endocrine/nutritional/metabolical	medical test result	Egypt	lmic
882	N. Raines, M. Gonzalez, C. Wyatt, M. Kurzrok, C. Pool, T. Lemma, I. Weiss, C. Marin, V. Prado, E. Marcas, K. Mayorga, J. F. Morales, A. Aragon and P. Sheffield	Risk factors for reduced glomerular filtration rate in a Nicaraguan community affected by Mesoamerican nephropathy	2014	INTRODUCTION: Mesoamerican nephropathy, also known as chronic kidney disease of unknown etiology, is widespread in Pacific coastal Central America. The cause of the epidemic is unknown, but the disease may be linked to multiple factors, including diet as well as environmental and occupational exposures. As many as 50% of men in some communities have Mesoamerican nephropathy. OBJECTIVE: Describe prevalence of reduced glomerular filtration rate in a region of Nicaragua suspected to harbor high rates of Mesoamerican nephropathy; and investigate potential risk factors for such reduction associated with agricultural work (such as pesticide exposure and specific agricultural tasks associated with increased heat stress); sugar consumption; and traditional factors such as age, sex, diabetes, hypertension and nephrotoxic medication use. METHODS: This study uses a cross-sectional design with nested case-control analysis. Cases were individuals with estimated glomerular filtration rates of <60mL/min/1.73m2 and controls were individuals with those >90mL/min/1.73m2, estimated using serum creatinine. Data on nutrition, past medical history, medication and substance use, and agricultural behaviors and exposures were collected using medical questionnaires from June through August, 2012. Venous blood and urine samples were collected to assess hemoglobin A1c, and dipstick proteinuria, respectively; anthropometry and blood pressure measurements were made using standard techniques. Analyses were conducted using chi square, and univariate and multiple logistic regression. RESULTS: Of 424 individuals in the study, 151 had an occupational history in agriculture. Prevalence of glomerular filtration rate <60mL/min/1.73m2 was 9.8% among women and 41.9% among men (male to female ratio = 4.3, p<0.0001). Proteinuria =300 mg/dL was observed in <10% of participants with decreased glomerular filtration rate. Hemoglobin A1c and use of NSAIDs were not associated with decreased glomerular filtration rate. Although systolic and diastolic blood pressure was higher among participants with decreased glomerular filtration rate (p <0.001), hypertension was uncommon. Significant agricultural risk factors for reduced glomerular filtration rate included increased lifetime days cutting sugarcane during the dry season (OR 5.86, 95% CI 2.45-14.01), nondeliberate pesticide inhalation (OR 3.31, 95% CI 1.32-8.31), and sugarcane chewing (OR 3.24, 95% CI 1.39-7.58). CONCLUSIONS: Our findings demonstrate a high prevalence of chronic kidney disease not linked to traditional risk factors, and suggest it may be associated instead with occupational exposure to heat stress in conjunction with pesticide inhalation, sugarcane chewing and sugar intake during the workday.	MEDICC review	16	2	16-22	Self-reported exposure			Case-control	Pesticides in general	genitourinary	doctor-diagnosed	Nicaragua	lmic
883	N. S. Fiori, A. G. Fassa, N. M. Faria, R. D. Meucci, V. I. Miranda and D. C. Christiani	Wheezing in tobacco farm workers in southern Brazil	2015	BACKGROUND: Tobacco workers are exposed to several respiratory occupational sensitizers. METHODS: A representative cross-sectional study was carried out on 2469 tobacco family farming growers. Gender-stratified multivariate analyses evaluated the association between wheezing and socio-demographic, behavioral, and occupational variables. RESULTS: Wheezing prevalence was 11.0% with no difference between genders. Among men, age, smoking, strenuous work, pesticide use, contact with vegetable dust and dried tobacco dust, lifting sticks with tobacco leaves to the curing barns, and green tobacco sickness (GTS) were risk factors for wheezing. Among women, family history of asthma, tying hands of tobacco, strenuous work, contact with chemical disinfectants, and GTS were positively associated with wheezing. Harvesting lower tobacco leaves was a protective factor for the outcome in both genders. CONCLUSIONS: Pesticides, dusts exposure, and GTS were risk factors for wheezing. The synergic effect of these factors needs to be better evaluated to improve prevention.	American Journal of Industrial Medicine	58	11	1217-28	Self-reported exposure			Cross-sectional	Job title	NA	self-reported	Brazil	umic
884	N. S. Ketchum, J. E. Michalek and J. E. Burton	Serum dioxin and cancer in veterans of Operation Ranch Hand	1999	We studied cancer prevalence and exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin (dioxin) in veterans of Operation Ranch Hand, the Air Force unit responsible for the aerial spraying of herbicides in Vietnam from 1962 to 1971. A comparison group of Air Force veterans who served in Southeast Asia during the same period and who were not involved with spraying herbicides was included. Comparison veterans were matched to Ranch Hand veterans on age, race, and military occupation. We measured dioxin in 1987 or 1992, extrapolated the result to the time of service in Southeast Asia, and assigned each Ranch Hand veteran to Background, Low, or High exposure categories. This study had low power to detect an effect for specific or rare cancers. The risk of cancer at sites other than the skin within 20 years of service was increased in the Low (odds ratio (OR) = 3.4, 95% confidence interval (CI) 1.5-8.0) and High (OR = 2.7, 95% CI 0.9-8.0) categories, but the pattern was inconsistent with another study, suggesting that the excess risk may not have been caused by dioxin exposure. Overall, we found no consistent evidence of a dose-response gradient and no significant increase in cancer risk in the High dioxin exposure category, the subgroup of greatest a priori interest.	American Journal of Epidemiology	149	7	630-9	Biomonitoring (blood)	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
885	N. S. Ketchum, J. E. Michalek and M. Pavuk	Mortality, length of life, and physical examination attendance in participants of the Air Force Health Study	2007	Begun in 1982, the Air Force Health Study (AFHS) has assessed the mortality of veterans of Operation Ranch Hand, the unit responsible for aerially spraying herbicides in Vietnam. A comparison group of other Air Force veterans involved with aircraft missions in Southeast Asia during the same period, but not involved with spraying herbicides, was included in the study. Among 18,082 veterans, this report examined whether attendance at AFHS physical examinations from 1982 to 1999 played a role in mortality experience and potential lengthening of life relative to veterans who did not attend. The years of potential life lost for 1173 veterans who died before age 65 was calculated. No statistically significant difference in risk of death was found from all causes, cancer, or circulatory disease between attendees and nonattendees. No evidence was found to suggest that attending physical examinations decreased mortality or substantially lengthened life in AFHS participants.	Military Medicine	172	1	19541	Job title			Cohort (prospective)	Chemical class	mortality (all cause)	doctor-diagnosed	USA	hic
886	N. S. M. Ketchum, J. E.	Postservice mortality of Air Force veterans occupationally exposed to herbicides during the Vietnam War: 20-year follow-up results	2005	Since 1982, the Air Force Health Study has continued to assess the mortality for veterans of Operation Ranch Hand, the unit responsible for aerially spraying herbicides in Vietnam. The mortality for 1,262 Ranch Hand veterans to December 31, 1999 was contrasted with that for 19,078 comparison veterans. The relative risk (RR) for all-cause death was borderline significantly increased (RR, 1.15; 95% confidence interval, 1.0-1.3; p = 0.06). The risk of death caused by cancer was not increased (RR = 1.0), but the risk of death caused by circulatory system diseases was significantly increased among enlisted ground crew workers (RR = 1.7; 95% confidence interval, 1.2-2.4; p = 0.001). Results for Ranch Hand all-cause death differed from previous reports, with the RR now exceeding 1.0. The risk of death attributable to circulatory system diseases continues to be increased, especially for enlisted ground crew, a subgroup with relatively high skin exposure to herbicides.	Military Medicine	170	5	406-13	Biomonitoring (blood)			Cohort (prospective)	Pesticides in general	mortality (all cause)	doctor-diagnosed	USA	hic
887	N. Sailaja, M. Chandrasekhar, P. V. Rekhadevi, M. Mahboob, M. F. Rahman, S. B. Vuyyuri, K. Danadevi, S. A. Hussain and P. Grover	Genotoxic evaluation of workers employed in pesticide production	2006	Pesticides are widely used throughout the world in agriculture to protect crops and in public health to control diseases. Nevertheless exposure to pesticides can represent a potential risk to humans. Pesticide manufacturing unit workers are prone to possible occupational pesticide exposure. Therefore, this study was performed to evaluate the genotoxic effect of pesticide exposure in these workers. In the present investigation 54 pesticide workers and an equal number of control subjects were assessed for genome damage in blood lymphocytes utilizing the chromosomal aberration analysis and the buccal epithelial cell by adopting the micronucleus test. The results suggested that pesticide workers had a significantly increased frequency of chromosomal aberrations when compared with controls (mean+/-S.D., 8.43+/-2.36 versus 3.32+/-1.26; P<0.05). Similarly, the pesticides exposed workers showed a significant increase in micronucleated cells compared with controls (1.24+/-0.72 versus 0.32+/-0.26; P<0.05). Analysis of variance revealed that occupational exposure to pesticides had a significant effect on frequency of micronuclei (P<0.05), whereas smoking, age, gender and alcohol consumption had no significant effect on genetic damage (P>0.05). However, no association was found between years of exposure, smoking, age, gender, alcohol consumption and higher levels of genetic damage as assessed by the chromosomal aberration assay (P>0.05). Our findings indicate that occupational exposure to pesticides could cause genome damage in somatic cells.	Mutation Research	609	1	74-80	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	India	lmic
888	N. Samsuddin, K. G. Rampal, N. H. Ismail, N. Z. Abdullah and H. E. Nasreen	Pesticides Exposure and Cardiovascular Hemodynamic Parameters Among Male Workers Involved in Mosquito Control in East Coast of Malaysia	2016	BACKGROUND: Research findings have linked exposure to pesticides to an increased risk of cardiovascular (CVS) diseases. Therefore, this study aimed to assess the impact of chronic mix-pesticides exposure on CVS hemodynamic parameters. METHODS: A total of 198 male Malay pesticide-exposed and 195 male Malay nonexposed workers were examined. Data were collected through exposure-matrix assessment, questionnaire, blood analyses, and CVS assessment. Explanatory variables comprised of lipid profiles, paraoxonase 1 (PON1), and oxidized low-density lipoprotein (ox-LDL). Outcome measures comprised of brachial and aortic diastolic blood pressure (DBP) and systolic BP (SBP), heart rate, and pulse wave velocity (PWV). Linear regressions identified the B coefficient showing how many units of CVS parameters are associated with each unit of covariates. RESULTS: Diazoxonase was significantly lower and ox-LDL was higher among pesticide-exposed workers than the comparison group. The final multivariate linear regression model revealed that age, body mass index (BMI), smoking, and pesticide exposure were independent predictors of brachial and aortic DBP and SBP. Pesticide exposure was also associated with heart rate, but not with PWV. Lipid profiles, PON1 enzymes, and ox-LDL showed no association with any of the CVS parameters. CONCLUSIONS: Chronic mix-pesticide exposure among workers involved in mosquito control has possible association with depression of diazoxonase and the increase in ox-LDL, brachial and aortic DBP and SBP, and heart rate. This study raises concerns that those using pesticides may be exposed to hitherto unrecognized CVS risks among others. If this is confirmed by further studies, greater efforts will be needed to protect these workers.	American Journal of Hypertension	29	2	226-33	Job exposure matrix			Cross-sectional	Pesticides in general	circulatory	medical test result	Malaysia	umic
889	N. Sathiakumar, E. Delzell and P. Cole	Mortality among workers at two triazine herbicide manufacturing plants	1996	Triazine herbicides, used extensively in the United States, have not been assessed adequately for carcinogenicity in humans. This study evaluated the mortality experience during the period 1960-1986 of 2,683 men with definite or probable manufacturing exposure to triazine herbicides and 2,234 men with possible exposure to triazines. Standardized mortality ratios (SMRs) were computed as the observed numbers of deaths among study subjects divided by the numbers expected on the basis of general population mortality rates. Subjects with definite or probable exposure to triazines had a favorable mortality experience, compared with U.S. men [all causes, SMR = 72, 95% confidence interval (CI) = 58-89; all cancer, SMR = 85, CI = 46-142]. This group had an increase in deaths from non-Hodgkin's lymphoma (NHL) (3 observed/0.78 expected, SMR = 385, CI = 79-1,124). Two of the decedents with NHL had worked for less than 1 year in triazine-related jobs. Among the 2,234 subjects with possible triazine-related work, the mortality rate for all causes combined was similar to the rates of U.S. men. There was only one confirmed death from NHL. On balance, the results were consistent with previous investigations, which have found no convincing evidence of a causal link between triazines and cancer. However, the exposed cohorts were relatively young and had, on average, only 18 years of follow-up. In particular, results were imprecise for subjects having both a long duration of exposure and long potential induction periods.	American Journal of Industrial Medicine	29	2	143-51	Expert case-by-case assessment			Cohort (prospective)	Chemical class	mortality (all cause)	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
890	N. Sathiakumar, E. Delzell, P. A. MacLennan, M. Anne, N. L. Rosenberg, H. Cheng and S. L. Myers	A cross-sectional study of triallate exposure and neurological health among workers at a pesticide manufacturing and formulating facility	2004	AIMS: To evaluate the relation between an indicator of cumulative exposure to triallate and selected measures of neurological function, including nerve conduction, the prevalence of certain neurological deficits as determined by a medical examination, and vibration perception threshold testing in workers at a pesticide manufacturing plant. METHODS: Subjects were 50 workers with high estimated triallate exposure ("high triallate" group) and 50 workers with no or low triallate exposure ("no/low triallate" group). Industrial hygienists used existing work histories and personal knowledge of plant operations to develop a triallate score. In-person interviews elicited information on past medical history and on occupational and non-occupational exposures. A neurologist carried out nerve conduction tests of the sural and the peroneal nerves, a standardised neurological examination, and vibration sensation testing. RESULTS: Differences between the high and the no/low triallate groups were minimal for all but one of the six nerve conduction tests, for the prevalence of neurological abnormalities, and for vibration sensation perception. The high triallate group had lower mean sural nerve peak amplitude than the no/low triallate group (11.7 v 15.2 microV, p = 0.03). This difference was reduced when adjusted for other potential risk factors (12.5 v 14.5 microV, p = 0.25) and was not associated with cumulative triallate score. We also noted several associations between factors other than triallate and nerve conduction measures. CONCLUSION: The results were consistent with the absence of an association between triallate and measures of neurological function.	Occupational & Environmental Medicine	61	11	936-44	Expert case-by-case assessment			Cross-sectional	Specific active ingredient	neurological	medical test result	USA	hic
891	N. Sawada, M. Iwasaki, M. Inoue, H. Itoh, S. Sasazuki, T. Yamaji, T. Shimazu, S. Tsugane and G. Japan Public Health Center Based Prospective Study	Plasma organochlorines and subsequent risk of prostate cancer in Japanese men: a nested case-control study	2010	BACKGROUND: Although accumulating evidence suggests that exposure to organochlorine pesticides and polychlorinated biphenyls (PCBs) may contribute to the development of prostate cancer, few investigations have used biological samples to classify exposure to specific organochlorines. To our knowledge, this is the first prospective study to investigate the association between blood levels of organochlorines and prostate cancer risk. METHODS: We conducted a nested case-control study using data from the Japan Public Health Center-based Prospective (JPHC) Study. A total of 14,203 men 40-69 years old who returned the baseline questionnaire and who provided blood samples were followed from 1990 to 2005. Using a mean follow-up period of 12.8 years, we identified 201 participants who were newly diagnosed with prostate cancer. Two matched controls for each case were selected from the cohort. We used a conditional logistic regression model to estimate the odds ratios (ORs) and 95% confidence intervals (CIs) for prostate cancer in relation to plasma levels of nine organochlorines: PCBs, dichlorodiphenyltrichloroethane (DDT), hexachlorobenzene (HCB), beta-hexachlorocyclohexane (beta-HCH), trans- and cis-nonachlor, oxychlordane, and mirex. RESULTS: No statistically significant association with total prostate cancer was seen for any plasma organochlorine, although we did observe an insignificant inverse association for plasma HCB and beta-HCH. Total PCB in plasma was also inversely associated with advanced prostate cancer but without statistical significance. CONCLUSION: Our results suggest that no overall association exists between prostate cancer and organochlorines at the levels measured in our study population.	Environmental Health Perspectives	118	5	659-65	Biomonitoring (blood)			Case-control	Specific active ingredient	cancer	doctor-diagnosed	Japan	hic
892	N. Schmeisser, L. Kaerlev, N. Bourdon-Raverdy, O. Ganry, A. Llopis-Gonzalez, P. Guenel, L. Hardell, F. Merletti, P. Zambon, M. Morales-Suarez-Varela, J. Olsen, H. Olsson, M. Vyberg and W. Ahrens	Occupational exposure to pesticides and bile tract carcinoma in men: results from a European multicenter case-control study	2010	OBJECTIVES: To estimate the associations between occupational exposure to pesticides and extrahepatic biliary tract carcinoma in men, a population-based case-control study was carried out. METHODS: Cases (n = 104), aged 35-70, diagnosed in 1995-1997, were sampled by active reporting systems from hospitals. Controls (n = 1,401) were a random sample of the general male population. Information on occupation and confounding factors was obtained by questionnaires. Exposures were quantified with respect to time, application methods, and use of personal protective equipment. Intensity was evaluated by using a published algorithm which weighted the exposure assigned according to the use of personal protective equipment and mode of application. Logistic regression analyses were conducted adjusted for gallstones, age, and country. RESULTS: Being ever exposed to pesticides resulted in an odds ratio (OR) of 1.0 [95%-confidence interval (CI) 0.6-1.6]. A modestly elevated risk was found for backpack mounted sprayers OR = 1.4 [95% CI 0.7-2.6] and vine farmers OR = 2.5 [95% CI 0.9-7.2]. Using time periods and exposure frequency as intensity measure, no elevated risks were found. The only exception was year of maximum exposure which yielded an OR of 1.6 [95% CI 0.7-3.5]. However, no clear trend was observed in this analysis. CONCLUSIONS: This study does not rule out that pesticide exposure represents an occupational risk factor for extrahepatic biliary tract carcinoma, but no indication of a strong association was observed. Some modes of exposure were weakly, albeit not significantly associated with carcinoma risk. The observed estimates of effects may be influenced by a lack of precise exposure assessment. Different chemical compositions of pesticides were utilized during a long time span of pesticide exposure, and it should be considered that the exposure is assessed with substantial uncertainty that could non-differential and bias results toward the null.	Cancer Causes & Control	21	9	1493-502	Self-reported job history			Case-control	Job title	cancer	doctor-diagnosed	AHIC	AHIC
893	N. Schmeisser, T. Behrens, B. Mester, A. Gottlieb, I. Langner and W. Ahrens	Local cluster of germ cell cancer in a cohort of male automotive workers in Germany not explained by previous or concurrent activities and exposures in farming and forestry	2011	OBJECTIVE: To examine whether exposures or activities in farming, forestry and related occupations explain the excess incidence of germ cell cancer (GCC) observed among male employees in one of the six car-manufacturing plants that is located in a geographic area where farming is frequent. METHODS: A cohort based case-control study was conducted among workers in six car-manufacturing plants located in areas with different industrial structure. The study involved 188 cases of germ cell cancer identified through active retrieval in 38 hospitals and 1000 controls, drawn from administrative accounting files, individually matched by year of birth (+/- 2 years). Information regarding tasks and exposures and potential confounding variables were obtained by face-to-face or telephone interviews. Odds ratios (OR) and 95% confidence intervals (CI) were estimated using a conditional logistic regression model adjusted for cryptorchidism and other potential confounders. RESULTS: In this case-control study 5.3% of cases and 6.3% of controls ever worked in agriculture or livestock farming. No increased risks were observed for working in agriculture (OR=0.8 95% CI: 0.4-1.6), livestock farming (OR=0.8 95% CI: 0.4-1.6) or for exposure to pesticides (OR=0.7 95% CI: 0.3-1.7), for exposure to fertilizers (OR=0.8 95% CI: 0.4-1.8) and disinfectants (OR=1.0 95% CI: 0.3-2.8). There were no statistically significant increases in risk associated with ever exposure to salt based wood protection agents (OR=2.3 95% CI: 0.6-9.1), working with plywood (OR=1.4 95% CI: 0.6-3.2), coated wood (OR=1.4 95% CI: 0.5-3.9) or working in forestry (OR=1.7 95% CI: 0.5-6.4). Lagging of exposures did not alter the results. CONCLUSIONS: The observed excess incidence in the cohort of automotive workers can be hardly explained by previous or concurrent work in farming or forestry. Because of the small numbers of subjects ever employed in farming the statistical power in assessing associations between agricultural work and agricultural exposures was limited and does not allow final conclusions about the association of farming related exposures and GCC risk.	Cancer Epidemiology	35	1	26846	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Germany	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
894	N. Senanayake, G. Gurunathan, T. B. Hart, P. Amerasinghe, M. Babapulle, S. B. Ellapola, M. Udupihille and V. Basanayake	An epidemiological study of the health of Sri Lankan tea plantation workers associated with long term exposure to paraquat	1993	Pulmonary function tests (FVC, FEV1, FEV1/FVC%, TLCO, single breath CO diffusion), chest x ray film, renal function (serum creatinine and blood urea nitrogen), liver function (serum alanine aminotransferase, aspartate transferase, and alkaline phosphatase, bilirubin, total protein, and albumin), a haematological screen (haemoglobin and packed cell volume), and a general clinical examination were performed on 85 paraquat spraymen (mean spraying time 12 years) and on two control groups (76 factory workers and 79 general workers) frequency matched for age and years of occupational service. All the subjects were men. There were no clinically important differences in any of the measurements made between the study group and the two control groups. In particular the results of the lung function tests, appropriate for paraquat toxicity of the study group, were similar to those of the control groups. The same was true of blood tests for liver and kidney function. The incidence of skin damage, nose bleeds, and nail damage in the study group was slightly higher than in the control groups but lower than the incidence reported for paraquat workers in previous studies. The results of this study confirmed that long term spraying of paraquat, at the concentrations used, produced no adverse health effects, in particular no lung damage, attributable to the occupational use of the herbicide.	British Journal of Industrial Medicine	50	3	257-63	Self-reported exposure			Cross-sectional	Specific active ingredient	pesticide-related symptoms	self-reported	Sri Lanka	lmic
895	N. Spinder, J. E. H. Bergman, H. M. Boezen, R. C. H. Vermeulen, H. Kromhout and H. E. K. de Walle	Maternal occupational exposure and oral clefts in offspring	2017	BACKGROUND: Previous studies suggest that periconceptional maternal occupational exposure to solvents and pesticides increase the risk of oral clefts in the offspring. Less is known about the effect of occupational exposure to metals, dust, and gases and fumes on development of oral clefts. METHODS: This case-malformed control study used data from a population-based birth defects registry (Eurocat) of children and foetuses born in the Northern Netherlands between 1997 and 2013. Cases were defined as non-syndromic oral clefts. The first control group had chromosomal/monogenic defects, and the second control group was defined as non-chromosomal/non-monogenic malformed controls. Maternal occupational exposure was estimated through linkage of mothers' occupation with a community-based Job Exposure Matrix (JEM). Multivariate logistic regression was used to estimate the effect of occupational exposures. Odds ratios were adjusted (aORs) for relevant confounders. RESULTS: A total of 387 cases, 1135 chromosomal and 4352 non-chromosomal malformed controls were included in this study. Prevalence of maternal occupational exposures to all agents was 43.9% and 41.0%/37.7% among cases and controls, respectively. Oral clefts had significantly increased ORs of maternal occupational exposure to pesticides (aOR = 1.7, 95% confidence interval [CI] 1.0-3.1) and dust (aOR = 1.3, 95% CI 1.1-1.6) when using non-chromosomal controls. Subgroup analysis for CL(P) stratified by gender showed a significantly increased risk for male infants exposed to 'other solvents' and exposure to mineral dust for female infants. CONCLUSION: Our study showed that maternal occupational exposure to pesticides and dust are risk factors for oral clefts in the offspring. Larger studies are needed to confirm this finding.	Environmental Health: A Global Access Science Source	16	1	83	Job exposure matrix			Case-control	Pesticides in general	offspring	doctor-diagnosed	Netherlands	hic
896	N. T. Fear, E. Roman, G. Reeves and B. Pannett	Childhood cancer and paternal employment in agriculture: the role of pesticides	1998	Previous studies have suggested that the offspring of men potentially exposed to pesticides at work may be at increased risk of kidney cancer (Wilms' tumour), brain tumours, Ewing's bone sarcoma and acute leukaemia. This paper examines the association between potential occupational exposure of fathers to pesticides and offspring's death from cancer in a large national database. Records for 167703 childhood deaths occurring during 1959-63, 1970-78 and 1979-90 in England and Wales have been analysed. Among the offspring of men with potential occupational exposure to pesticides there were 5270 deaths, of which 449 were due to cancer. Associations were assessed using proportional mortality ratios (PMRs), with adjustment for age, year of death and paternal social class. Of the childhood cancers previously linked with potential paternal occupational exposure to pesticides, the only statistically significant excess was for kidney cancer (PMR=1.59, 95% CI=1.18-2.15, based on 42 deaths). Although these results offer some support for the suggestion that paternal occupational exposure to pesticides may be related to the subsequent development of kidney cancer in offspring, other explanations cannot be excluded. In the light of the findings presented here and elsewhere, further, more detailed, research into the nature of this relationship is warranted.	British Journal of Cancer	77	5	825-9	Registers			Cohort (prospective)	Job title	offspring	doctor-diagnosed	UK	hic
897	N. T. Fear, K. Hey, T. Vincent and M. Murphy	Paternal occupation and neural tube defects: a case-control study based on the Oxford Record Linkage Study register	2007	Certain paternal occupations and related exposures have been suggested as possible risk factors for neural tube defects (NTD). We analysed data collected as part of a case-control study to investigate the relationship between paternal occupational exposures and NTD. Cases were 694 NTD-affected pregnancies diagnosed between 1970 and 1987 in Oxfordshire or West Berkshire, England. Controls were randomly selected from a computerised maternity database individually matched to cases on maternal year of birth and year of index pregnancy. Data on paternal occupation were abstracted from hospital antenatal records. Associations between paternal occupational exposures and NTD were assessed using odds ratios adjusted for maternal year of birth, year of index pregnancy, gender of baby, multiplicity of birth and number of previous obstetric events. Statistically significant positive associations were observed for paternal occupational exposure to agrochemicals and animals. Analysis by occupational title revealed that more case than control fathers were farmers, gardeners and butchers. Statistically significant negative associations were seen for paternal occupational exposure to inhaled hydrocarbons and metal-working oil mists. The findings from this population-based study for paternal agricultural and animal-related occupations overlap and have been previously observed. The apparent protective effects of fathers working with inhaled hydrocarbons and metal-working oil mists have not been previously described. No underlying biological mechanisms have been identified, therefore other explanations cannot be excluded.	Paediatric and Perinatal Epidemiology	21	2	163-8	Registers			Case-control	Job title	offspring	doctor-diagnosed	UK	hic
898	N. T. Fear, T. J. Vincent, J. C. King, A. MacCarthy, K. J. Bunch and M. F. Murphy	Wilms tumour and paternal occupation: an analysis of data from the National Registry of Childhood Tumours	2009	BACKGROUND: Wilms tumour is an embryonal malignant tumour that accounts for 90% of childhood kidney cancers. Parental occupational exposure has been hypothesised to be a cause of childhood Wilms tumour, in particular exposure to pesticides. However, the findings are inconsistent. PROCEDURE: We have examined the association between paternal occupational exposures and Wilms tumour using birth registration data for cases (n = 2568) from the National Registry of Childhood Tumours (NRCT) and matched controls (n = 2,568) drawn from the general population of Great Britain. Paternal occupation, as recorded at the time of birth, was used to infer "occupational exposure" using a previously defined occupational exposure classification scheme. Odds ratios and 95% confidence intervals were generated using conditional logistic regression with exact methods to estimate the association between each paternal occupational exposure group and childhood Wilms tumour. RESULTS: All odds ratios were close to 1.00 and no statistically significant associations were observed. CONCLUSION: The results of this study failed to support any of the previously identified associations between paternal occupation and childhood Wilms tumour.	Pediatric Blood & Cancer	53	1	28-32	Job title			Case-control	Job title	cancer	doctor-diagnosed	UK	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
899	N. T. Tagiyeva, E.; Fielding, S.; Devereux, G.; Semple, S.; Douglas, G.	Occupational exposure to asthmagens and adult onset wheeze and lung function in people who did not have childhood wheeze: A 50-year cohort study	2016	BACKGROUND: There are few prospective studies that relate the development of adult respiratory disease with exposure to occupational asthmagens. OBJECTIVE: To evaluate the risk of adult onset wheeze (AOW) and obstructive lung function associated with occupational exposures over 50years. METHODS: A population-based randomly selected cohort of children who had not had asthma or wheezing illness, recruited in 1964 at age 10-15years, was followed-up in 1989, 1995, 2001 and 2014 by spirometry and respiratory questionnaire. Occupational histories were obtained in 2014 and occupational exposures determined with an asthma-specific job exposure matrix. The risk of AOW and lung function impairment was analysed in subjects without childhood wheeze using logistic regression and linear mixed effects models. RESULTS: All 237 subjects (mean age: 61years, 47% male, 52% ever smoked) who took part in the 2014 follow-up had completed spirometry. Among those who did not have childhood wheeze, spirometry was measured in 93 subjects in 1989, in 312 in 1995 and in 270 subjects in 2001 follow-up. For longitudinal analysis of changes in FEV1 between 1989 and 2014 spirometry records were available on 191 subjects at three time points and on 45 subjects at two time points, with a total number of 663 records. AOW and FEV1<LLN were associated with occupational exposure to food-related asthmagens (adjusted odds ratios (adjORs) 95% CI: 2.7 [1.4, 5.1] and 2.9 [1.1, 7.7]) and biocides/fungicides (adjOR 95% CI: 1.8 [1.1, 3.1] and 3.4 [1.1, 10.8]), with evident dose-response effect (p-trends<0.05). Exposure to food-related asthmagens was also associated with reduced FEV1, FVC and FEF25-75% (adjusted regression coefficients 95% CI: -7.2 [-12.0, -2.4], -6.2 [-10.9, -1.4], and -13.3[-23.4, -3.3]). Exposure to wood dust was independently associated with AOW, obstructive lung function and reduced FEF25-75%. Excess FEV1 decline of 6-8ml/year was observed with occupational exposure to any asthmagen, biocides/fungicides and food-related asthmagens (p<0.05). CONCLUSIONS: This longitudinal study confirmed previous findings of increased risks of adult onset wheezing illness with occupational exposure to specific asthmagens. A novel finding was the identification of food-related asthmagens and biocides/fungicides as potential new occupational risk factors for lung function impairment in adults without childhood wheeze.	Environment International	94	NA	60-68	Job exposure matrix			Cohort (prospective)	Type of pesticide	respiratory	self-reported	UK	hic
900	N. Tahmaz, A. Soutar and J. W. Cherrie	Chronic fatigue and organophosphate pesticides in sheep farming: a retrospective study amongst people reporting to a UK pharmacovigilance scheme	2003	The Department of Health has recently published a report from the CFS/ME Working Group which concluded that chronic fatigue syndrome (CFS) should be recognized as a chronic illness. Symptoms consistent with CFS are often reported by people who consider their health has been affected by exposure to pesticides, but the Working Group concluded that this type of exposure is not a common trigger for the syndrome. The Veterinary Medicines Directorate (VMD) collects self-assessed reports of ill health in humans associated with veterinary medicines under their Suspected Adverse Reaction Surveillance Scheme. The reporters have mainly been sheep farmers. These reports were used to investigate the possible relationship between chronic fatigue (CF) and exposure to organophosphate pesticides in sheep farming. The overall aim of the study was to investigate a possible association between exposure to organophosphates and the development of CF amongst people who consider their health has been affected by pesticides in sheep farming. The hypothesis investigated was that repeated exposure to organophosphate pesticides in sheep dip may increase the probability of developing CF. A group of mostly sheep farmers who had reported to the VMD surveillance scheme were identified. We planned to use a retrospective case-control study design but the initial symptoms reports were not sufficiently reliable to enable this. The study population was asked to complete two questionnaires. The first questionnaire was designed to identify the history of exposure of subjects to organophosphate pesticides, and their exposure was then reconstructed using a metric specifically developed for this purpose. The second questionnaire collected detailed information to identify whether the subjects had CF when they originally reported to the VMD and at the time of the survey. The questionnaire was sent to a total of 206 subjects, of whom 28 had moved home. A total of 37% of the remaining 178 subjects participated. There was a high prevalence of CF amongst those who completed the questionnaire and this has generally persisted since the subjects reported to the VMD. Higher CF scores were associated with higher exposure to organophosphate pesticides. CF is very common amongst those who consider their health was affected by pesticides and we have shown there is limited evidence of an association between exposure to organophosphates and CF. Further research is needed to investigate the cause of this syndrome amongst farmers exposed to pesticides.	Annals of Occupational Hygiene	47	4	261-7	Algorithm/model	Self-reported exposure		Cross-sectional	Chemical class	neurological	self-reported	UK	hic
901	O. E. Oddone, C. P. Crosignani, S. A. Scaburri, B. E. Bai, M. C. Modonesi, I. M. Imbriani and B. R. Bergamaschi	Occupation and multiple sclerosis: An Italian case-control study	2013	Objectives The aim of the study is to explore possible relationships between occupational exposures and Multiple Sclerosis (MS), whose etiology is not well defined yet. To date, only few literature data are available on this subject. A more detailed study on this topic will be proposed as research theme to the Italian Ministry of Health. Methods We carried out a case-control study, where cases were MS patients included in the MS Register of the Province of Pavia, Northern Italy, and controls, 1:4 matched by sex and age (5 years classes), were randomly selected from the National Health Service population files. The occupational histories were obtained from Italian Institute for Social Security (INPS) archives by automatic linkage using Italian Occupational Cancer Monitoring (OCCAM) method that estimates the risk of specific occupational cancers, by geographic area and industrial sector. OR adjusted for sex and age and corresponding 90% confidence intervals were used to estimate the association between exposure and disease. Results We included in the study 183 MS patients (106 (57,9%) female, 77 (42,1%) male) and 769 controls. Our results suggest an increased risk for men in mechanical manufacturing industry (OR 2.37, 90% CI 1.23-4.58, p = 0.031, 22 cases) and agriculture (OR 4.05, 90% CI 1.20-13.69, p = 0.059, 4 cases). Women show an increased risk in mechanical manufacturing industry (OR 4.31, 90% CI 1.71-10.86, p = 0.009, 8 cases), agriculture (OR 13.18, 90% CI 2.91-59.61, p = 0.005, 3 cases) and leather/shoe industry (OR 7.75, 90% CI 2.49-24.07, p = 0.003, 6 cases). Conclusions Our preliminary findings indicate that solvent exposures could be related to the risk of MS, as both shoe/leather workers and mechanical manufacturing industry workers are exposed to organic solvents. Interestingly, a major risk of MS was also found among workers engaged in agriculture, suggesting a role of pesticides, whose neurotoxic effect is well known.	Occupational and Environmental Medicine	70	NA	NA	Registers			Case-control	Job title	neurological	doctor-diagnosed	Italy	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
902	O. Febvey, J. Schuz, H. D. Bailey, J. Clavel, B. Lacour, L. Orsi, T. Lightfoot, E. Roman, R. Vermeulen, H. Kromhout and A. Olsson	Risk of Central Nervous System Tumors in Children Related to Parental Occupational Pesticide Exposures in three European Case-Control Studies	2016	OBJECTIVE: The aim of this study was to assess the risk of childhood central nervous system (CNS) tumors associated with parental occupational pesticide exposure. METHODS: We pooled three population-based case-control studies from France, Germany, and the United Kingdom. Cases were children below 15 years of age with CNS tumors; controls were matched by gender and age. A general population job-exposure matrix assessed parental occupational pesticide exposure. Logistic regressions estimated odds ratios (ORs) and 95% confidence intervals (CIs). RESULTS: The study included 1361 cases and 5498 controls. Prevalence of maternal occupational pesticide exposure during pregnancy was low and no association with childhood CNS tumors was detected (OR 0.76, 95% CI: 0.41 to 1.41). Around conception, OR for childhood CNS tumors associated with paternal occupational pesticide exposure was 0.71 (95% CI: 0.53 to 0.95). CONCLUSION: Our results do not suggest a role of parental occupational pesticide exposure in the etiology of childhood CNS tumors.	Journal of Occupational & Environmental Medicine	58	10	1046-1052	Job exposure matrix			Case-control	Pesticides in general	offspring	doctor-diagnosed	AHIC	AHIC
903	O. Gomez-Marin, L. E. Fleming, D. J. Lee, W. LeBlanc, D. Zheng, F. Ma, D. Jane, T. Pitman and A. Caban, Jr.	Acute and chronic disability among U.S. farmers and pesticide applicators: the National Health Interview Survey (NHIS)	2004	The National Health Interview Survey (NHIS) is a multipurpose household survey of the U.S. civilian non-institutionalized population conducted annually since 1957. From 1986 to 1994, over 450,000 U.S. workers, age 18 years and older, participated in a probability sampling of the entire non-institutionalized U.S. population; variables collected included a range of measures of acute and chronic disability. The objective of the present study was to assess predictors of health status, and acute and chronic disability for farmers and pesticide applicators (pesticide-exposed workers) compared to all other U.S. workers using the 1986-1994 NHIS. After adjustment for sample weights and design effects using SUDAAN, several measures of acute and chronic disability and health status were modeled with multiple logistic regression. Farmers (n = 9576) were significantly older compared to all other U.S. workers (n = 453,219) and pesticide applicators (n = 180). Farmers and pesticide applicators had a higher proportion of males, whites, and Hispanics and were less educated. After adjusting for age, gender, race-ethnicity, and education, compared to all other workers, farmers were significantly less likely to report acute and chronic disability and health conditions, while pesticide applicators were more likely to report chronic disability, health conditions, and poor health. Given the cross-sectional nature of the data and the significant job demands of farming, both leading to a relative healthy worker effect, the present results indicate that at any point in time, farmers report less acute and chronic disability, compared to other U.S. workers, whereas pesticide applicators report similar or poorer health.	Journal of Agricultural Safety & Health	10	4	275-85	Job title			Cohort (prospective)	Job title	other	other	USA	hic
904	O. H. Lopez, A. F.; Rodrigo, L.; Gil, F.; Pena, G.; Serrano, J. L.; Parron, T.; Villanueva, E.; Pla, A.	Changes in antioxidant enzymes in humans with long-term exposure to pesticides	2007	Different pesticides, including organophosphates (OPs), have been reported to induce oxidative stress due to generation of free radicals and alteration in antioxidant defence mechanisms. In this study, a cohort of 81 intensive agriculture workers (pesticide sprayers) was assessed twice during the course of a spraying season for changes in erythrocyte antioxidant enzymes. Acetylcholinesterase (AChE) was used as a reference biomarker. Sprayers presented lower levels of superoxide dismutase (SOD) and glutathione reductase (GR) as compared to controls independently of age, BMI, smoking habit or alcohol consumption. A positive correlation between SOD and AChE was observed at the high exposure period. Those individuals with a decrease in AChE greater than 15% exhibited lower SOD and catalase (CAT) activities at the same period. Glutathione peroxidase (GPx) and glucose-6-phosphate dehydrogenase (G6PDH) remained unaffected in the exposed population. Paraoxonase (PON1) polymorphism influenced erythrocyte CAT and GR, as subjects with the R allele presented lower CAT and higher GR levels. Whether or not the decreased enzyme activities found in this study are linked to the adverse health effects related to chronic pesticide toxicity (in which oxidative damage plays a pathophysiological role, such as cancer or neurodegenerative disorders) is an attractive hypothesis that warrants further investigation.	Toxicology Letters	171	3	146-53	Biomonitoring (blood)			Cohort (prospective)	Chemical class	genetic (biomarkers)	medical test result	Spain	hic
905	O. K. Landgren, R. A.; Hoppin, J. A.; Beane Freeman, L. E.; Cerhan, J. R.; Katzmann, J. A.; Rajkumar, S. V.; Alavanja, M. C.	Pesticide exposure and risk of monoclonal gammopathy of undetermined significance in the Agricultural Health Study	2009	Pesticides are associated with excess risk of multiple myeloma, albeit inconclusively. We included 678 men (30-94 years) from a well-characterized prospective cohort of restricted-use pesticide applicators to assess the risk of monoclonal gammopathy of undetermined significance (MGUS). Serum samples from all subjects were analyzed by electrophoresis performed on agarose gel; samples with a discrete or localized band were subjected to immunofixation. Age-adjusted prevalence estimates of MGUS were compared with MGUS prevalence in 9469 men from Minnesota. Associations between pesticide exposures and MGUS prevalence were assessed by logistic regression models adjusted for age and education level. Among study participants older than 50 years (n = 555), 38 were found to have MGUS, yielding a prevalence of 6.8% (95% CI, 5.0%-9.3%). Compared with men from Minnesota, the age-adjusted prevalence of MGUS was 1.9-fold (95% CI, 1.3- to 2.7-fold) higher among male pesticide applicators. Among applicators, a 5.6-fold (95% CI, 1.9- to 16.6-fold), 3.9-fold (95% CI, 1.5- to 10.0-fold), and 2.4-fold (95% CI, 1.1- to 5.3-fold) increased risk of MGUS prevalence was observed among users of the chlorinated insecticide dieldrin, the fumigant mixture carbon-tetrachloride/carbon disulfide, and the fungicide chlorothalonil, respectively. In summary, the prevalence of MGUS among pesticide applicators was twice that in a population-based sample of men from Minnesota, adding support to the hypothesis that specific pesticides are causatively linked to myelomagenesis.	Blood	113	25	6386-91	Self-reported exposure			Cohort (prospective)	Specific active ingredient	other	other	USA	hic

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906	O. Nanni, D. Amadori, C. Lugaresi, F. Falcini, E. Scarpi, A. Saragoni and E. Buiatti	Chronic lymphocytic leukaemias and non-Hodgkin's lymphomas by histological type in farming-animal breeding workers: a population case-control study based on a priori exposure matrices	1996	OBJECTIVES: A population based case-control study was conducted in a highly agricultural area in Italy to investigate the association between chronic lymphocytic leukaemias (CLLs) and non-Hodgkin's lymphomas (NHLs), and subtypes, and exposure to pesticides in farming-animal breeding workers. METHODS: 187 cases of CLLs and NHLs and 977 population controls were interviewed on medical, residential, family, and occupational history. Detailed information was collected about cultivated crops and animals bred from subjects who worked in farming and animal breeding. Information on crop diseases and pesticides used (and their quantity and duration) was also obtained. A priori job-exposure matrices were applied when a crop disease was reported, estimating the most probable pesticide and, when possible, an estimate of the cumulative dose. Odds ratios (ORs) were calculated by unconditional logistic analysis with adjustment for relevant confounders in farmers who bred animals and in farmers alone, for the main crops, types of animals, and pesticides categories. First recall and then the matrices were used for defining exposure, as it affected CLLs and NHLs and then separately on CLLs and low grade NHLs. Finally, the dose-response was investigated for those pesticides which had shown some association. RESULTS: No variable under study was associated with work in farming alone. In farming and animal breeding, no crop or animal showed an association with CLLs and NHLs when adjusted by exposure during childhood to farming and animal breeding (an indicator of life in a farming and animal breeding environment before the age of 13, which behaved as an independent risk variable). A non-significant association was found with stannates, arsenates, phosphates, and dichloro-diphenyl-trichloroethane (DDT) based on recall, and for stannates, arsenates, and DDT after the application of the matrices. When CLLs together with low grade NHLs were considered, the association with insecticides in general, carbamates, and phosphates became significant according to personal recall (ORs and 95% confidence intervals (95% CIs) 2.46, 1.07-5.63; 3.08, 1.05-9.00; 2.97, 1.28-6.91, respectively). The application of the matrices also showed a risk of borderline significance for stannates and dithiocarbamates. A significant dose-response effect was found for phosphates (for logarithmic unit increase, OR 1.17, 95% CI 1.00-1.57); a strong trend for stannates and carbamates did not reach significance. CONCLUSION: The association of CLLs and NHLs with work in farming-animal breeding is partially explained by exposure to pesticides-namely insecticides (carbamates, phosphates, and DDT) and stannates-possibly related to their use in animal breeding. The association is limited to cases of CLL and low grade NHL. The independent effect of the variable exposure during childhood	Occupational & Environmental Medicine	53	10	652-7	Self-reported exposure			Case-control	Chemical class	cancer	doctor-diagnosed	Italy	hic
907	O. Nanni, F. Falcini, E. Buiatti, L. Bucchi, M. Naldoni, P. Serra, E. Scarpi, L. Saragoni and D. Amadori	Multiple myeloma and work in agriculture: results of a case-control study in Forli, Italy	1998	OBJECTIVES: To evaluate the relation between the exposure to specific pesticides in agricultural work and the risk of multiple myeloma (MM). METHODS: A case-control study was conducted in the province of Forli, Italy. Forty-six cases of MM (20 females, 26 males; mean age 64 years, range 40 to 74) identified through the Romagna Cancer Registry in the years 1987-90, and 230 age- and gender-matched controls from the general population were interviewed in-person using a structured questionnaire focused on exposure to pesticides and other occupational and nonoccupational variables. RESULTS: Among nonoccupational factors, the education level and the altitude of the place of residence were related inversely to MM risk. First-degree familiarity for hematolymphopoietic neoplasias and previous herpes zoster diagnosis were associated positively with the disease. A nonsignificant increase in MM risk was observed among workers in agriculture as a whole (odds ratio [OR] = 1.31, 95 percent confidence interval [CI] = 0.62-2.74). An increased risk was associated specifically with the cultivation of apples and pears (OR = 1.75, CI = 1.05-2.91). As regards pesticide exposure, only the chlorinated insecticides were related to an increase in the risk of MM. CONCLUSIONS: This study suggests that agricultural work and exposure to pesticides have a role in the etiology of MM.	Cancer Causes & Control	9	3	277-83	Self-reported exposure			Case-control	Chemical class	cancer	doctor-diagnosed	Italy	hic
908	O. S. Landgren, Y. K.; Michalek, J.; Costello, R.; Burton, D.; Ketchum, N.; Calvo, K. R.; Caporaso, N.; Raveche, E.; Middleton, D.; Marti, G.; Vogt, R. F., Jr.	Agent Orange Exposure and Monoclonal Gammopathy of Undetermined Significance: An Operation Ranch Hand Veteran Cohort Study	2015	IMPORTANCE: Multiple myeloma has been classified as exhibiting "limited or suggestive evidence" of an association with exposure to herbicides in Vietnam War veterans. Occupational studies have shown that other pesticides (ie, insecticides, herbicides, fungicides) are associated with excess risk of multiple myeloma and its precursor state, monoclonal gammopathy of undetermined significance (MGUS); however, to our knowledge, no studies have uncovered such an association in Vietnam War veterans. OBJECTIVE: To examine the relationship between MGUS and exposure to Agent Orange, including its contaminant 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), in Vietnam War veterans. DESIGN, SETTING, AND PARTICIPANTS: This was a prospective cohort study conducted in 2013 to 2014, testing for MGUS in serum specimens collected and stored in 2002 by the Air Force Health Study (AFHS). The relevant exposure data collected by the AFHS was also used. We tested all specimens in 2013 without knowledge of the exposure status. The AFHS included former US Air Force personnel who participated in Operation Ranch Hand (Ranch Hand veterans) and other US Air Force personnel who had similar duties in Southeast Asia during the same time period (1962 to 1971) but were not involved in herbicide spray missions (comparison veterans). Agent Orange was used by the US Air Force personnel who conducted aerial spray missions of herbicides (Operation Ranch Hand) in Vietnam from 1962 to 1971. We included 479 Ranch Hand veterans and 479 comparison veterans who participated in the 2002 follow-up examination of AFHS. EXPOSURES: Agent Orange and TCDD. Serum TCDD levels were measured in 1987, 1992, 1997, and 2002. MAIN OUTCOMES AND MEASURES: Risk of MGUS measured by prevalence, odds ratios (ORs), and 95% CIs. RESULTS: The 479 Ranch Hand veterans and 479 comparison veterans had similar demographic and lifestyle characteristics and medical histories. The crude prevalence of overall MGUS was 7.1% (34 of 479) in Ranch Hand veterans and 3.1% (15 of 479) in comparison veterans. This translated into a 2.4-fold increased risk for MGUS in Ranch Hand veterans than comparison veterans after adjusting for age, race, BMI in 2002, and the change in BMI between 2002 and the time of blood draw for TCDD measurement (adjusted OR, 2.37; 95% CI, 1.27-4.44; P=.007). CONCLUSIONS AND RELEVANCE: Operation Ranch Hand veterans have a significantly increased risk of MGUS, supporting an association between Agent Orange exposure and multiple myeloma.	JAMA Oncology	1	8	1061-8	Biomonitoring (blood)			Cohort (prospective)	Chemical class	other	other	USA	hic
909	O. Sorg	Association between agent orange exposure and nonmelanotic invasive skin cancer: a pilot study	2015	NA	Plastic & Reconstructive Surgery	135	1	233e-4e	Self-reported exposure			Cohort (retrospective)	Chemical class	cancer	doctor-diagnosed	USA?	hic

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910	O. Wong, F. Harris, T. W. Armstrong and F. Hua	A hospital-based case-control study of acute myeloid leukemia in Shanghai: analysis of environmental and occupational risk factors by subtypes of the WHO classification	2010	The objectives were: (1) to investigate potential environmental and occupational risk factors of acute myeloid leukemia (AML), and (2) to explore the relationships between risk factors and AML subtypes according to the World Health Organization (WHO) classification. The investigation was a hospital-based case-control study consisting of 722 newly diagnosed AML cases (August 2003 through June 2007) and 1444 individually gender-age-matched patient controls at 29 hospitals in Shanghai. A 17-page questionnaire was used to obtain information on demographics, medical history, family history, lifestyle risk factors, employment history, residential history, and occupational and non-occupational exposures. Certain occupations of interest triggered a second questionnaire, which was occupation-specific and asked for more details about jobs, tasks, materials used and work environment. Exposure assessments were based on the questionnaires, on-site workplace investigations, data published in the Chinese literature, historical exposure measurements maintained by government health agencies, and expert opinions of a panel of local scientists who were familiar with workplaces in Shanghai. Risk estimates (odds ratios and 95% confidence intervals) of individual risk factors were calculated using conditional logistic regression models. A number of potential environmental and occupational risk factors were associated with an increased risk of AML (all subtypes combined) and/or individual subtypes; including home or workplace renovation, living on a farm, planting crops, raising livestock or animals, farm workers, metal workers, rubber and plastic workers, wood and furniture workers, printers, loading and unloading workers, automobile manufacturing, general construction, and food and beverage industry (restaurants and other eateries). Exposures associated with an increased risk of AML (all subtypes combined) and/or individual subtypes included benzene, diesel fuel, metals, insecticides, fertilizers, glues and adhesives, paints and other coatings, and inks and pigments. Multivariate models were used to adjust for potential confounding exposures, and several potential risk factors were subsequently eliminated. The results of the investigation indicated that some risk factors applied to all or most subtypes (e.g., living on a farm and overall AML and several subtypes), while others to specific subtypes only (e.g., raising livestock and AML with multilineage dysplasia). Thus, some risk factors were subtype-specific. The difference in risk by subtype underscores the importance of the etiologic commonality and heterogeneity of AML subtypes.	Chemico-Biological Interactions	184	1	112-28	Self-reported job history			Case-control	Type of pesticide	cancer	doctor-diagnosed	China	umic
911	O. Wong, F. Harris, T. W. Armstrong and F. Hua	A hospital-based case-control study of non-Hodgkin lymphoid neoplasms in Shanghai: analysis of environmental and occupational risk factors by subtypes of the WHO classification	2010	The objectives were (1) to investigate potential environmental and occupational risk factors of non-Hodgkin lymphoid neoplasms (NHLN), and (2) to explore the relationships between risk factors and NHLN subtypes according to the World Health Organization (WHO) classification. The investigation was a hospital-based case-control study consisting of 649 newly diagnosed NHLN cases (August 2003 through January 2008) and 1298 individually gender-age-matched patient controls at 25 hospitals in Shanghai. A 17-page questionnaire was used to obtain information on demographics, medical history, family history, lifestyle risk factors, employment history, residential history, and occupational and non-occupational exposures. Certain occupations of interest triggered a second questionnaire, which was occupation-specific and asked for more details about jobs, tasks, materials used and work environment. Exposure assessments were based on the questionnaires, on-site workplace investigations, data published in the Chinese literature, historical exposure measurements maintained by government health agencies, and expert opinions of a panel of local scientists who were familiar with workplaces in Shanghai. Risk estimates (odds ratios and 95% confidence intervals) of individual risk factors were calculated using conditional logistic regression models. A number of potential environmental and occupational risk factors were associated with an increased risk of NHLN (all subtypes combined) and/or individual subtypes; including home/workplace renovation, living on a farm, planting crops, raising livestock or animals, farm workers, fabric sewing and cutting workers, welders and sheet metal workers, masonry and plastering workers, product and chemical testing workers, toy manufacturing, agriculture industry, and beauty salon. Exposures associated with an increased risk of NHLN (all subtypes combined) and/or individual subtypes included benzene, solvents, petroleum fuels, metals, insecticides, herbicides, fertilizers, and glues and adhesives. Multivariate models were used to adjust for potential confounding exposures, and several potential risk factors were subsequently eliminated. The results of the investigation indicated that some risk factors applied to all or most subtypes (e.g., insecticides and overall NHLN and subtypes of B-cell lymphoid neoplasms), while others to specific subtypes only (e.g., benzene and follicular lymphoma). Thus, some risk factors were subtype-specific. The difference in risk by subtype underscores the importance of the etiologic commonality and heterogeneity of NHLN subtypes.	Chemico-Biological Interactions	184	1	129-46	Expert case-by-case assessment	Self-reported job history		Case-control	Type of pesticide	cancer	doctor-diagnosed	China	umic
912	O. Yi	Cytogenetic study on workmen occupationally exposed to pesticides	2009	A cytogenetic study was performed on 40 workmen who were exposed to the pesticides malathion and chlorpyrifos and on 30 healthy males who had not been so exposed. The exposed workers had a consistent increase in chromosome abnormalities including chromatid gap, chromatid break, isochromatid break, dicentric and ring chromosomes, as determined by the standard chromosome aberration assay, when compared to the control group. The incidence was significantly higher in exposed smokers than that for exposed non smokers and than that for the unexposed controls as well. These findings provide further evidence for the intrinsic mutagenic activity of the pesticides studied.	Balkan Journal of Medical Genetics	12	1	51-59	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Jordan	umic
913	P. A. Buffler, M. E. Ginevan, J. S. Mandel and D. K. Watkins	The Air Force health study: an epidemiologic retrospective	2011	In 1979, the U.S. Air Force announced that an epidemiologic study would be undertaken to determine whether the Air Force personnel involved in Operation Ranch Hand-the program responsible for herbicide spraying in Vietnam-had experienced adverse health effects as a result of that service. In January 1982 the Air Force Health Study (AFHS) protocol was approved and the 20 year matched cohort study consisting of independent mortality, morbidity and reproductive health components was initiated. This controversial study has been criticized regarding the study's potential scientific limitations as well as some of the administrative aspects of its conduct. Now, almost 30 years since the implementation of the AFHS and nearly a decade since the final follow up examinations, an appraisal of the study indicates that the results of the AFHS do not provide evidence of disease in the Ranch Hand veterans caused by their elevated levels of exposure to Agent Orange.	Annals of Epidemiology	21	9	673-87	Index			Cohort (prospective)	Chemical class	mortality (all cause)	doctor-diagnosed	USA	hic

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914	P. A. D. Demers, H. W.; Friesen, M. C.; Hertzman, C.; Ostry, A.; Hershler, R.; Teschke, K.	Cancer and occupational exposure to pentachlorophenol and tetrachlorophenol (Canada)	2006	OBJECTIVE: The objective of this study is to assess the carcinogenicity of pentachlorophenol and tetrachlorophenol using data from the BC sawmill workers cohort study. METHODS: The cohort consisted of 27,464 men employed by 14 sawmills for 1 year or more between 1950 and 1995. Fatal (1950-1995) and incident (1969-1995) cancers were identified using national registries. Plant records and systematic interviews with senior employees were used to estimate dermal exposure. Comparisons were made with the general BC population and dose-response relationships were assessed using Poisson regression. RESULTS: There were 1,495 fatal cancer and 2,571 incident cancers. There were no large or statistically significant excesses of any of the specific cancers were observed compared to the general population. Internal analyses showed strong dose-response relationships for non-Hodgkin's lymphoma, multiple myeloma, and kidney cancer. These relationships were strongest when exposure was restricted to pentachlorophenol. The strength of the dose-response increased when exposure was lagged by 20 years. CONCLUSIONS: Dermal exposure to pentachlorophenol was associated with non-Hodgkin's lymphoma, multiple myeloma, and kidney cancer, but not with other cancers of a priori interest.	Cancer Causes & Control	17	6	749-58	Registers			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	Canada	hic
915	P. A. Demers, T. L. Vaughan, T. D. Koepsell, J. L. Lyon, G. M. Swanson, R. S. Greenberg and N. S. Weiss	A case-control study of multiple myeloma and occupation	1993	Lifetime job histories from a population-based, case-control study were analyzed to investigate the relationship between multiple myeloma and employment in various occupations and industries. Interviews were obtained from 89% (692) of eligible incident cases and 83% (1683) of eligible controls. An elevated risk was observed among persons ever employed as painters [odds ratio (OR) = 2.1, 95% confidence interval (CI) = 1.2-3.6], particularly for those employed for 10 or more years (OR = 4.1, 95% CI = 1.8-10.4). A small excess risk was observed among agricultural workers employed for 10 or more years (OR = 1.3, 95% CI = 1.0-2.2), with a higher relative risk observed among farm laborers (OR = 1.8, 95% CI = 1.0-4.0). Among agricultural workers who reported having been highly exposed to pesticides, the OR was 5.2 (95% CI = 1.6-21.1). Some evidence, based on smaller numbers, was also found to support an association with firefighting and employment in the petroleum- and coal-products manufacturing industries. Little evidence was found to support the previously noted association with wood exposure, and no evidence for an association with employment in the rubber or petroleum refining industries was found. This study lends further support to previously reported associations between multiple myeloma and employment among painters and agricultural workers.	American Journal of Industrial Medicine	23	4	629-39	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	USA	hic
916	P. A. Fall, M. Fredrikson, O. Axelson and A. K. Granerus	Nutritional and occupational factors influencing the risk of Parkinson's disease: a case-control study in southeastern Sweden	1999	PURPOSE AND METHODS: To investigate the possible impact of nutritional and environmental risk factors for idiopathic Parkinson's disease (IP), a case-control study was performed in the county of Ostergotland in southeastern Sweden. The study involved 113 cases of IP and 263 control subjects. Dietary, drinking, and smoking habits, as well as previous occupation, were requested in a structured questionnaire. RESULTS: No increased risk was found for any of the nutritional items in which information was requested. A reduced risk was found for coffee, wine, and liquor at various consumption levels but also for fried or broiled meat, smoked ham or meat, eggs, French loaf or white bread, and tomatoes. All these food and drink items contain niacin. As in many studies, the frequency of preceding and present smoking was reduced in IP patients. Various occupational groups and exposures were analyzed and increased risks of IP in men were found for agricultural work along with pesticide exposure; this was also the case for male carpenters and female cleaners. CONCLUSIONS: The findings indicate that nutritional factors and occupational exposures, especially to pesticides, could be of etiologic importance in IP.	Movement Disorders	14	1	28-37	Self-reported job history			Case-control	Pesticides in general	neurological	doctor-diagnosed	Sweden	hic
917	P. A. Hessel, R. Kalmes, T. J. Smith, E. Lau, P. J. Mink and J. Mandel	A nested case-control study of prostate cancer and atrazine exposure	2004	Elevated prostate cancer incidence was found at a plant producing atrazine that had an intensive prostate screening program. This study tested the relationship among atrazine exposure, prostate cancer, and the screening program. Twelve cases and 130 control subjects were selected from the original cohort. Prostate screening and occupational histories were abstracted from company records and atrazine exposures were estimated. Hire date was comparable for cases and control subjects. Nearly half of the control subjects and no cases left before the prostate-specific antigen (PSA) screening program. Cases had more PSA tests than control subjects (odds ratio for > or =1 test, 8.54; 95% confidence interval, 1.69-82.20). There was no association between atrazine exposure and prostate cancer when those with > or =1 test were compared. There was no evidence for an association between atrazine and prostate cancer.	Journal of Occupational & Environmental Medicine	46	4	379-85	Expert case-by-case assessment	Self-reported job history		Case-control	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
918	P. A. Kern, S. Said, W. G. Jackson, Jr. and J. E. Michalek	Insulin sensitivity following agent orange exposure in Vietnam veterans with high blood levels of 2,3,7,8-tetrachlorodibenzo-p-dioxin	2004	Our objective was to determine whether insulin sensitivity was related to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in Vietnam veterans exposed to Agent Orange. Air Force veterans of Operation Ranch Hand, the unit responsible for spraying Agent Orange and other herbicides in Vietnam from 1962 to 1971, and comparison veterans who did not spray herbicides were included. We measured insulin sensitivity (S(I)) using a frequently sampled iv glucose tolerance test in a matched study of 29 matched pairs of veterans and a quantitative insulin sensitivity check index (QUICKI) based on fasting glucose and insulin in 71 matched pairs. No group differences were found with regard to the mean values of S(I), QUICKI, TNFalpha, adiponectin, and two measures of insulin secretion. However, S(I) and QUICKI decreased significantly with regard to TCDD (P = 0.01 and 0.02). A corresponding pattern (although not significant) was found for blood levels of TNFalpha and adiponectin. These data suggest that high blood TCDD levels may promote an insulin-resistant state, but the magnitude of this effect appeared to be small, such that an 18-fold increase in blood TCDD due to increased exposure resulted in only a 10% change in S(I) in the 29 matched pairs.	Journal of Clinical Endocrinology & Metabolism	89	9	4665-72	Registers			Cohort (prospective)	Chemical class	endocrine/nutritional/metabolical	medical test result	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
919	P. A. Kristensen, A.; Irgens, L. M.; Laake, P.; Bye, A. S.	Incidence and risk factors of cancer among men and women in Norwegian agriculture	1996	OBJECTIVES: The objective of the study was to examine cancer incidence and identify risk factors among subjects born in 1925-1971 and engaged in agricultural activities in Norway. METHODS: A cohort was established through linkage between agricultural censuses in 1969-1989 and the Central Population Register, which identifies farm holders and their spouses. Available census information on the activity of the farm provided the exposure indicators. Incident cancer in 1969-1991 was identified in the Cancer Register. In an analysis for standardized incidence ratios (SIR), the cohort was compared with the total rural population of Norway. Associations with exposure indicators were investigated in a Poisson regression analysis. RESULTS: In the follow-up of 136,463 men for 1.5 million person-years and 109,641 women for 0.6 million person-years, 3333 and 2145 cancer cases were identified, respectively. The subset defined as farmers had an SIR of 77 [95% confidence interval (95% CI) 73-81] for the men and 92 (95% CI 85-99) for the women, with particularly low SIR values for lung cancer and other sites linked to life-style. The several positive associations found confirmed the a priori hypothesis of an association between dairy farming and acute leukemia among men [rate ratio 1.76, 95% CI 1.02-3.05]. Multiple myeloma was associated with pesticide indicators for both genders, mainly for subjects cultivating potatoes. CONCLUSIONS: The results support the hypothesis of a relationship between acute leukemia and animal contact and between multiple myeloma and pesticides in potato cultivation. Other exposure associations, especially for cancer among women, warrant further investigation.	Scandinavian Journal of Work, Environment & Health	22	1	14-26	Registers			Cohort (prospective)	Job title	cancer	doctor-diagnosed	Norway	hic
920	P. A. MacLennan, E. Delzell, N. Sathiakumar and S. L. Myers	Mortality among triazine herbicide manufacturing workers	2003	Atrazine produces mammary gland cancer in one strain of rats and has been classified as an endocrine modulator. Epidemiologic studies have reported associations between agricultural use of atrazine and several forms of cancer. This study evaluated mortality patterns among workers at a plant that made atrazine and other triazine herbicides. The study covered the time period 1970-1997 and included 2213 people employed for at least 6 mo in operations related to the manufacture or formulation of atrazine and other triazine herbicides at a plant in Louisiana (LA). Vital status was determined for all but six subjects. Standardized mortality ratios (SMRs) with 95% confidence intervals (CIs) compared employees' mortality rates with those of the LA industrial corridor general population. Subjects had a total of 32,473 person-years of observation and a median of 15.8 yr since hire. There were 84 observed/118 expected deaths from all causes combined (SMR = 72, CI = 57-89) and 22/21 total cancer deaths (SMR = 106, CI = 66-160). Subjects had 4/1.1 deaths from non-Hodgkin's lymphoma (SMR = 372, CI = 101-952); this increase was not concentrated in the subgroup with long duration of employment and many years since hire. There were 6/4.8 (SMR = 124, CI = 46-271) digestive cancer and 7/6.3 (SMR = 112, CI = 45-230) lung cancer deaths. Data on other forms of cancer were sparse. This study was limited by its small size, by the relatively young age and short follow-up of its subjects, and by the lack of exposure data. It did not provide evidence that employment in triazine herbicide manufacturing and formulating operations was associated causally with overall or cause-specific mortality.	Journal of Toxicology & Environmental Health Part A	66	6	501-17	Job title			Cohort (prospective)	Specific active ingredient	mortality (all cause)	doctor-diagnosed	USA	hic
921	P. A. MacLennan, E. Delzell, N. Sathiakumar, S. L. Myers, H. Cheng, W. Grizzle, V. W. Chen and X. C. Wu	Cancer incidence among triazine herbicide manufacturing workers	2002	This study evaluated cancer incidence and prostate specific antigen (PSA) testing among workers at a plant in Louisiana (LA) that made atrazine and other triazine herbicides. The study covered the time period 1985 through 1997 and included 2045 subjects, of whom 757 worked for the company that owned the plant and 1288 were contract employees. Linkage with a population-based cancer registry and review of death certificates and plant medical records identified cancer cases. Standardized incidence ratios (SIRs) with 95% confidence intervals (CIs) compared subjects' cancer incidence rates with those of a regional general population. Plant medical records provided data on the proportion receiving PSA tests among male company employees. Subjects had 46 observed and 40 expected cases of all cancers combined (SIR = 114, CI = 83-152) and had 11/6.3 prostate cancers (SIR = 175, CI = 87-312). The prostate cancer excess was greater in actively working company employees (5/1.3, SIR = 394, CI = 128-920) than in contract employees or inactive company employees (6/5.0, SIR = 119, CI = 44-260) and was limited to men under 60 years of age. Of the 11 prostate cancer cases, nine were diagnosed at an early clinical stage. From 1993 to 1999, the proportion of male company employees who had at least one PSA test was 86% for those who reached 40 years of age while actively working and was 98% for those who reached 45 years of age. The observed prostate cancer increase may have been due to the frequent PSA testing of actively working company employees. There is no epidemiologic or other information that clearly supports a causal relation between atrazine and prostate cancer.	Journal of Occupational & Environmental Medicine	44	11	1048-58	Job title			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
922	P. A. Schulte, C. A. Burnett, M. F. Boeniger and J. Johnson	Neurodegenerative diseases: occupational occurrence and potential risk factors, 1982 through 1991	1996	OBJECTIVES: To identify potential occupational risk factors, this study examined the occupational occurrence of various neurodegenerative diseases. METHODS: Death certificates from 27 states in the National Occupational Mortality Surveillance System were evaluated for 1982 to 1991. Proportionate mortality ratios were calculated by occupation for presenile dementia, Alzheimer's disease, Parkinson's disease, and motor neuron disease. RESULTS: Excess mortality was observed for all four categories in the following occupational categories: teachers; medical personnel; machinists and machine operators; scientists; writers/designers/entertainers; and support and clerical workers. Clusters of three neurodegenerative diseases were also found in occupations involving pesticides, solvents, and electromagnetic fields and in legal, library, social, and religious work. Early death from motor neuron disease was found for firefighters, janitors, military personnel, teachers, excavation machine operators, and veterinarians, among others. CONCLUSIONS: Neurodegenerative disease occurs more frequently in some occupations than in others, and this distribution, which may indicate occupational risk factors, should be further investigated.	American Journal of Public Health	86	9	1281-8	Registers			Cohort (prospective)	Pesticides in general	neurological	doctor-diagnosed	USA	hic

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923	P. B. P. Ryan, T.; Panuwet, P.; Hongsibsong, S.; Naksen, W.; Srinual, N.; Kerdnoi, T.; Bernoudy, G.; D'Souza, P.; Hunter Jr, R. E.; Chen, X.; Riederer, A. M.; Barr, D. B.	Study of asian women, offspring development and environmental exposure (sawasdee): Pesticide exposure and neurodevelopmental effects in a thai birth cohort	2012	Background: Female agricultural workers in Northern Thailand are exposed to higher levels of pesticides than typical workers in the United States. Exposures experienced by these women before and during pregnancy may lead to neurodevelopmental delays in their offspring. Objectives: Our objective was to recruit fifty Thai female agricultural workers, evaluate their pesticide exposures during pregnancy, and assess the neurodevelopmental effects associated with such exposures on their newborn children. Methods: Pregnant women in Chiang Mai Province in northern Thailand were recruited for this study during their first trimester of pregnancy. Blood and urine samples were collected from woman during each prenatal visit with individual women supplying up to eight samples of each matrix. Serum samples were analyzed for parent pesticides including both organophosphorus (OP) and pyrethroid insecticides. Urine samples were analyzed for pesticide metabolites including both specific and non-specific biomarkers including dialkyl phosphates (DAPs) metabolites of OP insecticides. Results: We report results from the DAP measurements here contrasting with two studies done the United States. Total DAP concentrations in urine average 210 nmol/L in our study versus 102.8 and 72 for the CHAMACOS (Salinas, CA) and NHANES studies, respectively. Total dimethyl DAPs were 21, 74.2, and 50 nmol/L and diethyl DAPs were 136, 14.1, and 8.9 nmol/L for the three studies, respectively. Conclusions: Preliminary data of DAP metabolites of OP demonstrate female agricultural workers in Thailand have higher total exposures than females in the general US population and women in the CHAMACOS agricultural cohort.	Epidemiology	23	5	S102	Biomonitoring (urine)	Biomonitoring (blood)		Cohort (prospective)	Chemical class	offspring	medical test result	Thailand	umic
924	P. C. Valery, W. McWhirter, A. Sleigh, G. Williams and C. Bain	Farm exposures, parental occupation, and risk of Ewing's sarcoma in Australia: a national case-control study	2002	OBJECTIVE: It has been suggested that parental occupation, particularly farming, increased the risk of Ewing's sarcoma in the offspring. In a national case-control study we examined the relationship between farm and other parental occupational exposures and the risk of cancer in the offspring. METHODS: Cases were 106 persons with confirmed Ewing's sarcoma or peripheral primitive neuroectodermal tumor. Population-based controls (344) were selected randomly via telephone. Information was collected by interview (84% face-to-face). RESULTS: We found an excess of case mothers who worked on farms at conception and/or pregnancy (odds ratio (OR)=2.3. 95% confidence interval (CI) 0.5-12.0) and a slightly smaller excess of farming fathers, more case mothers usually worked as laborers, machine operators, or drivers (OR = 1.8, 95% CI 0.9-3.9). Risk doubled for those whose mothers handled pesticides and insecticides, or fathers who handled solvents and glues, and oils and greases. Further, more cases lived on farms (OR= 1.6, 95% CI 0.9-2.8). In the 0-20 years group, the risk doubled for those who ever lived on a farm (OR = 2.0, 95% CI 1.0-3.9), and more than tripled for those with farming fathers at conception and/or pregnancy (OR = 3.5, 95% CI 1.0-1 1.9). CONCLUSIONS: Our data support the general hypothesis of an association of Ewing's sarcoma family of tumors with farming, particularly at younger ages. who represent the bulk of cases, and are more likely to share etiologic factors.	Cancer Causes & Control	13	3	263-70	Self-reported exposure			Case-control	Type of pesticide	cancer	doctor-diagnosed	Australia	hic
925	P. Carbone, F. Giordano, F. Nori, A. Mantovani, D. Taruscio, L. Lauria and I. Figa-Talamanca	The possible role of endocrine disrupting chemicals in the aetiology of cryptorchidism and hypospadias: a population-based case-control study in rural Sicily	2007	Abstract This was an open case-control study of the possible association between parental occupational and domestic exposures to potential endocrine disrupting chemicals (EDC) assessed by questionnaire and cryptorchidism and hypospadias in their offspring in the agricultural area of Ragusa. Cases of infants born between 1998 and 2002 with either of these two malformations (n=90), and controls (n=203), were recruited through the paediatric services (for cases) and a random sample of healthy infants attending the same services born in the same period of time (for controls). Data on occupational and environmental exposures of parents prior to and during the index case (or control), were collected through interviews with both parents. Concerning occupational exposures, we did not find a statistically significant increase in risk among parents directly involved in agricultural work. We did find a non-statistically significant increase in risk for cryptorchidism in mothers employed in agriculture [adjusted odds ratios (OR) 2.97; 95% confidence interval (CI) 0.77-11.47] and with probable exposure to pesticides (adjusted OR 2.74; 95% CI 0.72-10.42). Fathers who had indirect contact with agricultural products (transport and retail) had an increased risk (not statistically significant) for cryptorchidism (adjusted OR 2.45; 95% CI 0.63-9.59) and hypospadias and cryptorchidism combined (adjusted OR 2.24; 95% CI 0.67-7.48). Increases in risk of the two malformations pooled were also observed in relation to the mother's age below 25 (adjusted OR 1.99; 95% CI 0.97-4.09), to the presence of genital disease of the father (adjusted OR 2.41; 95%C I0.94-6.17), and the mother (adjusted OR 3.47;95% CI 1.34-8.99), to low birth weight of the infant (adjusted OR 4.49; 95% CI 1.23-16.31). Increased risk was also observed for mothers consuming alcohol during pregnancy (adjusted OR 3.09; 95% CI 0.98-9.66), and for couples who conceived while using condoms (adjusted OR 2.12; 95% CI 1.02-4.41). The study therefore provides only limited support to the hypothesis of a possible association between the risk of cryptorchidism and hypospadias and the occupational exposure to EDC and agricultural work.	International Journal of Andrology	30	1	43172	Self-reported exposure			Case-control	Pesticides in general	offspring	doctor-diagnosed	Italy	hic
926	P. Cocco, A. Blair, P. Congia, G. Saba, C. Flore, M. R. Ecca and C. Palmas	Proportional mortality of dichloro-diphenyl-trichloroethane (DDT) workers: a preliminary report	1997	The authors conducted a proportional mortality study of 1,043 deaths that occurred between 1956 and 1992 among men who used mainly dichloro-diphenyl-trichloroethane (DDT) in an anti-malarial campaign in Sardinia, Italy, during the late 1940s. For each cause of interest, investigators compared observed deaths with expected deaths. The estimated DDT exposure ranged from 170 to 600 mg/m3 in indoor operations and from 24 to 86 mg/m3 in outdoor operations. Workers directly exposed to DDT had a significant increase in risk for liver and biliary tract cancers (PMR = 228; 95% confidence interval = 143, 345) and multiple myeloma (PMR = 341; 95% confidence interval = 110, 795). However, the PMR for liver and biliary tract cancers was also elevated among workers who did not have direct occupational contact with DDT, and the authors observed no increase in either PMR, by number of days in exposed jobs. Perhaps DDT did not increase the risk or perhaps occupational exposure, although quite high, did not further increase the risk, compared with the heavy baseline exposure of the entire Sardinian population, (i.e., mainly through diet and drinking water). Expansion of the cohort to include all exposed workers, and collection of information to improve exposure assessment are needed to clarify these findings.	Archives of Environmental Health	52	4	299-303	Job title	Algorithm/model		Cohort (prospective)	Specific active ingredient	mortality (all cause)	doctor-diagnosed	Italy	hic

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927	P. Cocco, A. Loviselli, D. Fadda, A. Ibba, M. Melis, A. Oppo, S. Serra, A. Taberlet, M. G. Tocco and C. Flore	Serum sex hormones in men occupationally exposed to dichloro-diphenyl-trichloro ethane (DDT) as young adults	2004	To explore endocrine effects in relation to para,para'-dichloro-diphenyl-dichloro ethylene (p,p'-DDE) body burden and past occupational exposure to its precursor dichloro-diphenyl-trichloro ethane (DDT), we assayed serum sex hormones, including serum luteinizing hormone (LH), follicle-stimulating hormone (FSH), 17beta-estradiol (E2), testosterone and sex hormone binding globulin (SHBG), and p,p'-DDE levels in 107 male participants in a 1946-1950 anti-malarial campaign in Sardinia, Italy. Cumulative DDT exposure during the anti-malarial operations was retrospectively estimated from detailed reports of the anti-malarial agency. Ortho,para-DDE, and its precursor ortho,para-DDT were always below the detection limit. p,p'-DDT was detected in 14/107 subjects, and p,p'-DDE in 106/107 subjects. The median lipid-adjusted p,p'-DDE serum concentration over the total study population was 396 parts per billion (interquartile range 157-1045), and it did not vary according to the job at the time of anti-malarial operations, nor was it affected by cumulative DDT exposure. LH, FSH, and SHBG, but not testosterone or E2, showed a significant positive correlation with age. Neither current serum p,p'-DDE nor past cumulative DDT exposure affected sex hormone concentrations. Our results suggest that (1) the low current p,p'-DDE serum concentration does not affect serum hormone levels, and (2) past cumulative DDT exposure is not correlated with the current p,p'-DDE serum level, nor does it show persistent effects on serum hormone levels.	Journal of Endocrinology	182	3	391-7	Biomonitoring (blood)	Algorithm/model		Cross-sectional	Specific active ingredient	reproductive	medical test result	Italy	hic
928	P. Cocco, D. Fadda, A. Ibba, M. Melis, M. G. Tocco, S. Atzeri, G. Avataneo, M. Meloni, F. Monni and C. Flore	Reproductive outcomes in DDT applicators	2005	OBJECTIVES: To explore reproductive outcomes in relation to occupational exposure to DDT. METHODS: We inquired into the reproductive history, including total number of children, sex distribution in the offspring, time-to-pregnancy, and number of spontaneous abortions and stillbirths, of the spouses of 105 men first exposed to DDT in a 1946-1950 anti-malarial campaign in Sardinia, Italy. The time-to-pregnancy in months at the first successful conception was estimated from population Registrars. Cumulative DDT exposure during the anti-malarial campaign was retrospectively estimated. RESULTS: The stillbirth rate was elevated and the male/female ratio in the offspring was reversed among DDT-exposed workers, and particularly among DDT applicators, compared to the unexposed subjects. Among DDT applicators, the stillbirth rate increased and the male/female ratio decreased by the tertile of cumulative DDT exposure. The fecundity ratio among spouses of DDT applicators was 0.72 (95% CI, 0.41,1.21) compared to the unexposed. The average number of children and abortion rate were unaffected by DDT exposure. CONCLUSIONS: The low statistical power of our study does not allow definitive conclusions. However, the results prompt further in-depth research into adverse reproductive outcomes and reduced fertility among men heavily exposed to DDT.	Environmental Research	98	1	120-6	Job title			Cohort (prospective)	Specific active ingredient	reproductive	self-reported	Italy	hic
929	P. Cocco, E. F. Heineman and M. Dosemeci	Occupational risk factors for cancer of the central nervous system (CNS) among US women	1999	BACKGROUND: In a recent report, we found an elevated risk of cancer of the central nervous system (CNS) in several occupations and industries, and a modest association with exposure to solvents and to contact with the public. METHODS: To further explore the occupational risk of CNS cancer among women, we extended the analysis of the previous death certificate-based case-control study, including 12,980 female cases (ICD-9 codes 191 and 192) in 24 US states in 1984-1992 and 51,920 female controls who died from diseases other than malignancies and neurological disorders. We applied newly designed job-exposure matrices for 11 occupational hazards, previously reported as brain cancer risk factors, to the occupation and industry codes in the death certificates. We also conducted a separate analysis of 161 meningioma cases (ICD-9 codes 192.1 and 192.3), a tumor more frequent among women, particularly in the postmenopausal age group. RESULTS: Overall, CNS cancer risk showed a 20-30% increase among women exposed to electromagnetic fields (EMF), methylene chloride, insecticides and fungicides, and contact with the public. Risk for meningioma was elevated among women exposed to lead (OR = 1.9; 95% CI 1.0, 3.9). CNS cancer did not show a clear pattern of risk increase by probability and intensity of exposure to any of the explored risk factors. Cross-classification by probability and intensity of exposure did not reveal any significant trend. Cases were too few to explore trends of meningioma by probability and intensity of exposure to lead. CONCLUSIONS: We did not find evidence of a strong contribution of 11 occupational hazards to the etiology of CNS cancer. However, limitations of the occupational information might have reduced our ability to detect clear patterns of risk.	American Journal of Industrial Medicine	36	1	25659	Job exposure matrix			Case-control	Type of pesticide	cancer	doctor-diagnosed	USA	hic
930	P. Cocco, G. Satta, S. Dubois, C. Pili, M. Pilleri, M. Zucca, A. M. t Mannetje, N. Becker, Y. Benavente, S. de Sanjose, L. Foretova, A. Staines, M. Maynadie, A. Nieters, P. Brennan, L. Miligi, M. G. Ennas and P. Boffetta	Lymphoma risk and occupational exposure to pesticides: results of the Epilymph study	2013	OBJECTIVES: We investigated the role of occupational exposure to specific groups of agrochemicals in the aetiology of lymphoma overall, B cell lymphoma and its most prevalent subtypes. METHODS: In 1998-2003, 2348 incident lymphoma cases and 2462 controls were recruited to the EPILYMPH case-control study in six European countries. A detailed occupational history was collected in cases and controls. Job modules were applied for farm work including specific questions on type of crop, farm size, pests being treated, type and schedule of pesticide use. In each study centre, industrial hygienists and occupational experts assessed exposure to specific groups of pesticides and individual compounds with the aid of agronomists. We calculated the OR and its 95% CI associated with lymphoma and the most prevalent lymphoma subtypes with unconditional logistic regression, adjusting for age, gender, education and centre. RESULTS: Risk of lymphoma overall, and B cell lymphoma was not elevated, and risk of chronic lymphocytic leukaemia (CLL) was elevated amongst those ever exposed to inorganic (OR=1.6, 95% CI 1.0 to 2.5) and organic pesticides (OR=1.5, 95% CI 1.0 to 2.1). CLL risk was highest amongst those ever exposed to organophosphates (OR=2.7, 95% CI 1.2 to 6.0). Restricting the analysis to subjects most likely exposed, no association was observed between pesticide use and risk of B cell lymphoma. CONCLUSIONS: Our results provide limited support to the hypothesis of an increase in risk of specific lymphoma subtypes associated with exposure to pesticides.	Occupational & Environmental Medicine	70	2	33451	Expert case-by-case assessment			Case-control	Job title	cancer	doctor-diagnosed	AHIC	AHIC

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931	P. Cocco, L. Figgs, M. Dosemeci, R. Hayes, M. S. Linet and A. W. Hsing	Case-control study of occupational exposures and male breast cancer	1998	OBJECTIVE: To investigate whether risk of male breast cancer is associated with workplace exposures. METHODS: A case-control study of 178 cases of male breast cancer and 1041 controls was carried out with data from the United States national mortality follow-back survey, which collected questionnaire information from proxy respondents of a 1% sample of all 1986 United States deaths among subjects aged 25-74 years. Occupational exposure to electromagnetic fields, high temperatures, polycyclic aromatic hydrocarbons (PAHs), herbicides, other pesticides, and organic solvents was assessed by applying job-exposure matrices, based on the 1980 United States census occupation and industry codes, to the longest job held by study subjects as reported by the informants. A socioeconomic status index was created by combining information on annual family income, education, assets, and occupation to assess the association of socioeconomic status with male breast cancer. Relative risks were derived from logistic regression modelling, which included age, socioeconomic status, marital status, and body mass index, as well as occupational exposures. RESULTS: Risk for male breast cancer increased significantly with increasing socioeconomic status index (test for trend: p < 0.01), but the risks associated with individual socioeconomic status variables were smaller and the trends were not significant. A significant increase in risk of male breast cancer was associated with employment in blast furnaces, steel works, and rolling mills (odds ratio (OR) 3.4; 95% confidence interval (95% CI) 1.1 to 10.1, based on six cases), and motor vehicle manufacturing (OR 3.1; 95% CI 1.2 to 8.2, based on seven cases). However, exposures to electromagnetic fields, high temperature, PAHs, herbicides, other pesticides, and organic solvents were not associated with risk of male breast cancer. CONCLUSIONS: The role of workplace exposures in increasing risk of breast cancer among men employed in motor vehicle manufacturing and in blast furnaces, steel works, and rolling mills deserves further investigation. The finding on socioeconomic status suggests that, as well as reproductive factors, other lifestyle factors such as diet that may be related to high socioeconomic status in men should be investigated further.	Occupational & Environmental Medicine	55	9	599-604	Job exposure matrix			Case-control	Type of pesticide	cancer	doctor-diagnosed	USA	hic
932	P. Cocco, M. H. Ward and M. Dosemeci	Occupational risk factors for cancer of the gastric cardia. Analysis of death certificates from 24 US states	1998	We evaluated the risk of gastric cardia cancer by occupation and industry in a case-control study using information from death certificates for 24 US states in 1984-1992. One thousand fifty-six cases of gastric cardia cancer were identified among men aged 20 years or more, including 1,023 whites and 33 blacks. Controls were 5,280 subjects who died of nonmalignant diseases, 5:1 matched to cases by geographic region, race, gender, and 5-year age group. Among white men, occupations with elevated risk included financial managers (odds ratio [OR] = 6.1; 95% confidence interval [CI], 1.3-28.8), janitors and cleaners (OR = 1.7; 95% CI, 1.0-2.9), production inspectors (OR = 3.2; 95% CI, 1.5-6.9), and truck drivers (OR = 1.5; 95% CI, 1.0-2.2). Industries with elevated risk included pulp and paper mills (OR = 2.0; 95% CI, 1.0-37), newspaper publishing and printing (OR = 2.6; 95% CI, 1.0-6.3), industrial and miscellaneous chemicals (OR = 2.0; 95% CI, 1.0-3.9), water supply and irrigation (OR = 5.6; 95% CI, 1.6-19.9). Among black men, risks were nonsignificantly increased for subjects employed in railroads (3 cases, 2 controls) and for carpenters (3 cases, 0 controls). We created job-exposure matrices for asbestos, inorganic dust, metal dust, lead, polycyclic aromatic hydrocarbons, nitrogen oxides, nitrosamines, sulfuric acid, fertilizers, herbicides, other pesticides, and wood dust. Among white men, a consistent pattern of risk increase by level and probability of exposure was observed only for sulfuric acid mists, with a twofold excess (95% CI, 0.6-7.3) associated with high probability of high intensity exposure. A significant 30% increase in risk was observed for those subjects with a high probability of exposure (all levels combined) to lead, and a 60% increase was observed for subjects with high-level exposure to lead (all probabilities combined). However, crosstabulation of gastric cardia cancer risk by probability and level of exposure to lead did not show consistent trends. Asbestos exposure also showed an overall 50% increase but no consistent trends among white men. None of the 12 occupational hazards showed an association with risk for black men.	Journal of Occupational & Environmental Medicine	40	10	855-61	Job exposure matrix			Case-control	Type of pesticide	cancer	doctor-diagnosed	USA	hic
933	P. Cocco, M. H. Ward and M. Dosemeci	Risk of stomach cancer associated with 12 workplace hazards: analysis of death certificates from 24 states of the United States with the aid of job exposure matrices	1999	OBJECTIVE: To investigate the risk of gastric cancer associated with 12 workplace exposures suspected or discussed as aetiological agents in previous reports. METHODS: A case-control study was conducted based on the death certificates of several million deaths in 24 states of the United States in 1984-96. Overall, the data base included 41,957 deaths from stomach cancer among subjects aged > or = 25 years. These were 20,878 white men, 14,125 white women, 4215 African American men, and 2739 African American women. Two controls for each case were selected from among subjects who died from non-malignant diseases, frequency matched to cases by geographic region, race, sex and 5 year age group. Each three digit occupation and industry code listed in the 1980 United States census was classified for probability and intensity of exposure to asbestos, inorganic dust, metals, lead, polycyclic aromatic hydrocarbons (PAHs), nitrogen oxides, nitrosamines, sulphuric acid, fertilisers, herbicides, other pesticides (including insecticides and fungicides), and wood dust. These job exposure matrices were subsequently applied to the occupation-industry combinations in the death certificates of study subjects, separately by sex and race. RESULTS: Risk of stomach cancer showed a modest association with occupational exposure to inorganic dust (odds ratio (OR) = 1.06; 95% confidence interval (95% CI) 1.03 to 1.11) with significant increasing trends by probability and intensity of exposure overall and by cross classification of the two exposure matrices. Workplace exposure to nitrosamines also showed a modest association (OR = 1.06; 95% CI 1.01 to 1.11), but the excess risk was even smaller after adjusting for inorganic dust exposure. Risk of gastric cancer was not associated with any of the other workplace exposures considered in this study. CONCLUSIONS: Non-differential misclassification of exposure may have caused negative findings in this study, and inorganic dust may be a partial surrogate for exposure to other unknown risk factors. Alternatively, our results suggest that occupational factors contribute little to the aetiology of gastric cancer. Inorganic dust might act through non-specific mechanisms, similar to those proposed for salt, aspirin, and heat by other authors.	Occupational & Environmental Medicine	56	11	781-7	Registers	Job exposure matrix		Case-control	Job title	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
934	P. Cortes-Genchi, A. Villegas-Arrizon, G. Aguilar-Madrid, M. Del Pilar Paz-Roman, M. Maruris-Reducindo and C. A. Juarez-Perez	[Symptom prevalence and pesticide management on agricultural workers]	2008	INTRODUCTION: Mexico is a main importers of pesticides in Latin America. OBJECTIVE: to describe pesticide symptoms prevalence, use, and management in a group of agricultural workers. METHODS: we carried out a transversal study in 303 agricultural workers laboring in vegetables, grains and flowers fields. We investigated the work history, pesticide management, and pesticide use frequency, as well as exposure-associated symptoms. RESULTS: mean age was 46 years; 19.5 % of workers were illiterate, and mean pesticide use was 15 years. With regard to pesticide application, 17.2 % of laborers worked with pesticides from 11:00 a. m. to 3:00 p. m., and 36.4 % of them applied pesticides for > 2 h; 29.7 % applied pesticides against the wind, while 26.4 % applied these with the wind. After applying the pesticides, 37.4 % of them bathed after 3 h, 34.5 % changed clothes, and 18.8 % returned to cultivation some hours later; 23 % of workers presented some symptom, the most frequent being headache, itchiness, numbness, and perception of burning on skin; this latter proportion was greater in the < or = 46 years old group CONCLUSIONS: symptom prevalence is in agreement with inappropriate pesticide management; nonetheless, we found no statistically significant association. Our results are lower than other studies, possibly due to lesser exposure, determined by toxicity, pesticide amount utilized, and use and management of chemicals.	Revista Medica del Instituto Mexicano del Seguro Social	46	2	145-52	Self-reported job history			Cross-sectional	Pesticides in general	NA	self-reported	Mexico	umic
935	P. Cuenca and V. Ramirez	[Chromosomic aberrations in female workers exposed to pesticides]	2004	The purpose of this work was to determine if the occupational exposure to those pesticides used at banana plantations' packaging plants produces genetic damage to somatic cells of female workers. Chromosomal aberrations were scored in lymphocytes of 20 women, 10 female exposed workers and 10 female controls. Workers were recruited from independent farms from two locations in Costa Rica, during January through June in 1996 and 1997. These females had a minimum of three months of work, had never received chemotherapy or radiotherapy and did some of these labors: sealing, spraying or weighting of bananas. Control unexposed females lived in the same area, were of similar age and neither them nor their husbands/mates had ever worked in pesticide related labors. For each female, 100 mitotic figures were scored. The kind of aberrations detected were acentric fragments, dicentric chromosomes, rings, gaps and breaks. Among workers, 16% of cells (n=1000) had one or more abnormalities, whereas control unexposed females had 6% of cells (n=1000) with comparable anomalies ($p < 0.05$). In conclusion, the pesticide exposure is a risk factor for chromosome aberrations in female somatic cells.	Revista de Biologia Tropical	52	3	623-8	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Costa Rica	umic
936	P. F. Cocco, D.; Billai, B.; D'Atri, M.; Melis, M.; Blair, A.	Cancer mortality among men occupationally exposed to dichlorodiphenyltrichloroethane	2005	Several studies have evaluated cancer risk associated with occupational and environmental exposure to dichlorodiphenyltrichloroethane (DDT). Results are mixed. To further inquire into human carcinogenicity of DDT, we conducted a mortality follow-up study of 4,552 male workers, exposed to DDT during antimalarial operations in Sardinia, Italy, conducted in 1946 to 1950. Detailed information on DDT use during the operations provided the opportunity to develop individual estimates of average and cumulative exposure. Mortality of the cohort was first compared with that of the Sardinian population. Overall mortality in the cohort was about as expected, but there was a deficit for death from cardiovascular disease and a slight excess for nonmalignant respiratory diseases and lymphatic cancer among the unexposed subcohort. For internal comparisons, we used Poisson regression analysis to calculate relative risks of selected malignant and nonmalignant diseases with the unexposed subcohort as the reference. Cancer mortality was decreased among DDT-exposed workers, mainly due to a reduction in lung cancer deaths. Birth outside from the study area was a strong predictor of mortality from leukemia. Mortality from stomach cancer increased up to 2-fold in the highest quartile of cumulative exposure (relative risk, 2.0; 95% confidence interval, 0.9-4.4), but no exposure-response trend was observed. Risks of liver cancer, pancreatic cancer, and leukemia were not elevated among DDT-exposed workers. No effect of latency on risk estimates was observed over the 45 years of follow-up and within selected time windows. Adjusting risks by possible exposure to chlordane in the second part of the antimalarial operations did not change the results. In conclusion, we found little evidence for a link between occupational exposure to DDT and mortality from any of the cancers previously suggested to be associated.	Cancer Research	65	20	9588-94	Registers			Cohort (prospective)	Specific active ingredient	mortality (all cause)	doctor-diagnosed	Italy	hic
937	P. Fabbro-Peray, J. P. Daures and J. F. Rossi	Environmental risk factors for non-Hodgkin's lymphoma: a population-based case-control study in Languedoc-Roussillon, France	2001	OBJECTIVE: To investigate the occupational and environmental risk factors related to non-Hodgkin's lymphoma (NHL). METHODS: A case-control study was performed during the 1992-1996 period in Languedoc-Roussillon, southern France. Four hundred and forty-five cases of histologically diagnosed NHL were declared. One thousand and twenty-five randomly selected population controls were interviewed about their medical histories; occupational exposures, such as chemicals, pesticides, and electromagnetic radiation; and toxic habits. RESULTS: The following factors were independently and significantly related to NHL as a result of the multivariate analysis: a previous hematopoietic malignancy (ORa = 11.5, 95% CI 2.4-55.4), a history of hives (ORa = 1.7, 95% CI 1.2-2.2), benzene exposure > 810 days (ORa = 4.6, 95% CI 1.1-19.2), daily welding (ORa = 2.5, 95% CI 1.2-5.0), and activity of radio operator (ORa = 3.1, 95% CI 1.4-6.6). To be an agricultural professional seemed slightly related to NHL in reference to non-professionals (ORa = 1.5, 95% CI 1.0-2.1). All of these results have also been adjusted for age, gender, education level, and urban setting. CONCLUSIONS: As some of the reported associations were based on a very small proportion of exposed subjects, further investigations are necessary to confirm our results. However, the findings suggest that factors related to altered immune functions such as a history of hematopoietic malignancy, history of hives, occupational exposure to benzene, or being an agricultural professional might increase the risk of NHL. Currently, underlying mechanisms for these associations are still unclear, and further investigations focused on interactions between immunity alterations and different chemicals would be of great interest.	Cancer Causes & Control	12	3	201-12	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	France	hic

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938	P. Ganesan, E. Kuriakose, C. Smith, R. T. Harris, J. E. Dowell, A. Schecter and S. Parmar	Military service in vietnam/korea and serum dioxin levels do not affect the outcomes of patients diagnosed with plasma cell dyscrasias	2011	Military Service in Vietnam/Korea and Serum Dioxin Levels Do Not Affect the Outcomes of Patients Diagnosed with Plasma Cell Dyscrasias. Background: Exposure to dioxin, a contaminant found in herbicides has been associated with increased risk of cancers including multiple myeloma and postulated to cause poorer survival in the exposed population. Military personnel, especially those who had served in Vietnam and Korea have an increased risk of dioxin (which contaminated the herbicide Agent Orange which was sprayed during these wars) exposure. We looked at the impact of dioxin exposure and blood levels of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) which is the most toxic of the poly-chlorinated dioxins on the survival outcomes of military veterans diagnosed with plasma cell dyscrasias (PCD). Methods: A prospective analysis of newly diagnosed and existing myeloma patients was done. Information regarding the patient and disease characteristics, the military record, and outcomes were collected. Approximately 60 ml of heparinised peripheral blood was collected and immediately frozen at-20 degrees. These samples were shipped to Eurofins Laboratory, Hamburg, Germany for dioxin level measurement. Patients' blood lipid levels were also measured and the dioxin toxic equivalent (Teq) was calculated. Overall survival (OS) was calculated from the date of diagnosis till death (Kaplan Meier method). Cox regression and log rank analysis were used to look for prognostic variables. Results: Fifty two (52) patients of PCD were available for analysis. Majority had a diagnosis of multiple myeloma. Forty one underwent treatment including stem cell transplant in 16 (Table 1 shows the patient characteristics, laboratory results and treatment outcomes). During a median follow up of 54 months (2-348), 21 patients died (progressive myeloma: 12(23%), cardiac failure: 3 (5.7%), infections: 1 (1.9%), acute myeloid leukemia: 1 (1.9%), pulmonary embolism: 1 (1.9%) and unknown: 3 (5.7%). The median OS was 111 mos (95% CI 56-155) and the estimated survival at 5 yrs was 69.5% (+/-SE 0.067). The 5 yr OS was negatively impacted by abnormal cytogenetics (40.3 % vs. 75.5%; p=0.012), and service in the army (non-army vs. army: 83% vs. 40%; p=0.032). Patients who had served in Vietnam had outcomes similar to others; Korean War veterans had a poorer OS, but this was not statistically significant (5 yr OS 68% vs. 48%; p=0.1). There was no association between TCDD levels or the Teq with OS. Abnormal cytogenetics was the only significant factor on multivariate analysis. [Table Presented] Conclusions: We did not find an association between military service in Korea/Vietnam or serum dioxin levels and poor survival in military veterans diagnosed with Plasma cell dyscrasias. However, a study of a larger sample of myeloma patients with similar service and	Blood	118	21	NA	Biomonitoring (blood)			Cohort (prospective)	Chemical class	cancer	doctor-diagnosed	SHIC	SHIC
939	P. Grover, K. Danadevi, M. Mahboob, R. Rozati, B. S. Banu and M. F. Rahman	Evaluation of genetic damage in workers employed in pesticide production utilizing the Comet assay	2003	The use of pesticides has been increasing in recent years, resulting in the need for increased production of pesticides. However, some pesticides may represent a hazard to human health, especially by causing cancer. Genotoxicity tests form an important part of cancer research and risk assessment of potential carcinogens. Therefore, in the current study the potential DNA damage associated with exposure to pesticides of Indian pesticide production workers was assessed using the single cell gel electrophoresis assay or Comet assay. Blood leukocytes of a group of 54 pesticide workers and an equal number of control subjects were examined for genotoxicity in this study. The two groups had similar mean ages and smoking prevalences. The mean comet tail length was used to measure DNA damage. The exposed workers had significantly greater mean comet tail lengths than those of controls (mean +/- SD 19.17 +/- 2.467 versus 8.938 +/- 2.889, P < 0.001). Smokers had significantly larger mean tail lengths than non-smokers (19.75 +/- 2.52 versus 18.26 +/- 2.13, P = 0.024). Analysis of covariance showed that occupational exposure (P < 0.05) and smoking (P < 0.05) had significant effects on mean tail length, whereas age and gender had no effect on DNA damage. The present study suggests that occupational exposure to pesticides and smoking can cause DNA damage. This investigation confirms the sensitivity of the Comet assay.	Mutagenesis	18	2	201-5	Job title			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	India	lmic
940	P. J. Gabel, M. S.; Andersen, H. R.; Baelum, J.; Thulstrup, A. M.; Bonde, J. P.; Toft, G.	The risk of cryptorchidism among sons of women working in horticulture in Denmark: a cohort study	2011	BACKGROUND: Androgens are crucial for normal testicular descent. Studies show that some pesticides have estrogenic or antiandrogenic effects, and that female workers exposed to pesticides have increased risk of having a boy with cryptorchidism. The main objective of the present study was to investigate whether pregnant women exposed to pesticides due to their work in horticulture experience excess risk of having sons with cryptorchidism. METHODS: We conducted a cohort study of pregnant women working in horticulture using four cohorts including one cohort established with data from the departments of occupational medicine in Jutland and Funen and three existing mother-child cohorts (n=1,468). A reference group was established from the entire Danish population of boys born in the period of 1986-2007 (n=783,817). Nationwide Danish health registers provided information on birth outcome, cryptorchidism diagnosis and orchiopexy. The level of occupational exposure to pesticides was assessed by expert judgment blinded towards outcome status. Risk of cryptorchidism among exposed horticulture workers compared to the background population and to unexposed horticulture workers was assessed by Cox regression models. RESULTS: Pesticide exposed women employed in horticulture had a hazard ratio (HR) of having cryptorchid sons of 1.39 (95% CI 0.84; 2.31) and a HR of orchiopexy of 1.34 (0.72; 2.49) compared to the background population. Analysis divided into separate cohorts revealed a significantly increased risk of cryptorchidism in cohort 2: HR 2.58 (1.07;6.20) and increased risk of orchiopexy in cohort 4: HR 2.76 (1.03;7.35), but no significant associations in the other cohorts. Compared to unexposed women working in horticulture, pesticide exposed women had a risk of having sons with cryptorchidism of 1.34 (0.30; 5.96) and of orchiopexy of 1.93 (0.24;15.4). CONCLUSIONS: The data are compatible with a slightly increased risk of cryptorchidism in sons of women exposed to pesticides by working in horticulture.	Environmental Health: A Global Access Science Source	10	NA	100	Expert case-by-case assessment			Cohort (prospective)	Pesticides in general	offspring	doctor-diagnosed	Denmark	hic
941	P. J. Laurienti, J. H. Burdette, J. Talton, C. N. Pope, P. Summers, F. O. Walker, S. A. Quandt, R. G. Lyday, H. Chen, T. D. Howard and T. A. Arcury	Brain Anatomy in Latino Farmworkers Exposed to Pesticides and Nicotine	2016	OBJECTIVE: Migrant tobacco farmworkers experience regular occupational exposure to pesticides and nicotine. The present study was designed to determine whether there are differences in brain anatomy between Latino farmworkers and non-farmworkers. METHODS: Magnetic resonance brain images were compared between farmworkers and non-farmworkers. In addition, blood cholinesterase activity and urinary cotinine levels were also used to identify associations with pesticide and nicotine exposure. RESULTS: Farmworkers had greater gray matter signal in putamen and cerebellum, and lower gray matter signal in frontal and temporal lobes. Urinary cotinine was associated with the observed differences in brain anatomy, but blood cholinesterase activity was not. CONCLUSIONS: Nicotine exposure was associated with neuroanatomical differences between Latino farmworkers and non-farmworkers. Future studies are needed to differentiate iron deposition from brain atrophy and to further assess the potential role of nicotine and pesticide exposure.	Journal of Occupational & Environmental Medicine	58	5	436-43	Biomonitoring (urine)			Cross-sectional	Specific active ingredient	neurological	medical test result	USA	hic

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942	P. K. Henneberger, X. Liang, S. J. London, D. M. Umbach, D. P. Sandler and J. A. Hoppin	Exacerbation of symptoms in agricultural pesticide applicators with asthma	2014	PURPOSE: Exacerbation is a critical event in asthma management. We investigated whether exacerbation of symptoms is associated with farming exposures among agricultural pesticide applicators with asthma. METHODS: Participants were pesticide applicators with active asthma (wheezing and breathing problems in past 12 months) who completed enrollment questionnaires for the Agricultural Health Study (AHS). Exacerbation of asthma was defined as having visited a hospital emergency room or doctor for an episode of wheezing or whistling in the past 12 months. Exposures of interest were using 36 specific pesticides in the past 12 months and conducting various agricultural activities. Adjusted odds ratios (ORs) were estimated by logistic regression while controlling for potential confounders. RESULTS: The 926 AHS adult pesticide applicators with active asthma included 202 (22%) with exacerbation. Inverse associations with exacerbation were observed for two herbicides [glyphosate, odds ratio (OR) = 0.5, 95% confidence interval (CI) 0.3, 0.8, and paraquat, OR = 0.3, 95% CI 0.1, 0.9] and several agricultural activities (repairing engines, grinding metal, driving diesel tractors, and performing veterinary procedures). Only asthma cases with allergies (i.e., doctor-diagnosed hay fever or eczema, 46%) had positive exacerbation-pesticide associations, with OR = 2.1 (95% CI 1.1, 4.1) for the herbicide pendimethalin and OR = 10.2 (95% CI 1.9, 55) for the insecticide aldicarb. CONCLUSIONS: The inverse associations with two pesticides and specific farm activities are consistent with the possibility that asthma cases prone to exacerbation may avoid exposures that trigger symptoms. Although limited by small sample size and a cross-sectional design, our study suggests that use of specific pesticides may contribute to exacerbation of asthma among individuals with allergies.	International Archives of Occupational & Environmental Health	87	4	423-32	Self-reported exposure			Cross-sectional	Specific active ingredient	respiratory	doctor-diagnosed	USA	hic
943	P. K. Hsiao, Y. C. Lin, T. S. Shih and Y. M. Chiung	Effects of occupational exposure to 1,4-dichlorobenzene on hematologic, kidney, and liver functions	2009	PURPOSE: To investigate the effects of 1,4-dichlorobenzene (1,4-DCB) on kidney, liver, and hematological functions of workers in insect repellent factories in Taiwan. METHODS: A cross-sectional study was performed comparing 46 exposed workers and 29 non-exposed workers. Health information was collected using questionnaires and biochemical tests. The concentration of urinary 2,5-dichlorophenol (2,5-DCP), the major metabolite of 1,4-DCB, was analyzed by gas chromatography with electron-capture detection. RESULTS: Urinary 2,5-DCP concentration, white blood cell (WBC) count, and serum alanine aminotransferase (ALT) level were higher in exposed workers than in non-exposed ones (P < 0.05). Furthermore, the WBC count and ALT level were significantly correlated with the concentration of 2,5-DCP in urine (P < 0.05). The blood urea nitrogen was significantly higher in on-site exposed workers (P < 0.05). Urinary 2,5-DCP concentration was significantly lower in workers who wore personal protective equipment (PPE) during work than in those who did not (P < 0.05). CONCLUSIONS: The higher urinary 2,5-DCP concentration in exposed (105.38 mug/L) than non-exposed (1.08 mug/L) workers suggests that 1,4-DCB exposure may increase the 2,5-DCP concentration in urine. Moreover, exposure to 1,4-DCB may also increase WBC count and ALT activity, and PPE may protect workers from 1,4-DCB exposure.	International Archives of Occupational & Environmental Health	82	9	1077-85	Biomonitoring (urine)			Cross-sectional	Specific active ingredient	hematological	medical test result	Taiwan	hic
944	P. K. Mills and R. Yang	Regression analysis of pesticide use and breast cancer incidence in California Latinas	2006	An evaluation of pesticide use data and breast cancer incidence rates in California Hispanic females was conducted via a regression analysis. The analysis used 1988-2000 data from the California Cancer Registry, the population-based cancer registry that monitors cancer incidence and mortality in California. It also used pesticide use data from 1970-1988 from the California Department of Pesticide Regulation. California is the leading agricultural state in the United States, and more than a quarter of all pesticides in the United States are applied there. Hispanic (Latina) females are commonly employed in agricultural operations. The authors performed regression analysis of county-level specific pesticide use data (pounds of active ingredients applied) for two classes of pesticides, organochlorines and triazine herbicides, against the breast cancer incidence rates among Latinas, controlling for age, socioeconomic status, and fertility rates, using negative binomial regression models. A total of 23,513 Latinas were diagnosed with breast cancer in California during the years 1988-1999. Risk of breast cancer was positively and significantly associated with age and socioeconomic status, and inversely and significantly associated with fertility levels. With respect to pesticides, breast cancer was positively associated with pounds of the organochlorines methoxychlor (adjusted incidence rate ratio [IRR] for highest quartile = 1.18; confidence interval [CI] = 1.03-1.35) and toxaphene (IRR = 1.16; CI = 1.01-1.34). No significant associations were found for the triazine herbicides atrazine and simazine.	Journal of Environmental Health	68	6	15-22; quiz 43-4	Registers			Cohort (prospective)	Chemical class	cancer	doctor-diagnosed	USA	hic
945	P. K. Mills and R. Yang	Prostate cancer risk in California farm workers	2003	Previous studies have evaluated prostate cancer in farm-working populations and most, although not all, have found an elevated risk of this cancer in farmers and farm workers. Specific occupational risk factors have not been identified. A nested case-control study of prostate cancer was conducted within a large cohort of a predominantly Hispanic labor union in California, the United Farm Workers of America. By conducting an electronic record linkage between a roster of the union members and the California Cancer Registry for the years 1988 through 1999, newly diagnosed cases of prostate cancer were identified within the union. Age-matched controls were randomly selected from the remainder of the cancer-free cohort. Risk for prostate cancer was examined by examining the type of crops and commodities cultivated by the farm workers as well as by the date of first union activity and duration of union affiliation. In addition, the risk of prostate cancer was evaluated in association with use of several pesticides recorded by the California Department of Pesticide Regulation. Between 1988 and 1999, 222 newly diagnosed prostate cancer cases were identified for analysis and 1110 age-matched controls were selected. The risk of prostate cancer was not associated with patterns of employment in any crop/commodity. Increasing duration of union affiliation was associated with decreasing prostate cancer risk. Although risk was not associated with total pounds of pesticides applied in the years and counties where farm workers were employed, risk was increased with specific chemicals, including simazine, lindane, and heptachlor, and suggestive increases were observed with dichlorvos and methyl bromide. We concluded that Hispanic farm workers with relatively high levels of exposure to organochlorine pesticides (lindane and hepatachlor), organophosphate pesticides (dichlorvos), fumigants (methyl bromide), or triazine herbicides (simazine) experienced elevated risk of prostate cancer compared to workers with lower levels of exposure.	Journal of Occupational & Environmental Medicine	45	3	249-259	Registers			Case-control	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

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946	P. K. Mills, R. Yang and D. Riordan	Lymphohematopoietic cancers in the United Farm Workers of America (UFW), 1988-2001	2005	OBJECTIVE: Agricultural risk factors for lymphohematopoietic cancers (LHC) in Hispanic farm workers in California were examined in a nested case-control study embedded in a cohort of 139,000 ever members of a farm worker labor union in California. METHODS: Crop and pesticide exposures were estimated by linking county/month and crop specific job history information from union records with California Department of Pesticide Regulation pesticide use reports during the 20-year period prior to cancer diagnosis. RESULTS: A total of 131 LHC diagnosed in California between 1988 and 2001 were included in the analysis. Analyses were conducted by gender and subtype of non-Hodgkins lymphoma (nodal, extra nodal) and by leukemia histology (lymphocytic, granulocytic). Odds ratios were calculated by stratification and by unconditional logistic regression. Risk for all LHC was elevated in workers cultivating vegetables (OR = 1.67, 95% CI = 1.12-2.48). Risk of leukemia was associated with exposure to the pesticides mancozeb (OR = 2.35, 95% CI = 1.12-4.95) and toxaphene (OR = 2.20, 95% CI = 1.04-4.65) while NHL risk was increased in association with 2,4-D (OR = 3.80, 95% CI=1.85-7.81). Risk of leukemia was particularly elevated among female workers and for granulocytic versus lymphocytic leukemia for several chemicals. No associations were noted for multiple myeloma. CONCLUSIONS: California farm workers employed where mancozeb and toxaphene were used had an increased risk of leukemia compared to farm workers employed elsewhere. Employment in farms using 2,4-D was associated with an increased risk of NHL.	Cancer Causes & Control	16	7	823-30	Registers			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
947	P. Kongtip, B. Techasaensiri, N. Nankongnab, J. Adams, A. Phamonphon, A. Surach, S. Sangprasert, A. Thongsuksai, P. Srikumpol and S. Woskie	The Impact of Prenatal Organophosphate Pesticide Exposures on Thai Infant Neurodevelopment	2017	A birth cohort was begun to investigate the levels and sources of pesticide exposure in pregnant women living in Thailand, and to examine the effects of pesticide exposure on infant neurodevelopment at five months of age. Subjects were interviewed using questionnaires regarding their demographic characteristics, educational background, and work and home activities related to pesticide exposures. Spot urine samples were collected at 28 weeks gestation and analyzed by gas chromatography-mass spectrometry to determine maternal metabolite levels of organophosphate pesticides including dimethyl phosphate (DMP); total DEP (diethyl phosphate (DEP), diethyl thiophosphate (DETP), and diethyl dithiophosphate (DEDTP), and total DAP (the sum of all metabolite levels). At five months of age, infant development was evaluated using the Bayley Scales of Infant and Toddler Development-III (Bayley-III). Higher total DEP and total DAP metabolite levels from the mother at 28 weeks' gestation were significantly associated with reduced motor composite scores on the Bayley-III at five months of age. The total DEP levels were also significantly associated with reduced cognitive composite scores. Prenatal concentrations of maternal urinary metabolites were associated with infant cognitive and motor development. The results of several studies now suggest the need for public health intervention to reduce prenatal pesticide exposures from both agricultural and domestic use.	International Journal of Environmental Research & Public Health [Electronic Resource]	14	6	27	Self-reported exposure	Biomonitoring (urine)		Cohort (prospective)	Chemical class	offspring	medical test result	Thailand	umic
948	P. Kristensen, L. M. Irgens, A. Andersen, A. S. Bye and L. Sundheim	Gestational age, birth weight, and perinatal death among births to Norwegian farmers, 1967-1991	1997	Perinatal health was investigated by linkage with the Medical Birth Registry of Norway for 192,417 births that took place between 1967 and 1991 among parents identified as farm holders in Norwegian agricultural censuses in 1969-1989. In a comparison with 61,351 births to nonfarmers in agricultural municipalities, farmers' births had an advantageous distribution of gestational ages and birth weights. Perinatal mortality was similar in the two groups, but the proportion of late-term abortions (gestational weeks 16-27) was higher among farmers' birth (odds ratio (OR) = 1.9, 95% confidence interval (CI) 1.6-2.3). Exposure indicators were classified on the basis of information given in the agricultural censuses and climate data for the grain harvest seasons of 1966-1991. The main hypotheses were that perinatal death is associated with parental exposure to pesticides. Toxoplasma contracted from infected sheep or pigs, or mycotoxins found in grain farming. There was no convincing evidence that perinatal death is associated with use of pesticides, sheep farming, or pig farming. The increase in late-term abortion among the farmers could to some extent be attributed to an excess of midpregnancy (weeks 21-24) deliveries among grain farmers; grain farmers had 132 deliveries at this time in pregnancy (2.8 per 1,000 pregnancies), while the nongrain farmers had 236 deliveries in midpregnancy (1.8 per 1,000). The authors found odds ratios (95% CI) that indicated that grain farming risk was higher after the harvest (1.8, 1.1-2.8), in seasons with a poor quality harvest (2.4, 1.5-3.8), and in pregnancies with multiple births (3.8, 1.7-8.2). These results support the hypothesis that occupational exposure to mycotoxins in grain induces labor at an early stage of pregnancy.	American Journal of Epidemiology	146	4	329-38	Registers			Cohort (prospective)	Pesticides in general	offspring	doctor-diagnosed	Norway	hic
949	P. Kristensen, L. M. Irgens, A. Andersen, A. S. Bye and L. Sundheim	Birth defects among offspring of Norwegian farmers, 1967-1991	1997	We investigated birth defects (N = 4,565) reported to the Medical Birth Registry of Norway among 192,417 births between 1967 and 1991 to parents identified as farmers in five agricultural and horticultural censuses between 1969 and 1989. The prevalences at birth of all and specific birth defects deviated little from those among 61,351 births to non-farmers in agricultural municipalities. We classified exposure indicators on the basis of information provided at the agricultural censuses. The main hypotheses were that parental exposure to pesticides was associated with defects of the central nervous system, orofacial clefts, some male genital defects, and limb reduction defects. We found moderate increases in risk for spina bifida and hydrocephaly, the associations being strongest for exposure to pesticides in orchards or greenhouses [spina bifida: 5 exposed cases, odds ratio (OR) = 2.76, 95% confidence interval (CI) = 1.07-7.13; hydrocephaly: 5 exposed cases, OR = 3.49, 95% CI = 1.34-9.09]. Exposure to pesticides, in particular in grain farming, was also associated with limb reduction defects (OR = 2.50; 95% CI = 1.06-5.90). We also saw an association with pesticides for cryptorchism and hypospadias. We found less striking associations for other specific defects and pesticide indicators, animal farming, and fertilizer regimens.	Epidemiology	8	5	537-44	Registers			Cohort (prospective)	Pesticides in general	offspring	doctor-diagnosed	Norway	hic
950	P. L. Huang, M. F. Wang, H. S. Lee, Y. J. Liu, C. C. Chen, S. C. Chen, J. S. Lai and R. H. Wong	An OGG1 polymorphism is associated with mitochondrial DNA content in pesticide-exposed fruit growers	2011	Exposure to pesticides has the capacity to cause mitochondrial dysfunction. An increase mitochondrial DNA (mtDNA) content has also been suggested to relate with DNA damaging agent. In mitochondria, the manganese superoxide dismutase (MnSOD) is a scavenger of reactive oxygen species, and the 8-oxoguanine DNA glycosylase (OGG1) is the major DNA glycosylase for the repair of 8-oxoG lesions. However, the alteration of mtDNA content elicited by pesticide exposure in people with genetic variations in MnSOD or OGG1 has not been investigated. In this study, the mitochondrial to nuclear DNA ratio was quantified in the peripheral blood of 120 fruit growers who experienced pesticide exposure and 106 unexposed controls by real-time quantitative polymerase chain reaction (real-time qPCR). Questionnaires were administered to obtain demographic data and occupational history. The MnSOD and OGG1 genotypes were identified by the PCR based restriction fragment length polymorphism analysis. After adjusting for confounding effects, multiple regression model revealed that subjects experiencing high or low pesticide exposure had a greater mtDNA content than that of controls. The OGG1 Ser-Ser genotype was also associated with an increased mtDNA content. No association between MnSOD genotype and mtDNA content was revealed. Thus, subjects experiencing pesticide exposure had greater mtDNA content and the OGG1 genotype may modulate mtDNA content in pesticide-exposed fruit growers.	Toxicology	287	1	43326	Self-reported job history			Cross-sectional	Job title	genetic (biomarkers)	medical test result	NA	NA

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951	P. Lebailly, A. Devaux, D. Pottier, M. De Meo, V. Andre, I. Baldi, F. Severin, J. Bernaud, B. Durand, M. Henry-Amar and P. Gauduchon	Urine mutagenicity and lymphocyte DNA damage in fruit growers occupationally exposed to the fungicide captan	2003	AIMS: To determine haematological parameters, urine mutagenicity (on three Salmonella typhimurium strains), and DNA damage (using the comet assay) in mononuclear leucocytes of farmers before and after a one-day spraying period of pear and apple trees with the fungicide captan in usual conditions. METHODS: Fruit growers were exposed to captan during the 1998 (n = 12) and/or the 2000 spraying seasons (n = 17). Biological samples were collected on the morning of the day of spraying (S1), the evening after spraying (S2), and the morning of the day after (S3). The UK Predictive Operator Exposure Model (UK-POEM) was used to quantify pesticide exposure intensity. RESULTS: No effect was observed on haematological parameters for these two spraying seasons. Proportions of mutagenic urine samples did not significantly differ between S1 and S2/S3 sampling points. In contrast with strains TA97a and YG1041 mainly sensitive to frameshift mutations, a positive trend was observed between the difference (S3-S1) of mutagenic power on strain TA102 detecting base-pair mutations and the exposure predicted value given by UK-POEM, mainly due to parameters related to protective clothing. No significant variations in DNA damage levels were observed between S1 and S3, nor were correlations observed with parameters of pesticide exposure. CONCLUSIONS: A one-day spraying period with captan and other pesticides does not significantly induce DNA damages in mononuclear leucocytes. In contrast, an inefficient protective clothing could correlate with an increase in urine mutagenicity as assessed by the TA102 tester strain.	Occupational & Environmental Medicine	60	12	910-7	Algorithm/model			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	France	hic
952	P. Lebailly, C. Vigreux, C. Lechevrel, D. Ledemeney, T. Godard, F. Sichel, J. Y. LeTalaer, M. Henry-Amar and P. Gauduchon	DNA damage in mononuclear leukocytes of farmers measured using the alkaline comet assay: discussion of critical parameters and evaluation of seasonal variations in relation to pesticide exposure	1998	The alkaline comet assay was used to quantify, using visual and image analyses, the level of DNA damage in mononuclear leukocytes of farmers who were occupationally exposed to pesticides. Hematological parameters were also measured on the same samples. Enrollment of farmers was based on handling of heavily used pesticides at particular periods during one spraying season. Forty-one blood samples from 29 different farmers were collected at the beginning of the season (n = 11) and at the intermediate (n = 14) and final (n = 16) periods of intense spraying activity. The mean numbers of lymphocytes and eosinophils were nonsignificantly higher in groups 3, 1, and 4 than they were in group 2. No individual characteristics significantly influenced the mean number of lymphocytes or eosinophils, and no correlation was observed between pesticide exposure-related parameters and hematological parameters. The level of DNA damage was significantly ($P < 0.01$) higher in groups 3, 1, and 4 than it was in group 2. In addition, DNA damage quantification was not significantly different among investigators or among slides. Prescription medicine, alcohol consumption, and age had no statistically significant effect on DNA damage level. Conversely, smoking (smokers versus non- and ex-smokers) significantly influenced DNA damage level ($P < 0.0001$). A significant ($P < 0.05$) negative correlation was detected between the number of days without pesticide spraying and DNA damage level, particularly among non- and ex-smokers. DNA damage detected by the alkaline comet assay seems to reflect ongoing exposure to genotoxic agents but not an accumulation of damage.	Cancer Epidemiology, Biomarkers & Prevention	7	10	917-27	Self-reported exposure			Cohort (prospective)	Pesticides in general	genetic (biomarkers)	medical test result	France	hic
953	P. Lebailly, C. Vigreux, C. Lechevrel, D. Ledemeney, T. Godard, F. Sichel, J. Y. LeTalaer, M. Henry-Amar and P. Gauduchon	DNA damage in mononuclear leukocytes of farmers measured using the alkaline comet assay: modifications of DNA damage levels after a one-day field spraying period with selected pesticides	1998	The alkaline comet assay was used to assess DNA damage in mononuclear leukocytes of farmers before and after a 1-day spraying period with selected pesticides under usual conditions. Two blood samples were collected, one in the morning of the day of spraying (S0) and the second in the morning of the day after (S1). Here, we assessed variations in DNA damage levels between these two sampling times. Four groups of farmers were formed, according to exposure to: (a) various fungicide-insecticide mixtures (including chlorothalonil; group 1, n = 8), (b) the herbicide isoproturon (group 2, n = 11), (c) fungicide triazoles (group 3, n = 14), and (d) a fungicide (chlorothalonil)-insecticide mixture (group 4, n = 8). An increase in DNA damage levels was observed at S1 for groups 1 and 4, who were exposed to similar pesticides. This increase was correlated with area sprayed between S0 and S1 and with the number of spraying tanks used over this 1-day period. No effect was observed on cell viability or on hematological parameters for these two groups. No statistically significant modification of DNA damage level was observed the day after spraying for groups 2 and 3, when each was observed as a whole. However, some farmers presented significantly more DNA damage after exposure, and others presented less damage. In these two groups, a significant decrease of neutrophils was observed at S1, and a decrease of red blood cells was observed in group 3. In parallel, a significant loss of lymphocyte viability was observed in these two groups. A 1-day spraying period seems to be sufficient to significantly modify DNA damage levels in mononuclear leukocytes, but the correlation of this change with pesticide-related exposure parameters depends on the kind of pesticide concerned.	Cancer Epidemiology, Biomarkers & Prevention	7	10	929-40	Self-reported exposure			Cohort (prospective)	Type of pesticide	genetic (biomarkers)	medical test result	France	hic
954	P. M. Lebailly, G.; Herin, F.; Lecluse, Y.; Salles, B.; Boutet-Robinet, E.	DNA damage in B and T lymphocytes of farmers during one pesticide spraying season	2015	PURPOSE: The effect of one pesticide spraying season on DNA damage was measured on B and T lymphocytes among open-field farmers and controls. METHODS: At least two peripheral blood samples were collected from each individual: one in a period without any pesticide application, several weeks after the last use (January, at period P0), and another in the intensive pesticide spraying period (May or June, at period P4). DNA damage was studied by alkaline comet assay on isolated B or T lymphocytes. RESULTS: Longitudinal comparison of DNA damage observed at both P0 and P4 periods revealed a statistically significant genotoxic effect of the pesticide spraying season in both B ($P = 0.02$) and T lymphocytes ($P = 0.02$) in exposed farmers. In contrast, non-farmers did not show any significant modifications. DNA damage levels in B and T lymphocytes were significantly higher in farmers than in non-farmers during the P4 period ($P = 0.003$ and $P = 0.001$ for B and T lymphocytes, respectively) but not during the P0 period. The seasonal effect observed among farmers was not correlated with either total farm area, farm area devoted to crops or recent solar exposure. On average, farmers used pesticides for 21 days between P0 and P4. Between the two time points studied, there was a tendency for a potential effect of the number of days of fungicide treatments ($r (2) = 0.43$; $P = 0.11$) on T lymphocyte DNA damage. CONCLUSIONS: A genotoxic effect was found in lymphocytes of farmers exposed to pesticides, suggesting in particular the possible implication of fungicides.	International Archives of Occupational & Environmental Health	88	7	963-72	Biomonitoring (blood)			Cohort (prospective)	Pesticides in general	genetic (biomarkers)	medical test result	France	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
955	P. M. Rabinowitz, K. D. Sircar, S. Tarabar, D. Galusha and M. D. Slade	Hearing loss in migrant agricultural workers	2005	BACKGROUND: Farmers have high rates of hearing loss, yet little is known about the hearing status of migrant agricultural workers. We performed a cross-sectional survey to assess the prevalence and impact of hearing loss in this population. METHODS: One hundred fifty migrant and seasonal agricultural workers were surveyed at a series of health fairs held at migrant camps. A bilingual questionnaire included items related to hearing loss risk factors and subjective hearing difficulties. Pure tone audiometry and tympanometry were performed in a mobile testing van. RESULTS: More than half the subjects had some degree of hearing loss at audiometric frequencies between 500 and 6,000 Hz, especially in the higher frequencies. Hispanic males in the sample had significantly greater prevalence of high-frequency hearing loss compared to adults in the national Hispanic Health and Nutrition Examination Survey (HHANES). More than 35% of respondents complained of subjective difficulty hearing or understanding speech, yet no workers reported use of hearing aids. Even after adjusting for measured hearing loss, Hispanic farm workers were more likely than their English- speaking counterparts to complain of difficulty hearing or understanding speech, suggesting that language barriers could worsen the impact of hearing loss. Risk factors for hearing loss included age and abnormal tympanometry. Occupational exposures to noise from tractors and other machinery as well as pesticides were frequently reported, while use of hearing protection was rare. CONCLUSION: Hearing loss is a significant and under-recognized problem in the migrant worker population. Further preventive and treatment efforts are warranted.	Journal of Agromedicine	10	4	43360	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	USA	hic
956	P. M. V. Sutton, X.; Beckman, J.; Nicas, M.; Das, R.	Pesticide illness among flight attendants due to aircraft disinsection	2007	BACKGROUND: Aircraft "disinsection" is the application of pesticides inside an aircraft to kill insects that may be on board. Over a 1-year period, California's tracking system received 17 reports of illness involving flight attendants exposed to pesticides following disinsection. METHODS: Interviews, work process observations, and a records review were conducted. Illness reports were evaluated according to the case definition established by the National Institute for Occupational Safety and Health. RESULTS: Twelve cases met the definition for work-related pesticide illness. Eleven cases were attributed to the "Residual" method of disinsection, i.e., application of a solution of permethrin (2.2% w/w), solvents (0.8%), and a surfactant (1.4%); the method of disinsection could not be determined for one case. CONCLUSIONS: The aerosol application of a pesticide in the confined space of an aircraft cabin poses a hazard to flight attendants. Nontoxic alternative methods, such as air curtains, should be used to minimize disease vector importation via aircraft cabins. Employers should mitigate flight attendant pesticide exposure in the interim.	American Journal of Industrial Medicine	50	5	345-56	Algorithm/model			Cohort (prospective)	Specific active ingredient	pesticide-related illness	doctor-diagnosed	USA	hic
957	P. Mathew, A. Jose, R. Alex and V. Mohan	Chronic pesticide exposure: Health effects among pesticide sprayers in Southern India	2015	Background: Occupational health has never been a priority for policy makers in India, despite 63% of the Indian population being in the economically productive age group. Objectives: The study was designed to find out the morbidity as a result of long-term exposure to pesticides among professional pesticide sprayers in a rural block in Tamil Nadu. Subjects and Methods: A cross-sectional study was done in Kaniyambadi block of Vellore district, Tamil Nadu, during July to October 2013. A total of 70 professional pesticide sprayers and 66 people engaged in other occupations were enrolled into the study. The participants were administered a standardized questionnaire apart from measuring pulmonary function and peripheral sensations. Venous blood samples were collected for measuring serum cholinesterase. Results: The pesticide sprayers had higher prevalence of breathlessness on activities of daily living (odds ratio [OR]: 3.14, 95% confidence interval [CI]: 1.22-8.07), chronic cough/phlegm (OR: 3.53, 95% CI: 1.09-11.46), symptoms of peripheral sensory neuropathy (OR: 6.66, 95% CI: 2.53-17.51) and recurrent abdominal pain (OR: 3.05, 95% CI: 1.03-9.01), when compared to people engaged in other occupations. Pesticide sprayers also had significantly lower mean peak expiratory low rates and poor peripheral sensations. The serum cholinesterase levels were not statistically different between the groups. Conclusion: The pesticide sprayers had a higher morbidity when compared to people engaged in other occupations, and further research is needed to find out methods to prevent the same. Serum cholinesterase may not be a good marker for quantifying exposure to pesticide among sprayers, during a spraying season.	Indian Journal of Occupational and Environmental Medicine	19	2	95-101	Job title			Cross-sectional	Job title	morbidity	self-reported	India	lmic
958	P. Monge, C. Wesseling, J. Guardado, I. Lundberg, A. Ahlbom, K. P. Cantor, E. Weiderpass and T. Partanen	Parental occupational exposure to pesticides and the risk of childhood leukemia in Costa Rica	2007	OBJECTIVES: Parental exposure to pesticides and the risk of leukemia in offspring were examined in a population-based case-control study in Costa Rica. METHODS: All cases of childhood leukemia (N=334), in 1995-2000, were identified at the Cancer Registry and the Children's Hospital. Population controls (N=579) were drawn from the National Birth Registry. Interviews of parents were conducted using conventional and icon-based calendar forms. An exposure model was constructed for 25 pesticides in five time periods. RESULTS: Mothers' exposures to any pesticides during the year before conception and during the first and second trimesters were associated with the risk [odds ratio (OR) 2.4, 95% confidence interval (95% CI) 1.0-5.9; OR 22, 95% CI 2.8-171.5; OR 4.5, 95% CI 1.4-14.7, respectively] and during anytime (OR 2.2, 95% CI 1.0-4.8). An association was found for fathers' exposures to any pesticides during the second trimester (OR 1.5, 95% CI 1.0-2.3). An increased risk with respect to organophosphates was found for mothers during the first trimester (OR 3.5, 95% CI 1.0-12.2) and for fathers during the year before conception and the first trimester (OR 1.5, 95% CI 1.0-2.2 and OR 1.6, 95% CI 1.0-2.6, respectively), and benzimidazoles during the first, second, and third trimesters of pregnancy (OR 2.2, 95% CI 1.0-4.4; OR 2.2, 95% CI 1.0-5.0; OR 2.2, 95% CI 1.0-5.2, respectively). There was a suggestion of an exposure-response gradient for fathers as regards picloram, benomyl, and paraquat. Age at diagnosis was positively associated with fathers' exposures and inversely associated with mothers' exposures. CONCLUSIONS: The results suggest that parental exposure to certain pesticides may increase the risk of leukemia in offspring.	Scandinavian Journal of Work, Environment & Health	33	4	293-303	Self-reported exposure			Case-control	Pesticides in general	offspring	doctor-diagnosed	Costa Rica	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
959	P. N. Kongtip, N.; Woskie, S.; Phamonphon, A.; Tharnpoophasiam, P.; Wilaiwan, K.; Srasom, P.	Organophosphate urinary metabolite levels during pregnancy, delivery and postpartum in women living in agricultural areas in Thailand	2014	OBJECTIVE: Prenatal exposure to organophosphate pesticides can lead to developmental neurotoxicity. A longitudinal birth cohort was established to investigate pesticide exposures from different agricultural activities. Maternal urinary organophosphate metabolites were measured at 28 weeks of pregnancy (n=86), delivery (n=67) and 2 months postpartum (n=51). METHOD: Subjects were interviewed with questionnaires about work, home and behavioral factors potentially associated with pesticide exposures, and spot urine samples were also collected. The urine samples were analyzed for dimethyl phosphate (DMP), diethyl phosphate (DEP), diethyl thiophosphate (DETP) and diethyl dithiophosphate (DEDTP), using gas chromatography-mass spectrometry. RESULTS: The urinary DMP and dialkyl phosphate (DAP) concentrations at 28 weeks of pregnancy and delivery were not significantly different, but the DMP and DAP concentrations at 28 weeks of pregnancy and DAP concentrations at delivery were significantly different (p<0.05) from those at 2 months postpartum. The factors influencing the urinary DAP concentrations at 28 weeks of pregnancy included insecticide used in the home, living close to agricultural farmland, frequency of agricultural field visits during the first and second trimesters of pregnancies, occupation of subjects, pesticide used and other agricultural activities. CONCLUSIONS: The urinary organophosphate metabolites, DMP, DEP, DETP, DEDTP, total DEP and DAPs, at 28 weeks of pregnancy, delivery and 2 months postpartum fluctuated depending on their pesticide exposures both at home and in agricultural fields.	Journal of Occupational Health	55	5	367-75	Biomonitoring (urine)	Self-reported exposure		Cohort (prospective)	Chemical class	offspring	self-reported	Thailand	umic
960	P. O. Behan	Chronic fatigue syndrome as a delayed reaction to chronic low-dose organophosphate exposure	1996	In the early 1960s, researchers noted persistent central nervous system effects in workers who had been chronically exposed to organophosphate (OP) insecticides. A large number of anecdotal reports of neurobehavioural abnormalities in agricultural workers exposed to insecticides and OPs have accumulated since then. In the last few years in Great Britain, there has been increasing interest in farmers who develop neurobehavioural abnormalities. These farmers are identical clinically to patients with typical chronic fatigue syndrome (CFS). The mode of onset, clinical symptoms and results of detailed neuroendocrine studies are identical in both groups. This paper compares and contrasts patients with classical CFS to those with the neurobehavioural syndrome that occurs following delayed chronic exposure to OPs.	Journal of Nutritional and Environmental Medicine	6	4	341-350	Biomonitoring (blood)			NA	Chemical class	neurological	NA	UK	hic
961	P. Olaya-Contreras, J. Rodriguez-Villamil, H. J. Posso-Valencia and J. E. Cortez	Organochlorine exposure and breast cancer risk in Colombian women	1998	An epidemiological study was performed in Santa Fe de Bogota, Colombia, with a total of 306 women enrolled, including 153 incident BC cases and 153 age-matched controls. The objective of this study was to evaluate the association between BC risk and serum dichlorodiphenyl-dichloroethene (DDE) levels. Sociodemographic and reproductive data, diet, and past exposure to pesticides were obtained through a structured questionnaire. Chemical analysis of samples was performed by high resolution gas chromatography-ECD. Likelihood of developing BC by exposure to these substances was evaluated through odds ratios (OR) adjusted for: first-child breast-feeding, family BC history, body mass index (BMI), parity, and menopausal status. Data analysis was performed by conditional logistic regression techniques. Adjusted OR for exposure to serum DDE and BC suggests an increase risk of BC in the higher category of DDE exposure (OR=1.95; CI 1.10-3.52). The test for trend was not statistically significant (p=0.09). We confirm that serum DDE levels bear a positive association to risk of BC and could support the association between risk of BC and burden of DDE exposure.	Cadernos de Saude Publica	14	NA	125-32	Biomonitoring (blood)			Case-control	Specific active ingredient	cancer	doctor-diagnosed	Colombia	umic
962	P. Pahwa, C. P. Karunanayake, J. A. Dosman, J. J. Spinelli, H. H. McDuffie and J. R. McLaughlin	Multiple myeloma and exposure to pesticides: a Canadian case-control study	2012	The objective of this study was to investigate the putative associations of specific pesticides with multiple myeloma. A matched, population-based, case-control study was conducted among men residing in six Canadian provinces (Quebec, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia). Data were collected on 342 multiple myelome cases and 1506 age and province of residence matched controls. Data were collected by mailed questionnaires to capture demographic characteristics, antecedent medical history, detailed lifetime occupational history, smoking history, family history of cancer, and exposure to broadly characterized pesticides at home, work, and practicing hobbies. Details of pesticide exposures were collected by telephone interview for those who reported 10 hours or more per year of exposure. Exposure to pesticides grouped into major chemical classes resulted in increased risk being detected only for carbamate insecticides [odds ratio (OR) and 95% confidence interval (CI) 1.90 (1.11, 3.27) adjusted for potential confounders]. An exposure to fungicide captan [2.35 (1.03, 5.35)] was positively associated with the incidence of multiple myeloma. While an exposure to carbaryl [1.89 (0.98, 3.67)] was associated with the incidence of multiple myelome with borderline significance. The authors further suggest that certain pesticide exposures may have a role in multiple myeloma etiology, and identify specific factors warranting investigation in other populations.	Journal of Agromedicine	17	1	40-50	Self-reported exposure	Self-reported job history		Case-control	Specific active ingredient	cancer	doctor-diagnosed	Canada	hic
963	P. Pahwa, C. P. Karunanayake, J. A. Dosman, J. J. Spinelli, J. R. McLaughlin and G. Cross-Canada	Soft-tissue sarcoma and pesticides exposure in men: results of a Canadian case-control study	2011	OBJECTIVES: The objective was to investigate the putative associations of specific pesticides with soft-tissue sarcoma (STS). METHODS: A Canadian population-based case-control study conducted in six provinces was used in this analysis. The study design consisted of two stages: a self-administered postal questionnaire and a telephone interview for those reporting pesticides exposure of 10 hours per year or more; and a 15% random sample of the remainder. Conditional logistic regression was used to fit the statistical models. RESULTS: A positive history of cancer among first-degree relatives and exposure to aldrin and diazinon were statistically significant independent predictors of an increased risk for STS, whereas diagnosis of whopping cough lowered the risk of STS. CONCLUSIONS: The incidence of STS was associated with specific insecticides after adjustment for other independent predictors.	Journal of Occupational & Environmental Medicine	53	11	1279-86	Self-reported exposure	Self-reported exposure		Case-control	Pesticides in general	cancer	doctor-diagnosed	Canada	hic
964	P. Pahwa, H. H. McDuffie, J. A. Dosman, J. R. McLaughlin, J. J. Spinelli, D. Robson and S. Fincham	Hodgkin lymphoma, multiple myeloma, soft tissue sarcomas, insect repellents, and phenoxyherbicides	2006	OBJECTIVE: The objective of this study was to determine if there is an additional risk of developing Hodgkin lymphoma, multiple myeloma, or soft tissue sarcoma as a consequence of exposure to a combination of phenoxyherbicides, rubber gloves, DEET (N, N-diethyl-m-toluamide), and sunlight compared with each of the individual chemicals. METHODS: This was a population-based study of men with specific cancers and age, province-matched control subjects. RESULTS: No additional risk from these combinations of exposures of developing these three types of tumor was found in contrast to non-Hodgkin lymphoma. CONCLUSIONS: The mechanisms by which phenoxyherbicides contribute to the risk of multiple myeloma and non-Hodgkin lymphoma may be different.	Journal of Occupational & Environmental Medicine	48	3	264-74	Self-reported exposure	Self-reported exposure		Case-control	Chemical class	cancer	doctor-diagnosed	Canada	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
965	P. Panuwet, C. Ladva, D. B. Barr, T. Prapamontol, J. D. Meeker, P. E. D'Souza, H. Maldonado, P. B. Ryan and M. G. Robson	Investigation of associations between exposures to pesticides and testosterone levels in Thai farmers	2017	We conducted a cross-sectional study to assess the relationship between pesticide exposures and testosterone levels in 133 male Thai farmers. Urine and serum samples were collected concurrently from participants. Urine was analyzed for levels of specific and nonspecific metabolites of organophosphates (OPs), pyrethroids, select herbicides, and fungicides. Serum was analyzed for total and free testosterone. Linear regression analyses revealed significant negative relationships between total testosterone and the herbicide 2,4-dichlorophenoxyacetic acid (2,4-D) after controlling for covariates (eg, age, BMI, smoking status). Positive significant associations were found between some OP pesticides and total testosterone. Due to the small sample size and the observational nature of the study, future investigation is needed to confirm our results and to elucidate the biological mechanisms.	Archives of Environmental and Occupational Health	NA	NA	43114	Biomonitoring (urine)			Cross-sectional	Chemical class	endocrine/nutritional/metabolical	medical test result	Thailand	umic
966	P. Pasqualetti, A. Collacciani and R. Casale	Risk of monoclonal gammopathy of undetermined significance: a case-referent study	1996	A retrospective study was conducted in 285 cases of monoclonal gammopathy of undetermined significance (MGUS) and in 570 sex- and age-matched hospital controls in order to investigate the possible association between socioeconomic status, residence, alcohol and tobacco habits, occupation, occupational exposure to toxic substances, chronic antigenic stimulation, and risk of MGUS. Significant associations with the risk of MGUS were found for farmers (P < 0.005) and for workers in industry (P < 0.025). Occupational exposure to asbestos, fertilizers, mineral oils and petroleum, paints and related products, pesticides, and radiation was significantly (P < 0.05) associated with an increase in risk of MGUS. Chronic immune-stimulating conditions, when considered as a group, presented a significant (P < 0.025) association with the risk of MGUS, but no specific disease has been found to be significantly associated. These data are in agreement with the previous reports on multiple myeloma, suggesting that these factors may play an important role in the development of monoclonal gammopathies. However, these findings need to be confirmed in prospective larger population-based studies.	American Journal of Hematology	52	3	217-20	Self-reported exposure			Case-control	Pesticides in general	other	other	Italy	hic
967	P. R. Band, N. D. Le, R. Fang, M. Deschamps, R. P. Gallagher and P. Yang	Identification of occupational cancer risks in British Columbia. A population-based case-control study of 995 incident breast cancer cases by menopausal status, controlling for confounding factors	2000	Lifetime occupational histories as well as information on known and suspected breast cancer risk factors were collected by means of a self-administered questionnaire from 1018 women with incident breast cancer ascertained from the British Columbia Cancer Registry, and from 1020 population controls. A matched case-control study design was used. Conditional logistic regression for matched sets data and the likelihood ratio were used in a two-step procedure and were performed separately for pre-menopausal women, post-menopausal women, and for all cases combined. Excess risk was noted for several white-collar occupations. Significantly increased risk was observed: (1) among pre-menopausal women: in electronic data-processing operators; barbers and hairdressers; in sales and material processing occupations; and in the food, clothing, chemical and transportation industries; (2) among post-menopausal women: in schoolteaching; in medicine, health, and nursing occupations; in laundry and dry-cleaning occupations; and in the aircraft and automotive, including gasoline service station, industries. Several significant associations were also seen in the combined group of pre- and post-menopausal women, particularly in crop farmers and in the fruit and vegetable, publishing and printing, and motor vehicle repair industries. The results of this study suggest excess breast cancer risk in a number of occupations and industries, notably those that entail exposure to solvents and pesticides.	Journal of Occupational & Environmental Medicine	42	3	284-310	Self-reported job history			Case-control	Job title	cancer	doctor-diagnosed	Canada	hic
968	P. R. Band, Z. Abanto, J. Bert, B. Lang, R. Fang, R. P. Gallagher and N. D. Le	Prostate cancer risk and exposure to pesticides in British Columbia farmers	2011	BACKGROUND: Several epidemiologic studies have reported an increased risk of prostate cancer among farmers. Our aim was to assess the risk of developing prostate cancer in relation to exposure to specific active compounds in pesticides. METHOD: A case-control approach was used with 1,516 prostate cancer patients and 4,994 age-matched internal controls consisting of all other cancer sites excluding lung cancer and cancers of unknown primary site. Lifetime occupational history was obtained through a self-administered questionnaire and used in conjunction with a job exposure matrix to estimate the participants' lifetime cumulative exposure to approximately 180 active compounds in pesticides. Conditional logistic regression was used to assess prostate cancer risk, adjusting for potential confounding variables and effect modifiers. These include age, ethnicity, alcohol consumption, smoking, education, and proxy respondent. RESULTS AND CONCLUSIONS: The significant association between prostate cancer risk and exposure to DDT (OR=1.68; 95% CI: 1.04-2.70 for high exposure), simazine (OR=1.89; 95% CI: 1.08-3.33 for high exposure), and lindane (OR=2.02; 95% CI: 1.15-3.55 for high exposure) is in keeping with those previously reported in the literature. We also observed a significant excess risk for several active ingredients that have not been previously reported in the literature such as dichlone, dinoseb amine, malathion, endosulfan, 2,4-D, 2,4-DB, and carbaryl. Some findings in our study were not consistent with those reported in the literature, including captan, dicamba, and diazinon. It is possible that these findings showed a real association and the inconsistencies reflected differences of characteristics between study populations.	Prostate	71	2	168-83	Self-reported job history	Job exposure matrix		Case-control	Job title	cancer	doctor-diagnosed	Canada	hic
969	P. R. Jonnalagadda, P. Jahan, S. Venkatasubramanian, I. A. Khan, A. Prasad, K. A. Reddy, M. V. Rao, K. Venkaiah and Q. Hasan	Genotoxicity in agricultural farmers from Guntur district of South India--A case study	2012	BACKGROUND: Pesticides play an important role in controlling the pests on agricultural crops and thereby to increase the yield of agricultural produce. Farmers occupationally exposed to pesticides during spraying activities are more prone to genotoxicity than unexposed. AIM: To assess the genotoxicity in farmers, engaged in spraying complex mixture of pesticides in the cultivation of cotton crops. MATERIAL AND METHODS: A total number of 152 male subjects were selected randomly from Guntur district of Andhra Pradesh (AP), South India. The demographic particulars viz., personal habits, duration of exposure to pesticides, types of pesticides used were collected from the study subjects using an interview schedule. Among them 76 subjects were farmers and the remaining individuals served as unexposed or controls. Blood samples from these subjects were collected for assessing the genetic damage by chromosomal aberrations (CAs) test and micronucleus test (MNT). RESULTS: The results of the study indicated that CA was significantly higher with 2.8% in farmers who were exposed to pesticides when compared to unexposed (0.72%). However, there was a minor difference in MN with 0.13% and 0.12% between exposed and unexposed which was not statistically significant (p < 0.05). CONCLUSION: A correlation between CA frequency and exposure to benzene hexachloride (BHC) pesticide residue was observed.	Human & Experimental Toxicology	31	7	741-7	Biomonitoring (blood)	Self-reported exposure		Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	India	lmic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
970	P. R. Salameh, M. Waked, I. Baldi, P. Brochard and B. A. Saleh	Chronic bronchitis and pesticide exposure: a case-control study in Lebanon	2006	OBJECTIVE: Pesticides are widely used toxics. The objective of the study is to evaluate the odds of exposure to pesticides in chronic bronchitis patients. METHODS: Using the American Thoracic Society standardized questionnaire confirmed by medical diagnosis of chronic bronchitis, a case-control study was performed in Lebanon. Pesticide exposure was estimated and between groups comparison was made. RESULTS: The study involved 262 controls and 110 chronic bronchitis outpatient subjects from 10 medical centers. Any exposure to pesticides was associated to chronic bronchitis (OR = 2.46 [1.53-3.94]; p < 10(-4)). Occupational use presented the highest association (15.92 [3.50-72.41]; p < 10(-4)), followed by regional exposure (3.70 [2.05-6.70]; p < 10(-4)). Results were confirmed by multivariate and subgroup analysis. CONCLUSION: Pesticide exposure was associated with chronic bronchitis in Lebanese adults. Pesticides toxicological effects may explain chronic respiratory effects associations found with all exposure types.	European Journal of Epidemiology	21	9	681-8	Self-reported exposure			Case-control	Pesticides in general	respiratory	doctor-diagnosed	Lebanon	umic
971	P. Rohr, J. da Silva, B. Erdtmann, J. Saffi, T. N. Guecheva, J. Antonio Pegas Henriques and K. Kvitko	BER gene polymorphisms (OGG1 Ser326Cys and XRCC1 Arg194Trp) and modulation of DNA damage due to pesticides exposure	2011	The susceptibility of individuals to the genotoxic effect of pesticides can be modulated by genetic variations in the xenobiotic detoxification and DNA repair processes. This study evaluates if the two BER polymorphisms (XRCC1Arg194Trp and OGG1Ser326Cys) or the combined genotypes of these polymorphisms with PON1Gln192Arg could modify individual susceptibility to pesticide exposure in vineyard workers, as measured by micronucleus formation and DNA damage induction in peripheral leukocytes. The study population comprised 108 agricultural workers exposed to pesticides and 65 nonexposed. Our results demonstrate that individuals with the variant allele (OGG1Cys) showed higher DNA damage, detected by the comet assay, in relation to individuals carrying the wild-type OGG1Ser allele. Considering the combined influence of metabolizing PON1 and the DNA repair OGG1 genes, we observed significantly higher DNA damage in the comet assay in the exposed group when a less efficient OGG1Cys allele was acting independently of the PON1 genotype, reinforcing the importance of the OGG1 repair enzyme in the response to DNA damage by pesticide exposure. The association of the PONGln/Gln genotype with higher MN frequency suggests that the PON1 genotype is a major determinant of genotoxic risk in individuals exposed to pesticides. Analysis of the compared effect of XRCC1 and PON1 genotypes in the exposed group suggested that, among the poorly metabolizing PON1Gln/Gln individuals, the XRCC1Arg/Trp genotype has a protective effect with respect to MN formation. These results indicate that enhanced XRCC1 function may provide some protection from the enhanced genotoxic risk associated with inefficient xenobiotic detoxification in the studied population.	Environmental & Molecular Mutagenesis	52	1	43301	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Brazil	umic
972	P. Salameh, M. Waked, I. Baldi and P. Brochard	Spirometric changes following the use of pesticides	2005	We compared the respiratory function of 19 pesticide factory workers and a control group of 43 other factory workers in Lebanon. The groups had no difference in smoking status. Baseline measurements of respiratory function showed significantly lower forced expiratory volume and flow rates (FEV1, FEF(25-75%), and FEV1/FVC ratio) among subjects working with pesticides, i.e. obstruction may be linked to chronic exposure to pesticides. After 4 hours of work, all respiratory variables were still significantly lower in pesticide-exposed subjects, but no acute changes in respiratory function were seen. Pesticide-exposed workers had 5.6 times higher risk of abnormal FEV1/FVC ratio and 16.5 higher risk for abnormal FEF(25-75%). Duration of occupation in the pesticide factory was significantly correlated with abnormal respiratory measures.	Eastern Mediterranean Health Journal	11	1	126-36	Self-reported job history			Cohort (prospective)	Job title	respiratory	medical test result	Lebanon	umic
973	P. Salameh, M. Waked, I. Baldi, P. Brochard and B. A. Saleh	Respiratory diseases and pesticide exposure: a case-control study in Lebanon	2006	STUDY OBJECTIVE: To evaluate the odds of being exposed to pesticides in asthmatic adults. DESIGN: A case-control study was performed in Lebanon. SETTING: People were approached when consulting physicians as outpatients. PATIENTS: Asthmatic patients and non-asthmatic controls in several Lebanese hospitals were interviewed. MAIN RESULTS: The study included 407 subjects from 10 medical centres. Any exposure to pesticides was associated to asthma (OR = 2.11 (1.47 to 3.02); p<10(-4)). Occupational use presented the highest association (OR = 4.98 (1.07 to 23.28); p = 0.02), followed by regional exposure (OR 3.51 (2.11 to 5.85); p<10(-4)). Results were confirmed by multivariate analysis, particularly for regional exposure (OR(a) = 2.78; p = 0.02) and house exposure (OR(a) = 2.17; p = 0.001). CONCLUSIONS: Results are comparable to those found in other studies; especially for occupational exposure. Pesticides toxicological effects may explain chronic respiratory symptoms and asthma associations found with all exposure types. Pesticide exposure was associated with asthma in Lebanese adults.	Journal of Epidemiology & Community Health	60	3	256-61	Self-reported exposure			Case-control	Pesticides in general	respiratory	doctor-diagnosed	Lebanon	umic
974	P. Steerenberg, L. van Amelsvoort, C. Colosio, E. Corsini, S. Fustinoni, T. Vergieva, C. Zaikov, S. Pennanen, J. Liesivuori and H. Van Loveren	Toxicological evaluation of the immune function of pesticide workers, a European wide assessment	2008	In this study, the prolonged low-dose exposure of mixtures of pesticides has been examined on hematological parameters and components of the immune defense in occupationally exposed humans. This investigation was carried out in five field studies in: the Netherlands (flower bulb growers, mainly re-entry workers), Italy (vineyard workers), Finland (potato farmers), and Bulgaria (workers from a zineb factory and greenhouse workers). Immunotoxicity was studied by measuring hematological parameters, complement, immunoglobulins, lymphocyte subpopulations, natural killer cells, autoimmunity, and antibody responses to hepatitis B vaccination. The total study population consisted of 248 pesticide-exposed and 231 non-occupationally exposed workers. As a surrogate measure of pesticide exposure the urinary excretion of ethylenethiourea (ETU), the main metabolite ethylenebisdithiocarbamates was measured. A significantly higher level of ETU in occupationally exposed subjects compared with controls (2.7 +/- 8.1 microg/g vs 0.5 +/- 3.7 microg/g creatinine) was found. Statistically significant differences, albeit very low, were found for complement C3 and C4 and the immunoglobulin classes IgG4 and IgA. For complement and IgG4, the levels were slightly increased and the level of IgA was decreased. In the lymphocyte populations, the CD8 subpopulation was increased. No effects were found on autoimmune antibodies and antibody response to hepatitis vaccination. In conclusion, pesticide exposure under various work place conditions in Europe was associated only with some subtle effects on the immune system, which may suggest that occupational exposure to pesticides does not influence the immunologic system in a clinically significant fashion, and does not pose a significant health risk to the exposed subjects.	Human & Experimental Toxicology	27	9	701-7	Biomonitoring (urine)			Cross-sectional	Chemical class	immunological	medical test result	SHIC	SHIC

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
975	P. Thonneau, A. Abell, S. B. Larsen, J. P. Bonde, M. Joffe, A. Clavert, B. Ducot, L. Multigner and G. Danscher	Effects of pesticide exposure on time to pregnancy: results of a multicenter study in France and Denmark. ASCLEPIOS Study Group	1999	The aim of this study was to determine whether there was a relation between male exposure to pesticides and the amount of time needed to conceive (time to pregnancy) for farmers and agricultural workers in France and Denmark. The authors used retrospective studies to compare the time to pregnancy of couples in which the man was exposed to pesticides during the year before the birth of their youngest child with that of couples in which the man was not exposed. In 1995 and 1996, the authors studied 362 French rural workers (142 exposed to pesticides and 220 not exposed), 449 Danish farmers (326 conventional farmers exposed to pesticides and 123 nonexposed organic farmers), and 121 Danish greenhouse workers exposed to pesticides. The fecundability ratio for exposure to pesticides (Cox model, before and after adjustment for confounding factors) did not differ from 1 in any of the three populations. In France, the adjusted fecundability ratio was 1.17 (95% confidence interval (CI) 0.89-1.55) for exposed and nonexposed agricultural workers. In Denmark, it was 1.09 (95% CI 0.82-1.43) for exposed and nonexposed farmers and 0.83 (95% CI 0.69-1.18) for greenhouse workers and nonexposed farmers. Thus, this study found no relation between fertility (time to pregnancy) and male exposure to pesticides.	American Journal of Epidemiology	150	2	157-63	Registers			Cohort (prospective)	Pesticides in general	reproductive	self-reported	AHIC	AHIC
976	P. Thonneau, S. B. Larsen, A. Abell, A. Clavert, J. P. Bonde, B. Ducot and L. Multigner	Time to pregnancy and paternal exposure to pesticides in preliminary results from Danish and French studies. Asclepios	1999	NA	Scandinavian Journal of Work, Environment & Health	25	NA	62-3; discussion 76-8	Registers			Cross-sectional	Pesticides in general	reproductive	self-reported	AHIC	AHIC
977	Q. Bian, L. C. Xu, S. L. Wang, Y. K. Xia, L. F. Tan, J. F. Chen, L. Song, H. C. Chang and X. R. Wang	Study on the relation between occupational fenvalerate exposure and spermatozoa DNA damage of pesticide factory workers	2004	AIMS: To determine sperm nuclear DNA integrity and to investigate the relation between fenvalerate (FE) exposure and spermatozoa DNA damage. METHODS: Sperm DNA fragmentation was detected by a modified alkaline single cell gel electrophoresis (Comet) assay and a terminal deoxynucleotidyl transferase mediated dUTP nick end labelling (TUNEL) assay. The olive tail moment (OTM) and percentage tail DNA were measured by the Comet assay, and cell positive percentage was measured by the TUNEL assay for DNA damage evaluation. RESULTS: The DNA integrity of spermatozoa of external and internal control groups were both significantly greater than that of the FE exposed group. The median value of tail DNA percentage in the exposure group was 11.30, which was significantly higher than 5.60 in the internal control group and 5.10 in the external control group. The median value of OTM was 3.80 in the exposure group, significantly higher than 1.50 in the internal control group and 2.00 in the external control group. Mean cell positive was 31.2% in the exposure group, significantly higher than 17.4% in the internal control and 19.6% in the external control groups. Cell positive (%) was significantly correlated with tail DNA percentage and with OTM of whole subjects (n = 63). CONCLUSIONS: Results showed that occupational FE exposure is associated with an increase in sperm DNA damage. A combination of the Comet and TUNEL assays would offer more comprehensive information for a better understanding of sperm DNA damage, and the biological significance of sperm DNA damage in sperm function and male infertility.	Occupational & Environmental Medicine	61	12	999-1005	Personal air sampling			Cross-sectional	Specific active ingredient	genetic (biomarkers)	medical test result	China	umic
978	R. Ahmad, M. K. Baloach, A. Ahmad, R. Rauf, H. Siddiqui and M. Y. Khokar	Evaluation of toxicity due to commercial pesticides in female workers	2004	Objective: To see the agricultural sprays hazards in female workers at Multan. Settings: Cotton research station, government of Punjab, Multan. Main outcomes measure: Age, work experience, physical health, marital status, fertility, menstrual status, number of offspring, number of abortion, blood choline esterase level, reproductive hormonal assay. Results: The overall age of the 38 participants included in the study was in the range of 12-50 years. Most of the participants enjoyed good physical health. The overall toxicity determined through the reproductive hormonal assay was 18.42%; with 22.22% in the married group and 9.09% in the unmarried group. Eleven participants were in follicular phase of menstrual cycle, two were in luteal state, five were in mid cycle, six were pregnant, six participants had menopause, one had lactational amenorrhea while seven were poisoning cases with no infertility case. The blood plasma level of AChE of 7.8% participants were on safe side, 42.86% were in alarming situation while 52.63% participants were in dangerous condition. Conclusion: Agricultural pesticides are the endocrine disrupting chemicals which poses a health threat, particularly to the sensitive gender, frequent farm workers and onward into their children.	Pakistan Journal of Medical Sciences	20	4	392-396	Biomonitoring (blood)			Cross-sectional	Chemical class	pesticide-related symptoms	self-reported	India	lmic
979	R. B. Dick, K. Steenland, E. F. Krieg and C. J. Hines	Evaluation of acute sensory--motor effects and test sensitivity using termiticide workers exposed to chlorpyrifos	2001	Sensory and motor testing was performed on a group of termiticide workers primarily using chlorpyrifos-containing products to evaluate both the acute effects from current exposure and sensitivity of the measures to detect effects. The study group comprised 106 applicators and 52 nonexposed participants. Current exposure was measured by urinary concentrations of 3,5,6-trichloro-2-pyridinol (TCP) collected the morning of testing. The mean TCP value for the 106 applicators was 200 microg/g creatinine. Participants received 4--5 h of testing and were evaluated using a sensory--motor test battery recommended by a National Institute for Occupational Safety and Health (NIOSH)-sponsored advisory panel to be appropriate for testing effects from pesticide exposures. Measurements testing olfactory dysfunction, visual acuity, contrast sensitivity, color vision, vibrotactile sensitivity, tremor, manual dexterity, eye--hand coordination, and postural stability were analyzed. Study results indicated limited acute effects from exposure to chlorpyrifos using urinary TCP as a measure of current exposure. The effects occurred primarily on measures of postural sway in the eyes closed and soft-surface conditions, which suggests a possible subclinical effect involving the proprioceptive and vestibular systems. Several other tests of motor and sensory functions did not show any evidence of acute exposure effects, although statistically significant effects of urinary TCP on the Lanthony color vision test scores and one contrast sensitivity test score were found. The visual measures, however, were not significant when a step-down Bonferroni correction was applied. Information also is presented on the sensitivity of the measures to detect effects in an occupationally exposed population using standard error of the parameter estimates.	Neurotoxicology & Teratology	23	4	381-93	Biomonitoring (urine)			Cross-sectional	Chemical class	neurological	medical test result	NA	NA

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
980	R. B. Gunier, A. Kang, S. K. Hammond, K. Reinier, C. S. Lea, J. S. Chang, M. Does, G. Scelo, J. Kirsch, V. Crouse, R. Cooper, P. Quinlan and C. Metayer	A task-based assessment of parental occupational exposure to pesticides and childhood acute lymphoblastic leukemia	2017	OBJECTIVES: Associations between parental occupational pesticide exposure and childhood acute lymphoblastic leukemia (ALL) vary across studies, likely due to different exposure assessment methodologies. METHODS: We assessed parental occupational pesticide exposure from the year before pregnancy to the child's third year of life for 669 children diagnosed with ALL and 1021 controls. We conducted expert rating using task-based job modules (JM) to estimate exposure to pesticides among farmer workers, gardeners, agricultural packers, and pesticide applicators. We compared this method to (1) partial JM using job titles and a brief description, but without completing the task-based questionnaire, and (2) job exposure matrix (JEM) linking job titles to the International Standard Classifications of Occupation Codes. We used unconditional logistic regression to calculate odds ratios (OR) and 95% confidence intervals (95% CI) for ALL cancer risk and pesticide exposure adjusting for child's sex, age, race/ethnicity and household income. RESULTS: Compared to complete JMs, partial JMs and JEM led to 3.1% and 9.4% of parents with pesticide exposure misclassified, respectively. Misclassification was similar in cases and controls. Using complete JMs, we observed an increased risk of ALL for paternal occupational exposure to any pesticides (OR=1.7; 95% CI=1.2, 2.5), with higher risks reported for pesticides to treat nut crops (OR=4.5; 95% CI=0.9, 23.0), and for children diagnosed before five years of age (OR=2.3; 95% CI: 1.3, 4.1). Exposure misclassification from JEM attenuated these associations by about 57%. Maternal occupational pesticide exposure before and after birth was not associated with ALL. CONCLUSIONS: The risk of ALL was elevated in young children with paternal occupational pesticide exposure during the perinatal period, using more detailed occupational information for exposure classification.	Environmental Research	156	NA	57-62	Job exposure matrix	Expert case-by-case assessment		Case-control	Pesticides in general	offspring	doctor-diagnosed	USA	hic
981	R. B. I. Postuma, A.; Hogl, B.; Arnulf, I.; Ferini-Strambi, L.; Manni, R.; Miyamoto, T.; Oertel, W.; Dauvilliers, Y.; Ju, Y. E.; Puligheddu, M.; Sonka, K.; Pelletier, A.; Santamaria, J.; Frauscher, B.; Leu-Semenescu, S.; Zucconi, M.; Terzaghi, M.; Miyamoto, M.; Unger, M. M.; Carlander, B.; Fantini, M. L.; Montplaisir, J. Y.	Risk factors for neurodegeneration in idiopathic rapid eye movement sleep behavior disorder: a multicenter study	2015	OBJECTIVE: To assess whether risk factors for Parkinson disease and dementia with Lewy bodies increase rate of defined neurodegenerative disease in idiopathic rapid eye movement (REM) sleep behavior disorder (RBD). METHODS: Twelve centers administered a detailed questionnaire assessing risk factors for neurodegenerative synucleinopathy to patients with idiopathic RBD. Variables included demographics, lifestyle factors, pesticide exposures, occupation, comorbid conditions, medication use, family history, and autonomic/motor symptoms. After 4 years of follow-up, patients were assessed for dementia or parkinsonism. Disease risk was assessed with Kaplan-Meier analysis, and epidemiologic variables were compared between convertors and those still idiopathic using logistic regression. RESULTS: Of 305 patients, follow-up information was available for 279, of whom 93 (33.3%) developed defined neurodegenerative disease. Disease risk was 25% at 3 years and 41% after 5 years. Patients who converted were older (difference=4.5 years, p<0.001), with similar sex distribution. Neither caffeine, smoking, nor alcohol exposure predicted conversion. Although occupation was similar between groups, those who converted had a lower likelihood of pesticide exposure (occupational insecticide=2.3% vs 9.0%). Convertors were more likely to report family history of dementia (odds ratio [OR]=2.09), without significant differences in Parkinson disease or sleep disorders. Medication exposures and medical history were similar between groups. Autonomic and motor symptoms were more common among those who converted. Risk factors for primary dementia and parkinsonism were generally similar, except for a notably higher clonazepam use in dementia convertors (OR=2.6). INTERPRETATION: Patients with idiopathic RBD are at very high risk of neurodegenerative synucleinopathy. Risk factor profiles between convertors and nonconvertors have both important commonalities and differences.	Annals of Neurology	77	5	830-9	Self-reported exposure			Cohort (prospective)	Type of pesticide	neurological	doctor-diagnosed	SHIC	SHIC
982	R. B. Mahajan, A.; Lynch, C. F.; Schroeder, P.; Hoppin, J. A.; Sandler, D. P.; Alavanja, M. C.	Fonofos exposure and cancer incidence in the agricultural health study	2006	BACKGROUND: The Agricultural Health Study (AHS) is a prospective cohort study of licensed pesticide applicators from Iowa and North Carolina enrolled 1993-1997 and followed for incident cancer through 2002. A previous investigation in this cohort linked exposure to the organophosphate fonofos with incident prostate cancer in subjects with family history of prostate cancer. OBJECTIVES: This finding along with findings of associations between organophosphate pesticides and cancer more broadly led to this study of fonofos and risk of any cancers among 45,372 pesticide applicators enrolled in the AHS. METHODS: Pesticide exposure and other data were collected using self-administered questionnaires. Poisson regression was used to calculate rate ratios (RRs) and 95% confidence intervals (CIs) while controlling for potential confounders. RESULTS: Relative to the unexposed, leukemia risk was elevated in the highest category of lifetime (RR = 2.24; 95% CI, 0.94-5.34, Ptrend = 0.07) and intensity-weighted exposure-days (RR = 2.67; 95% CI, 1.06-6.70, Ptrend = 0.04), a measure that takes into account factors that modify pesticide exposure. Although prostate cancer risk was unrelated to fonofos use overall, among applicators with a family history of prostate cancer, we observed a significant dose-response trend for lifetime exposure-days (Ptrend = 0.02, RR highest tertile vs. unexposed = 1.77, 95% CI, 1.03-3.05; RRinteraction = 1.28, 95% CI, 1.07-1.54). Intensity-weighted results were similar. No associations were observed with other examined cancer sites. CONCLUSIONS: Further study is warranted to confirm findings with respect to leukemia and determine whether genetic susceptibility modifies prostate cancer risk from pesticide exposure.	Environmental Health Perspectives	114	12	1838-42	Algorithm/model	Self-reported exposure		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
983	R. B. Mahajan, M. R.; Hoppin, J. A.; Alavanja, M. C.	Phorate exposure and incidence of cancer in the agricultural health study	2006	BACKGROUND: We recently reported a link between use of the organophosphate pesticide phorate and risk of prostate cancer among applicators with a family history of prostate cancer in the Agricultural Health Study (AHS). OBJECTIVE: This finding, together with findings of associations between other organophosphate pesticides and cancer more broadly, prompted us to examine phorate exposure and overall cancer incidence in the AHS. Adding 3 years of follow-up and using more detailed exposure information allowed us to see whether the prostate cancer finding held. METHODS: The AHS is a prospective study of licensed restricted-use pesticide applicators from North Carolina and Iowa. To our knowledge, this is the largest examination of workers occupationally exposed to phorate. Pesticide exposure and other information was collected using two self-administered questionnaires completed from 1993 to 1997. Poisson regression was used to calculate rate ratios (RR) and 95% confidence intervals (CI), adjusting for potential confounders. RESULTS: Phorate use was not related to the incidence of all cancers combined or to any individual cancer, although we had insufficient numbers to study non-Hodgkin lymphoma or leukemia, which have been linked to organophosphates in other studies. Although prostate cancer risk was not significantly related to phorate use overall or among those without a family history, the risk tended to increase among applicators with a family history of prostate cancer. The interaction RR was 1.53 (95% CI, 0.99-2.37). CONCLUSION: The observed statistical interaction suggests a gene-environment interaction between family history and phorate exposure in the incidence of prostate cancer, but other explanations are also possible.	Environmental Health Perspectives	114	8	1205-9	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
984	R. B. Postuma, J. Y. Montplaisir, A. Pelletier, Y. Dauvilliers, W. Oertel, A. Iranzo, L. Ferini-Strambi, I. Arnulf, B. Hogl, R. Manni, T. Miyamoto, G. Mayer, K. Stiasny-Kolster, M. Puligheddu, Y. Ju, P. Jennum, K. Sonka, J. Santamaria, M. L. Fantini, M. Zucconi, S. Leu-Semenescu, B. Frauscher, M. Terzaghi, M. Miyamoto, M. M. Unger, V. Cochen De Cock and C. Wolfson	Environmental risk factors for REM sleep behavior disorder: a multicenter case-control study	2012	OBJECTIVE: Idiopathic REM sleep behavior disorder is a parasomnia characterized by dream enactment and is commonly a prediagnostic sign of parkinsonism and dementia. Since risk factors have not been defined, we initiated a multicenter case-control study to assess environmental and lifestyle risk factors for REM sleep behavior disorder. METHODS: Cases were patients with idiopathic REM sleep behavior disorder who were free of dementia and parkinsonism, recruited from 13 International REM Sleep Behavior Disorder Study Group centers. Controls were matched according to age and sex. Potential environmental and lifestyle risk factors were assessed via standardized questionnaire. Unconditional logistic regression adjusting for age, sex, and center was conducted to investigate the environmental factors. RESULTS: A total of 694 participants (347 patients, 347 controls) were recruited. Among cases, mean age was 67.7 +/- 9.6 years and 81.0% were male. Cases were more likely to smoke (ever smokers = 64.0% vs 55.5%, adjusted odds ratio [OR] = 1.43, p = 0.028). Caffeine and alcohol use were not different between cases and controls. Cases were more likely to report previous head injury (19.3% vs 12.7%, OR = 1.59, p = 0.037). Cases had fewer years of formal schooling (11.1 +/- 4.4 years vs 12.7 +/- 4.3, p < 0.001), and were more likely to report having worked as farmers (19.7% vs 12.5% OR = 1.67, p = 0.022) with borderline increase in welding (17.8% vs 12.1%, OR = 1.53, p = 0.063). Previous occupational pesticide exposure was more prevalent in cases than controls (11.8% vs 6.1%, OR = 2.16, p = 0.008). CONCLUSIONS: Smoking, head injury, pesticide exposure, and farming are potential risk factors for idiopathic REM sleep behavior disorder.	Neurology	79	5	428-34	Self-reported exposure			Case-control	Pesticides in general	circulatory	doctor-diagnosed	AHIC	AHIC
985	R. Bergamaschi, P. Crosignani, E. Oddone, C. Montomoli and M. Imbriani	Multiple sclerosis and occupational exposures: A case-control study	2013	OBJECTIVE: To assess possible relationships between occupational exposures and risk of multiple sclerosis (MS). BACKGROUND: MS is recognized as a multi-factorial disease, in which genetic and environmental factors could act together. The exposure to substances spreading in work environment and potentially neurotoxic could be one of the co-factors involved in MS etiology, but there are very few studies about the association between occupational status and MS. DESIGN/METHODS: We carried out a case-control study, where cases were patients included in the MS Register of the Province of Pavia, Northern Italy, and controls, 1:2 matched by sex and age, were randomly selected from the National Health Service population files. The occupational histories were obtained from the Italian Institute for Social Providence (INPS) archives by automatic linkage using Italian Occupational Cancer Monitoring (OCCAM) method, that estimate the risk of specific occupational diseases, by geographic area and industrial sector. RESULTS: We included 660 MS patients (411 F, 249 M; mean age 49.1 years; mean disease duration 16.7 years) and 1320 controls. The risk of MS turned out to be higher in workers of mechanic industry (OR 17.4, 90% CI 5-60.6, p < 0.001), leather industry (OR 11.5, 90% CI 4.9-26.9, p < 0.001), and agriculture (OR 19.1, 90% CI 4.2-87.6, p < 0.001). CONCLUSIONS: The case-control study design with OCCAM approach appears to be a useful and low-cost method, not only for occupational cancer surveillance, but also for the study of diseases, like MS, whose etiology is not well defined yet. Our findings indicate that solvent exposures could be related to the risk of MS, as both shoe/leather workers and mechanic industry workers are exposed to organic solvents. A major risk of MS was also found among workers engaged in agriculture, suggesting a role of pesticides, whose neurotoxic effect is well known.	Neurology	80	1	NA	Registers			Case-control	Job title	neurological	doctor-diagnosed	Italy	hic
986	R. Boostani, A. Mellat, R. Afshari, S. Derakhshan, M. Saeedi, E. Rafeemanesh and M. Mellat	Delayed polyneuropathy in farm sprayers due to chronic low dose pesticide exposure	2014	Background: The use of organophosphates (OPs) in developing countries is rising in large quantities and non-secure methods. This problem not only causes acute poisoning but also may lead to chronic diseases such as polyneuropathy. In Iran, 60% of pesticides are organophosphate compounds that may lead to delayed polyneuropathy. Objectives: The purpose of the current study was to evaluate delayed polyneuropathy in farm sprayers due to chronic low dose pesticide exposure. Patients and Methods: In our cross-sectional study, non-randomized sampling method was performed and 100 farm sprayers (cases) and 100 hospital personnel (controls) after precise systemic and neurological examination were recruited to this study from June 2011 to august 2011. The nerve conduction studies were performed and these indices were recorded: Compound Muscle Action Potential (CMAP), amplitude and Distal Latency (DL) and Nerve Conduction Velocity (NCV) of common peroneal nerve, Peak Latency (PL) and amplitude of Sensory Nerve Action Potential (SNAP) and Nerve Conduction Velocity (NCV) of sural and radial sensory nerves. Results: Among 100 cases, 55 farm sprayers complained of non-neurological problems including: ophthalmologic, dermatologic and pulmonary complications. The ophthalmologic complaints (44%) were the most. The mean peroneal CMAP amplitude and NCV, sural PL, radial SNAP amplitude, PL and NCV in the case group were significantly different compared to control group. Mean exposure time to OPs in farm sprayers without neurological problem (40%) was 11.81 <U+00AC><U+00B1> 5.84 years but in farm sprayers with neurological problems (60%) was 15.70 <U+00AC><U+00B1> 9.08 years, which represents the effect of OPs exposure duration on neurologic problems. Conclusions: Chronic low dose pesticide exposure could lead to delayed peripheral neuropathy as well as systemic (skin, eyes and lungs) complications. In farm sprayers electrodiagnostic indices were significantly abnormal as compared to control group. The normal indices did not rule out neurologic involvement and it seems that measurement of these indices at the beginning of the farm sprayers employment and intermittently during their work is helpful for detecting delayed polyneuropathy. <U+00AC><U+00A9> 2014, Iranian Red Crescent Medical Journal.	Iranian Red Crescent Medical Journal	16	5	NA	Job title			Cross-sectional	Job title	neurological	medical test result	Iran	umic

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987	R. Bretveld, S. Kik, M. Hooiveld, I. van Rooij, G. Zielhuis and N. Roeleveld	Time-to-pregnancy among male greenhouse workers	2008	OBJECTIVES: Fertility problems are an increasing public health issue in industrialised countries. Exposure to exogenous agents with endocrine disrupting properties, such as some pesticides, are potential risk factors for subfertility. The aim of this study was to determine whether time-to-pregnancy (TTP) is prolonged in male greenhouse workers exposed to pesticides in comparison with a non-exposed reference group. METHODS: Data were collected through self-administrated questionnaires with detailed questions on TTP, as well as on lifestyle (for example, smoking habits, coffee and alcohol consumption), work tasks, and occupational exposures of the men and their partners in the six months before conception of the most recent pregnancy. TTP was compared between male greenhouse workers (n = 694) and a non-exposed reference group (n = 613) by means of discrete proportional hazards regression analysis. RESULTS: The crude analyses did not show a decreased overall fecundability among greenhouse workers compared to the non-exposed reference group. However, when fecundability was assessed for primigravidous couples, duogravidous couples, and multigravidous couples separately, greenhouse workers were found to be less fecund when trying to conceive their first pregnancy (FR = 0.65; 95% CI 0.46 to 0.92), which is also the most valid analysis in which pregnancy planning issues were avoided. Among couples who already experienced one or more pregnancies, no association was seen between pesticide exposure and TTP after adjustment for confounders. CONCLUSION: A prolonged time-to-pregnancy was observed in male greenhouse workers exposed to pesticides before conception of their first pregnancy.	Occupational & Environmental Medicine	65	3	185-90	Self-reported exposure			Cross-sectional	Pesticides in general	reproductive	self-reported	Netherlands	hic
988	R. Castro, V. Ramirez and P. Cuenca	[Micronuclei and other nuclear abnormalities in the oral epithelium of female workers exposed to pesticides]	2004	In order to study if banana fields labour exposure to pesticides produces some kind of DNA damage, we determine the presence of micronuclei in epithelial oral cells in working women in Guapiles and Siquirres, Costa Rica, as an effect biomarker. We also analyzed other abnormalities in the nucleus of those cells such as broken-egg, karyolysis or kariorrhexis, to see if there was some kind of genotoxicity or citotoxicity. The women group exposed to pesticides worked in packing bananas plant from different independent farms. The control group of women had never done any farming tasks; they did not live in the banana fields, neither their husband. We got information about the life style, medical and familial history of the participants through an interview. We did not found any significant increment in the frequency of micronuclei form the exposed group compared with the controls. The other nuclei abnormalities showed signs ofcitotoxicity or genotoxicity in the controls, associated with the intake of coffee and dental x-rays. These results do not rule out at that pesticides used in packing bananas are agents capable of producing damage to the DNA, but it seems that micronuclei from the oral epithelium is not the most adequate marker to measure it.	Revista de Biologia Tropical	52	3	611-21	Self-reported exposure			Case-control	Pesticides in general	genetic (biomarkers)	medical test result	Costa Rica	umic
989	R. E. Rowland, L. A. Edwards and J. V. Podd	Elevated sister chromatid exchange frequencies in New Zealand Vietnam War veterans	2007	From July 1965 until November 1971, New Zealand Defence Force Personnel fought in the Vietnam War. During this time more than 76,500,000 litres of phenoxylic herbicides were sprayed over parts of Southern Vietnam and Laos, the most common being known as 'Agent Orange'. The current study aimed to ascertain whether or not New Zealand Vietnam War veterans show evidence of genetic disturbance arising as a consequence of their now confirmed exposure to these defoliants. A sample group of 24 New Zealand Vietnam War veterans and 23 control volunteers were compared using an SCE (sister chromatid exchange) analysis. The results from the SCE study show a highly significant difference ($P < 0.001$) between the mean of the experimental group (11.05) and the mean of a matched control group (8.18). The experimental group also has an exceptionally high proportion of HFCs (cells with high SCE frequencies) above the 95th percentile compared to the controls (11.0 and 0.07%, respectively). We conclude that the New Zealand Vietnam War veterans studied here were exposed to a clastogenic substance(s) which continues to exert an observable genetic effect today, and suggest that this is attributable to their service in Vietnam.	Cytogenetic & Genome Research	116	4	248-51	Registers			Cohort (prospective)	Chemical class	genetic (biomarkers)	medical test result	New Zealand	hic
990	R. E. Slager, J. A. Poole, T. D. LeVan, D. P. Sandler, M. C. Alavanja and J. A. Hoppin	Rhinitis associated with pesticide exposure among commercial pesticide applicators in the Agricultural Health Study	2009	OBJECTIVES: Rhinitis is common, but the risk factors are not well described. To investigate the association between current rhinitis and pesticide use, we used data from 2245 Iowa commercial pesticide applicators in the Agricultural Health Study. METHODS: Using logistic regression models adjusted for age, education and growing up on a farm, we evaluated the association between current rhinitis and 34 pesticides used in the past year. RESULTS: 74% of commercial pesticide applicators reported at least one episode of rhinitis in the past year (current rhinitis). Five pesticides used in the past year were significantly positively associated with current rhinitis: the herbicides 2,4-D, glyphosate and petroleum oil, the insecticide diazinon and the fungicide benomyl. The association for 2,4-D and glyphosate was limited to individuals who used both in the past year (OR 1.42, 95% CI 1.14 to 1.77). Both petroleum oil and diazinon showed consistent evidence of an association with rhinitis, based on both current use and exposure-response models. We saw no evidence of confounding by common agricultural rhinitis triggers such as handling grain or hay. CONCLUSIONS: Exposure to pesticides may increase the risk of rhinitis.	Occupational & Environmental Medicine	66	11	718-24	Self-reported exposure			Cross-sectional	Specific active ingredient	respiratory	self-reported	USA	hic
991	R. E. Slager, S. L. Simpson, T. D. Levan, J. A. Poole, D. P. Sandler and J. A. Hoppin	Rhinitis associated with pesticide use among private pesticide applicators in the agricultural health study	2010	Farmers commonly experience rhinitis but the risk factors are not well characterized. The aim of this study was to analyze cross-sectional data on rhinitis in the past year and pesticide use from 21,958 Iowa and North Carolina farmers in the Agricultural Health Study, enrolled 1993-1997, to evaluate pesticide predictors of rhinitis. Polytomous and logistic regression models were used to assess association between pesticide use and rhinitis while controlling for demographics and farm-related exposures. Sixty-seven percent of farmers reported current rhinitis and 39% reported 3 or more rhinitis episodes. The herbicides glyphosate [odds ratio (OR) = 1.09, 95% confidence interval (95% CI) = 1.05-1.13] and petroleum oil (OR = 1.12, 95% CI = 1.05-1.19) were associated with current rhinitis and increased rhinitis episodes. Of the insecticides, four organophosphates (chlorpyrifos, diazinon, dichlorvos, and malathion), carbaryl, and use of permethrin on animals were predictors of current rhinitis. Diazinon was significant in the overall polytomous model and was associated with an elevated OR of 13+ rhinitis episodes (13+ episodes OR = 1.23, 95% CI = 1.09-1.38). The fungicide captan was also a significant predictor of rhinitis. Use of petroleum oil, use of malathion, use of permethrin, and use of the herbicide metolachlor were significant in exposure-response polytomous models. Specific pesticides may contribute to rhinitis in farmers; agricultural activities did not explain these findings.	Journal of Toxicology & Environmental Health Part A	73	20	1382-93	Self-reported exposure			Cross-sectional	Pesticides in general	respiratory	self-reported	USA	hic

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992	R. G. Ames, K. Steenland, B. Jenkins, D. Chrislip and J. Russo	Chronic neurologic sequelae to cholinesterase inhibition among agricultural pesticide applicators	1995	To test the hypothesis that chronic neurologic sequelae are associated with cholinesterase depression short of frank organophosphate poisoning, we compared 45 male subjects who had a history of moderate cholinesterase inhibition with 90 male subjects who had neither past cholinesterase inhibition nor current pesticide exposure. Cholinesterase-inhibited subjects were defined as having had a history of (a) red blood cell cholinesterase at 70% or less of baseline or (b) plasma cholinesterase at 60% or less of baseline absent symptoms of frank poisoning. In the subject comparison evaluation, only 1 of 27 neurologic tests (i.e., serial digit performance) was significant statistically, but it was opposite of the direction hypothesized. In a companion study for which the same battery of neurologic tests and the same subjects were used, neurologic sequelae were related to high exposures among subjects who sought treatment for organophosphate poisoning. The data in the current study, in which the subjects experienced lower exposures short of frank poisoning, provide some evidence that preventing acute organophosphate poisoning also prevents neurologic sequelae.	Archives of Environmental Health	50	6	440-4	Biomonitoring (blood)			Cross-sectional	Chemical class	neurological	medical test result	USA	hic
993	R. G. Trabanino, R. Aguilar, C. R. Silva, M. O. Mercado and R. L. Merino	[End-stage renal disease among patients in a referral hospital in El Salvador]	2002	OBJECTIVE: El Salvador is a country with high mortality from end-stage renal disease (ESRD). The objective of this study was to determine the epidemiological characteristics of a series of new cases of ESRD seen in a referral hospital in the country. METHODS: A cross-sectional study was conducted of all the new cases that initiated chronic dialysis between November 1999 and March 2000. Using a personal interview, data were obtained on the patients' clinical, demographic, and occupational characteristics, among others. RESULTS: During the five months that the study lasted, 205 new cases of ESRD were observed. Among the 202 interviewees, two groups were clearly distinguished. One group, of 67 patients (33%), had known risk factors for ESRD, similar to those for developed countries (basically, diabetes mellitus, hypertension, and chronic consumption of non-steroidal anti-inflammatories). Another group of 135 patients (67%) had unusual characteristics that were not associated with the known risk factors. The majority of the patients in this second group were male, farmers, residents of coastal areas or areas next to rivers, and some years before had been exposed, without adequate protection, to agricultural insecticides or pesticides through their work. CONCLUSIONS: We have identified an important group of patients with ESRD who seem to lack a cause for their disease. Their special characteristics make it possible to suspect a relationship with the occupational exposure to insecticides or pesticides. New studies are needed in order to confirm this hypothesis.	Pan American Journal of Public Health	12	3	202-6	Self-reported exposure			Cross-sectional	Pesticides in general	genitourinary	doctor-diagnosed	El Salvador	lmic
994	R. H. Hu, X.; Huang, J.; Li, Y.; Zhang, C.; Yin, Y.; Chen, Z.; Jin, Y.; Cai, J.; Cui, F.	Long- and short-term health effects of pesticide exposure: a cohort study from China	2015	Pesticides are extensively used by farmers in China. However, the effects of pesticides on farmers' health have not yet been systematically studied. This study evaluated the effects of pesticides exposure on hematological and neurological indicators over 3 years and 10 days respectively. A cohort of 246 farmers was randomly selected from 3 provinces (Guangdong, Jiangxi, and Hebei) in China. Two rounds of health investigations, including blood tests and neurological examinations, were conducted by medical doctors before and after the crop season in 2012. The data on pesticide use in 2009-2011 were collected retrospectively via face-to-face interviews and the 2012 data were collected from personal records maintained by participants prospectively. Ordinary least square (OLS), Probit, and fixed effect models were used to evaluate the relationship between pesticides exposure frequency and the health indicators. Long-term pesticide exposure was found to be associated with increased abnormality of nerve conductions, especially in sensory nerves. It also affected a wide spectrum of health indicators based on blood tests and decreased the tibial nerve compound muscle action potential amplitudes. Short-term health effects included alterations in complete blood count, hepatic and renal functions, and nerve conduction velocities and amplitudes. However, these effects could not be detected after 3 days following pesticide exposure. Overall, our results demonstrate that pesticide exposure adversely affects blood cells, the liver, and the peripheral nervous system. Future studies are needed to elucidate the specific effects of each pesticide and the mechanisms of these effects.	PLoS ONE [Electronic Resource]	10	6	e0128766	Registers	Self-reported exposure		Cohort (prospective)	Pesticides in general	hematological	medical test result	China	umic
995	R. H. Wong, S. Y. Chang, S. W. Ho, P. L. Huang, Y. J. Liu, Y. C. Chen, Y. H. Yeh and H. S. Lee	Polymorphisms in metabolic GSTP1 and DNA-repair XRCC1 genes with an increased risk of DNA damage in pesticide-exposed fruit growers	2008	Pesticide exposure is associated with various neoplastic diseases and congenital malformations. Previous studies have indicated that pesticides may be metabolized by cytochrome P450 3A5 or glutathione S-transferases. DNA-repair genes, including X-ray repair cross-complementing group 1 (XRCC1) and xeroderma pigmentosum group D (XPD), may also be implicated in the process of pesticide-related carcinogenesis. Thus, we investigated whether various metabolic and DNA-repair genotypes increase the risk of DNA damage in pesticide-exposed fruit growers. Using the comet assay, the extent of DNA damage was evaluated in the peripheral blood of 135 pesticide-exposed fruit growers and 106 unexposed controls. The metabolic genotypes CYP3A5 (A(-44)G) and GSTP1 (Ile105Val) and DNA-repair genotypes XRCC1 (Arg399Gln, Arg194Trp, T(-77)C) and XPD (Asp312Asn, Lys751Gln) were identified by polymerase chain reaction. Our multiple regression model for DNA tail moment showed that age, high pesticide exposure, low pesticide exposure, GSTP1 Ile-Ile, and XRCC1 399 Arg-Arg genotype were associated with increased DNA tail moment (DNA damage). Further analysis of interaction between GSTP1 and XRCC1 genes that increase susceptibility revealed a significant difference in DNA tail moment for high pesticide-exposed subjects carrying both GSTP1 Ile-Ile with XRCC1 399 Arg-Arg genotypes (2.49+/-0.09 microm/cell; P=0.004), compared to those carrying GSTP1 Ile-Val/Val-Val with XRCC1 399 Arg-Gln/Gln-Gln genotypes (1.98+/-0.15 microm/cell). These results suggest that individuals with susceptible metabolic GSTP1 and DNA-repair XRCC1 genotypes may be at increased risk of DNA damage due to pesticide exposure.	Mutation Research	654	2	168-75	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Taiwan	hic

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996	R. Hebert, J. Lindsay, R. Verreault, K. Rockwood, G. Hill and M. F. Dubois	Vascular dementia : incidence and risk factors in the Canadian study of health and aging	2000	BACKGROUND AND PURPOSE: Very few population-based studies have systematically examined incident vascular dementia (VaD). From the Canadian Study of Health and Aging cohort, incidence rates of VaD were determined and risk factors analyzed. METHODS: This was a cohort incidence study that followed 8623 subjects presumed to be free of dementia over a 5-year period. The risk factors were examined with a nested prospective case-control study. Exposure was determined by means of a risk factor questionnaire administered to the subject or a proxy at the beginning of the study. RESULTS: On the basis of 38 476 person-years at risk, the annual incidence rate was estimated to be 2.52 per thousand undemented Canadians (95% CI 2. 02 to 3.02). Including an estimation of the probability of VaD among the decedents, this figure rose to 3.79. For the risk factors study, 105 incident cases of VaD according to the NINCDS-AIREN criteria were compared with 802 control subjects. Significant risk factors were: age (OR=1.05), residing in a rural area (2.03), living in an institution (2.33), diabetes (2.15), depression (2.41), apolipoprotein E epsilon4 (2.34), hypertension for women (2.05), heart problems for men (2.52), taking aspirin (2.33), and occupational exposure to pesticides or fertilizers (2.05). Protective factors were eating shellfish (0.46) and regular exercise for women (0.46). There was no relation with sex, education, or alcohol. CONCLUSIONS: The study confirmed some previously reported risk factors but also suggested new ones. It raised concerns about the prescription of aspirin and perhaps other factors related to rural life.	Stroke	31	7	1487-93	Self-reported exposure			Case-control	Type of pesticide	circulatory	doctor-diagnosed	Canada	hic
997	R. J. Peiris-John, D. K. Ruberu, A. R. Wickremasinghe, L. A. Smit and W. van der Hoek	Effects of occupational exposure to organophosphate pesticides on nerve and neuromuscular function	2002	This study aimed to investigate whether occupational exposure to organophosphate (OP) pesticides caused neurophysiological abnormalities. Thirty farmers who regularly spray OP pesticides and 30 fishermen (controls), living close by but not involved in pesticide spraying, were evaluated during and between cultivation seasons. The farmers had higher erythrocyte acetylcholinesterase levels than the controls during (P = 0.06) and between cultivation seasons (P = 0.09). During the cultivation season, there was a significant reduction in erythrocyte acetylcholinesterase activity in both groups (P < 0.01). Significant differences between the farmers and controls were found in sensory conduction velocity (P = 0.04) and motor conduction velocity (P = 0.04) between cultivation seasons. Sensory conduction velocity was reduced significantly in farmers (P < 0.01) and in controls (P = 0.04) during the cultivation season. Effects of OP poisoning were seen both in farmers and in controls, who had no history of spray activities. Evidence of sensory dysfunction after acute exposure and sensory and motor impairment after long-term low-level exposure to OP was seen.	Journal of Occupational & Environmental Medicine	44	4	352-7	Biomonitoring (blood)			Cohort (prospective)	Chemical class	neurological	medical test result	Sri Lanka	lmic
998	R. J. R. Peiris-John, D. K.; Wickremasinghe, A. R.; van-der-Hoek, W.	Low-level exposure to organophosphate pesticides leads to restrictive lung dysfunction	2005	Apart from symptomology, there are very few reports on lung function following exposure to low levels of organophosphate (OP) pesticides in man. Twenty-five occupationally exposed farmers and 22 environmentally exposed freshwater fishermen were evaluated between and during OP spray seasons. Forty marine fishermen living away from agricultural areas were recruited as a control group. Forced vital capacity (FVC) and forced expiratory volume in the first second (FEV(1)) were measured by spirometry. Haemoglobin corrected erythrocyte acetylcholinesterase (AChE) levels were measured during and between (baseline estimation) spray seasons using a portable WHO-approved Test-mate system (EQM Research, Ohio). FVC ratio was lower in the farmers as compared to the controls (P<0.001) between exposure seasons. In the farmers, FVC ratio decreased further during the exposure season (P=0.023). FEV(1) was lower in the farmers as compared to the controls in both periods (P<0.05). In the fishermen, the decrease in ratios of FVC and FEV(1) following exposure to pesticides was not significant. FEV(1)/FVC ratios were similar in the three groups between (P=0.988) and during (P=0.159) exposure periods. Following exposure to OPs, AChE levels dropped 12.75% in the farmers (P<0.001) and 5.62% in the freshwater fishermen (P=0.001). Occupational exposure to OP results in restrictive lung dysfunction, a phenomenon not observed following environmental exposure.	Respiratory Medicine	99	10	1319-24	Job title			Cohort (prospective)	Job title	respiratory	medical test result	Sri Lanka	lmic
999	R. J. Schmidt, V. Kogan, J. F. Shelton, L. Delwiche, R. L. Hansen, S. Ozonoff, C. C. Ma, E. C. McCanlies, D. H. Bennett, I. Hertz-Picciotto, D. J. Tancredi and H. E. Volk	Combined Prenatal Pesticide Exposure and Folic Acid Intake in Relation to Autism Spectrum Disorder	2017	BACKGROUND: Maternal folic acid (FA) protects against developmental toxicity from certain environmental chemicals. OBJECTIVE: We examined combined exposures to maternal FA and pesticides in relation to autism spectrum disorder (ASD). METHODS: Participants were California children born from 2000-2007 who were enrolled in the Childhood Autism Risks from Genetics and the Environment (CHARGE) case-control study at age 2-5 y, were clinically confirmed to have ASD (n=296) or typical development (n=220), and had information on maternal supplemental FA and pesticide exposures. Maternal supplemental FA and household pesticide product use were retrospectively collected in telephone interviews from 2003-2011. High vs. low daily FA intake was dichotomized at 800mug (median). Mothers' addresses were linked to a statewide database of commercial applications to estimate agricultural pesticide exposure. RESULTS: High FA intake (>=800mug) during the first pregnancy month and no known pesticide exposure was the reference group for all analyses. Compared with this group, ASD was increased in association with <800mugFA and any indoor pesticide exposure {adjusted odds ratio [OR]=2.5 [95% confidence interval (CI): 1.3, 4.7]} compared with low FA [OR=1.2 (95% CI: 0.7, 2.2)] or indoor pesticides [OR=1.7 (95% CI: 1.1, 2.8)] alone. ORs for the combination of low FA and regular pregnancy exposure (>=6mo) to pet pesticides or to outdoor sprays and foggers were 3.9 (95% CI: 1.4, 11.5) and 4.1 (95% CI: 1.7, 10.1), respectively. ORs for low maternal FA and agricultural pesticide exposure 3 mo before or after conception were 2.2 (95% CI: 0.7, 6.5) for chlorpyrifos, 2.3 (95% CI: 0.98, 5.3) for organophosphates, 2.1 (95% CI: 0.9, 4.8) for pyrethroids, and 1.5 (95% CI: 0.5, 4.8) for carbamates. Except for carbamates, these ORs were approximately two times greater than those for either exposure alone or for the expected ORs for combined exposures under multiplicative or additive models. CONCLUSIONS: In this study population, associations between pesticide exposures and ASD were attenuated among those with high versus low FA intake during the first month of pregnancy. Confirmatory and mechanistic studies are needed. https://doi.org/10.1289/EHP604.	Environmental Health Perspectives	125	9	97007	Expert case-by-case assessment	Self-reported exposure		Case-control	Pesticides in general	offspring	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1000	R. K. Sharma, G. Upadhyay, N. J. Siddiqi and B. Sharma	Pesticides-induced biochemical alterations in occupational North Indian suburban population	2013	Pesticides are used in agriculture to protect crops from insects-pests. Most of the field workers of North Indian population are exposed to commonly used insecticides. In the present study, pesticides induced oxidative stress as well as alterations in the level of acetylcholinesterase (AChE) in a total of 70 male healthy agricultural sprayers, exposed to pesticides for about 5 years, were studied and the results were compared with 70 controls. The levels of antioxidant enzymes (superoxide dismutase, CAT, glutathione-S-transferase and glutathione peroxidase), AChE, lipid peroxidation and glutathione (GSH) contents were determined in their blood erythrocytes (red blood cells (RBCs)). The results indicated significant increase in the levels of malondialdehyde as well as the activities of antioxidant enzymes in pesticide-exposed individuals. The levels of GSH, RBC-AChE activity and plasma antioxidant potential were sharply decreased when compared with control subjects. The ferric-reducing ability of plasma (FRAP) assay was carried out to evaluate the antioxidant potential of pesticide in exposed as well as healthy controls. A significant positive correlation was observed between plasma FRAP value and the activity of AChE from RBCs in pesticides sprayers. Furthermore, these results were supported by enhanced messenger RNA expressions of cytochrome P450 isoform 2E1 (CYP2E1) and gutathione-S-transferase isoform pi (GST-pi) in the white blood cells of the randomly selected pesticide-exposed individuals. The decreased GSH level in human red blood cells accompanied by increase in the levels of the activities of antioxidative enzymes and over expressions of CYP2E1 and GST-pi is an indicative of oxidative stress in pesticides-exposed individuals. The reduced activity of AChE indicates possible occurrence of perturbations in blood as well as neurotoxicity in pesticide sprayers.	Human & Experimental Toxicology	32	11	1213-27	Biomonitoring (blood)			Cross-sectional	Chemical class	biochemical	medical test result	India	lmic
1001	R. Kasmani, N. A. Othieno-Abinya, M. T. Singh Riyat, G. W. Kiarie and P. Wanzala	Environmental and occupational factors associated with chronic myeloid leukemia: a case-control study	2014	Background: The relationship between chronic myeloid leukemia (CML) and a broad range of exposures to occupational and environmental factors known to cause leukemia in general is limited. CML is by and large incurable and treatment is just palliative and life prolonging, with high case fatality rate, even in the best centers. Furthermore treatment is very expensive. Identification of leukemogenic factors is therefore important if this can lead to simple public health interventions. Objective: The objective was to determine key environmental and occupational exposure factors that may be associated with CML. Methods: This was a case-control study involving CML cases enrolled in Glivec International Patient Assistance Program (GIPAP) clinics at the Nairobi Hospital and Aga Khan University Hospital and two control groups for each case, matched for age and sex: a family- and hospital-based control, was carried out. One hundred and eight cases with ageand-gender-matched family- and hospital-based controls were recruited and a standard questionnaire was administered. Individual data on demographics, occupation, environment, and exposures to benzene and farm organochemical products were obtained. Clinical examination was carried out in control subjects. Statistical analysis was done using bivariate and multivariate analysis to look for associations between exposure factors and CML. Results: The median age at diagnosis of CML cases was 41.32 years with an age range of 8<U+201A><U+00C4><U+00EC>81 years and a male to female ratio of 1.7:1. Most of our cases were concentrated in or around Nairobi. There was no significant correlation found for exposure to benzene or pesticides. Long duration of exposure to pesticides in the family control group was significantly associated (t-test, P = 0.017) with risk of CML. Conclusions: Associations between exposures to organic solvents like pesticides and CML were indicated but were not entirely consistent, although no associations with benzene products were found. Nevertheless, for almost all cases of Ph chromosome-positive CML, other explanations must be sought for.	Journal Africain du Cancer	6	4	194-201	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Kenya	lmic
1002	R. Kaur, S. Kaur and M. Lata	Evaluation of DNA damage in agricultural workers exposed to pesticides using single cell gel electrophoresis (comet) assay	2011	Background : Pesticides are used in agriculture to protect crops, but they pose a potential risk to farmers and environment. The aim of the present study is to investigate the relation between the occupational exposure to various pesticides and the presence of DNA damage. Materials and Methods : Blood samples of 210 exposed workers (after a day of intense spraying) and 50 control subjects belonging to various districts of Punjab (India) were evaluated using Comet assay. Sixty workers who showed DNA damage were selected for follow up at 5-6 months after the first sampling during a low or null spraying period. Results : Significant differences were found in DNA damage between freshly exposed workers and controls and freshly exposed and followed up cases. There was significant increase in the comet parameters viz. mean comet tail length and frequency of cells showing migration in exposed workers as compared to controls (72.22 <U+00AC><U+00B1> 20.76 vs. 46.92 <U+00AC><U+00B1> 8.17, P<0.001; 31.79 vs. 5.77, P<0.001). In the second samples, followed up cases showed significant decrease in frequency of damaged cells as compared to freshly exposed workers of first sampling (P<0.05). The confounding factors such as variable duration of pesticide exposure, age, smoking, drinking and dietary habits etc which were expected to modulate the damage, were instead found to have no significant effect on DNA fragmentation. Conclusion : The evidence of a genetic hazard related to exposure resulting from the intensive use of pesticides stresses the need for educational programs for agricultural workers to reduce the use of chemicals in agriculture.	Indian Journal of Human Genetics	17	3	179-187	Job title			Case-control	Job title	genetic (biomarkers)	medical test result	India	lmic
1003	R. M. M. Semenciw, H. I.; Morison, D.; Mao, Y.	Leukemia mortality and farming in the prairie provinces of Canada	1994	BACKGROUND: An increased risk of leukemia has been previously noted among farmers. PURPOSE: To examine the risk of fatal leukemia according to various farming practices in a large cohort of Canadian farm operators. METHODS: A cohort study of the mortality experience (1971-1987) of male farmers in Manitoba, Saskatchewan and Alberta has been conducted. The census records of 156,242 male farmers identified on the 1971 Census of Agriculture and the corresponding Census of Population were linked to mortality records through 1987. RESULTS: We observed a statistically significant test for trend (p = 0.03) between leukemia mortality and the number of chickens and/or turkeys owned (relative risk for > or = 130 chickens and/or turkeys = 1.32, 95% CI = 0.99, 1.77). No association was observed between leukemia mortality and either insecticide or herbicide use. CONCLUSIONS: Further research is necessary regarding why farmers exposed to chickens may be at an increased risk of leukemia.	Canadian Journal of Public Health. Revue Canadienne de Sante Publique	85	3	208-11	Job title			Cohort (prospective)	Job title	mortality (all cause)	doctor-diagnosed	Canada	hic

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1004	R. M. Park, P. A. Schulte, J. D. Bowman, J. T. Walker, S. C. Bondy, M. G. Yost, J. A. Touchstone and M. Dosemeci	Potential occupational risks for neurodegenerative diseases	2005	BACKGROUND: Associations between occupations and neurodegenerative diseases (NDD) may be discernable in death certificate data. METHODS: Hypotheses generated from 1982 to 1991 study were tested in data from 22 states for the years 1992-1998. Specific occupations and exposures to pesticides, solvents, oxidative stressors, magnetic fields, and welding fumes were evaluated. RESULTS: About one third (26/87) of the occupations hypothesized with neurodegenerative associations had statistically significant elevated mortality odds ratios (MOR) for the same outcome. Occupations with the largest MORs were (a) for presenile dementia (PSD)-dentists, graders/sorters (non-agricultural), and clergy; (b) for Alzheimer's disease (AD)-bank tellers, clergy, aircraft mechanics, and hairdressers; (c) for Parkinson's disease (PD)-biological scientists, clergy, religious workers, and post-secondary teachers; and (d) for motor neuron disease (MND)-veterinarians, hairdressers, and graders and sorters (non-agricultural). Teachers had significantly elevated MORs for all four diseases, and hairdressers for three of the four. Non-horticultural farmers below age 65 had elevated PD (MOR = 2.23, 95% CI = 1.47-3.26), PSD (MOR = 2.22, 95% CI = 1.10-4.05), and AD (MOR = 1.76, 95% CI = 1.04-2.81). Sixty hertz magnetic fields exhibited significant exposure-response for AD and, below age 65, for PD (MOR = 1.87, 95% CI = 1.14-2.98) and MND (MOR = 1.63, 95% CI = 1.10-2.39). Welding had elevated PD mortality below age 65 (MOR = 1.77, 95% CI = 1.08-2.75). CONCLUSIONS: Support was observed for hypothesized excess neurodegenerative disease associated with a variety of occupations, 60 Hz magnetic fields and welding.	American Journal of Industrial Medicine	48	1	63-77	Job title			Cohort (prospective)	Job title	neurological	doctor-diagnosed	USA	hic
1005	R. M. Salvi, D. R. Lara, E. S. Ghisolfi, L. V. Portela, R. D. Dias and D. O. Souza	Neuropsychiatric evaluation in subjects chronically exposed to organophosphate pesticides	2003	Long-term exposure to low levels of organophosphate pesticides (OP) may produce neuropsychiatric symptoms. We performed clinical, neuropsychiatric, and laboratory evaluations of 37 workers involved in family agriculture of tobacco from southern Brazil who had been exposed to OP for 3 months, and in 25 of these workers, after 3 months without exposure to OP. Plasma acetylcholinesterase activity levels of all subjects were within the normal range (3.2 to 9.0 U/l) and were not different between on- and off-exposure periods (4.7 +/- 0.9 and 4.5 +/- 1.1 U/l, respectively). Clinically significant extrapyramidal symptoms were present in 12 of 25 subjects, which is unexpected in such a population. There was a significant reduction of extrapyramidal symptoms after 3 months without exposure to OP, but 10 subjects still had significant parkinsonism. Mini-mental and word span scores were within the expected range for this population and were not influenced by exposure to OP. Eighteen of the 37 subjects (48%) had current psychiatric diagnoses in the first interview (13 with generalized anxiety disorder and 8 with major depression). Among the 25 subjects who completed both evaluations, the total number of current psychiatric diagnoses, after 3 months without using OP, dropped from 24 to 13 and the number of affected individuals with any psychiatric diagnosis dropped from 11 to 7. In conclusion, this study reinforces the need for parameters other than acetylcholinesterase activity to monitor for chronic consequences of chronic low-dose OP exposure, and it suggests that subjects have not only transient motor and psychiatric consequences while exposed, but may also develop enduring extrapyramidal symptoms.	Toxicological Sciences	72	2	267-71	Biomonitoring (blood)			Cohort (prospective)	Chemical class	neurological	medical test result	Brazil	umic
1006	R. Magauzi, B. Mabaera, S. Rusakaniko, A. Chimusoro, N. Ndlovu, M. Tshimanga, G. Shambira, A. Chadambuka and N. Gombe	Health effects of agrochemicals among farm workers in commercial farms of Kwekwe district, Zimbabwe	2011	INTRODUCTION: Farm workers are at a very high risk of occupational diseases due to exposure to pesticides resulting from inadequate education, training and safety systems. The farm worker spends a lot of time exposed to these harmful agrochemicals. Numerous acute cases with symptoms typical of agrochemical exposure were reported from the commercial farms. We assessed the health effects of agrochemicals in farm workers in commercial farms of Kwekwe District (Zimbabwe), in 2006. METHODS: An analytical cross sectional study was conducted amongst a sample of 246 farm workers who handled agrochemicals when discharging their duties in the commercial farms. Plasma cholinesterase activity in blood specimens obtained from farm workers was measured using spectrophotometry to establish levels of poisoning by organophosphate and/or carbamates. Information on the knowledge, attitudes and practices of farm workers on agrochemicals use was collected using a pre-tested interviewer administered questionnaire. Bivariate and multivariate analyses were conducted to determine factors that were associated with abnormal cholinesterase activity. RESULTS: The prevalence of organophosphate poisoning, indicated by cholinesterase activity of 75% or less, was 24.1%. The median period of exposure to agrochemicals was 3 years (Q(1):=1 year, Q(3):=7 years). Ninety eight (41.5%) farm workers knew the triangle colour code for the most dangerous agrochemicals. Not being provided with personal protective equipment (OR 2.00; 95% CI: 1.07 - 3.68) and lack of knowledge of the triangle colour code for most dangerous agrochemicals (OR 2.02; 95% CI: 1.02 - 4.03) were significantly associated with abnormal cholinesterase activity. CONCLUSION: There was organophosphate poisoning in the commercial farms. Factors that were significantly associated with the poisoning were lack of protective clothing and lack of knowledge of the triangle colour code for most dangerous agrochemicals. We recommended intensive health education and training of farm workers on the use of agrochemicals, provision of adequate and proper personal protective equipment as mitigation measures to this problem.	The Pan African medical journal	9	NA	26	Biomonitoring (blood)			Cross-sectional	Chemical class	NA	self-reported	Zimbabwe	lic
1007	R. Mahajan, A. Blair, J. Coble, C. F. Lynch, J. A. Hoppin, D. P. Sandler and M. C. Alavanja	Carbaryl exposure and incident cancer in the Agricultural Health Study	2007	Carbaryl is a carbamate insecticide with a broad spectrum of uses in agricultural, commercial and household settings. It has previously been linked with non-Hodgkin lymphoma (NHL) but studies of cancer risk in humans are limited. We examined occupational carbaryl use and risk of all cancers in the Agricultural Health Study, a prospective study of a cohort of pesticide applicators in North Carolina and Iowa. This analysis included 21,416 subjects (1,291 cases) enrolled from 1993-1997 and followed for cancer incidence through 2003. Pesticide exposure and other data were collected using self-administered questionnaires. Poisson regression was used to calculate rate ratios (RRs) and 95% confidence intervals (CIs) while controlling for potential confounders. Carbaryl was not associated with cancer risk overall. Relative to subjects who never used carbaryl, melanoma risk was elevated with >175 lifetime exposure-days (RR = 4.11; 95%CI, 1.33-12.75; p-trend = 0.07), >10 years of use (RR = 3.19; 95%CI, 1.28-7.92; p-trend = 0.04), or >or=10 days of use per year (RR = 5.50; 95%CI, 2.19-13.84; p-trend < 0.001). Risk remained after adjusting for sunlight exposure. Although not significant, there appeared to be a trend of decreasing prostate cancer risk with increasing level of exposure. A small increase in NHL risk was observed using some, but not all, exposure measures. No associations were observed with other examined cancer sites. Because the observed results were not hypothesized a priori and because of limited study of their biological plausibility, they should be interpreted with caution.	International Journal of Cancer	121	8	1799-805	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

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1008	R. McConnell and A. J. Hruska	An epidemic of pesticide poisoning in Nicaragua: implications for prevention in developing countries	1993	OBJECTIVES: The purpose of this study was to demonstrate the usefulness of the Northwestern Nicaraguan Ministry of Health surveillance system for detecting pesticide poisonings. METHODS: Cases were reported to the regional department of epidemiology through daily telephone reports and through monthly consolidated reports from each of the 18 health centers of the National Health Service. Reporting forms were also distributed to the four area hospitals. RESULTS: During June and July 1987, an epidemic of 548 pesticide poisoning was detected in northwestern Nicaragua. Seventy-seven percent of the poisonings were caused by carbofuran or methamidophos. Of the work-related cases (91% of reported poisonings), more than 80% occurred among maize farmers and on small to medium land holdings (fewer than 140 hectares). Nineteen percent of the work-related cases involved children under 16 years of age. CONCLUSIONS: Unsafe working conditions such as manual application of pesticides and the use of backpack sprayers, the introduction of a hazardous powdered formulation of carbofuran highly restricted in the developed world, and agricultural subsidies that encouraged the use of hazardous pesticides all contributed to the epidemic.	American Journal of Public Health	83	11	1559-1562	Registers			Cohort (prospective)	Pesticides in general	pesticide-related illness	doctor-diagnosed	Nicaragua	lmic
1009	R. Meinert, J. Schuz, U. Kaletsch, P. Kaatsch and J. Michaelis	Leukemia and non-Hodgkin's lymphoma in childhood and exposure to pesticides: results of a register-based case-control study in Germany	2000	Previous studies have suggested an association between exposure to pesticides and different types of childhood cancer. This paper presents results from a population-based case-control interview study of parents of children less than 15 years of age, which was conducted in the states of West Germany from 1993 to 1997. Cases were 1,184 children with leukemia, 234 with non-Hodgkin's lymphoma, and 940 with a solid tumor; 2,588 controls were also included. Parental occupational exposures were found to be related to childhood cancer regardless of the time period of exposure and the type of cancer. This finding might partially be explained by different recall of past exposures by the parents of cases and controls. Residential use of insecticides was associated with childhood lymphoma: both extermination of insects by professional pest controllers (odds ratio (OR) = 2.6, 95% confidence interval (CI): 1.2, 5.7) and frequency of parental use of household insecticides (p for trend = 0.02) were significant risk factors for this diagnosis. The use of pesticides on farms was weakly related to childhood leukemia (OR = 1.5, 95% CI: 1.0, 2.2), while their use in gardens was not associated with childhood leukemia (OR = 1.0, 95% CI: 0.8, 1.2). The major strengths of this study were the population base and the large number of cases and controls included; a drawback was assessment of exposure on the basis of parental interviews. The data provide some evidence for an increased leukemia risk for children living on farms and for an association between use of household pesticides and risk of childhood leukemia or lymphoma.	American Journal of Epidemiology	151	7	639-46; discussion 647-50	Self-reported exposure			Case-control	Pesticides in general	offspring	doctor-diagnosed	Germany	hic
1010	R. Naravaneni and K. Jamil	Determination of AChE levels and genotoxic effects in farmers occupationally exposed to pesticides	2007	Pesticides can cause cytogenetic effects and lower the acetyl cholinesterase (AChE) levels in farmers exposed to pesticides. In this study, 210 farmers exposed to pesticides and 160 non-exposed individuals were enrolled for determining the genotoxicity and AChE levels. The AChE levels were determined in plasma and RBC lysate from blood samples collected from farmers and control subjects. AChE (true and pseudo) estimation done by the colorimetric method revealed that there was a progressive fall in both the RBC and plasma AChE levels in exposed individuals compared to unexposed individuals, which correlated with the severity of exposure (253.5 versus 311.1 and 142.3 versus 152.1; P < 0.001). Cytogenetic studies showed an increase in DNA damage and higher chromosomal aberrations (CAs) in exposed farmers compared to the control subjects (26.13 versus 07.61 and 21.37 versus 1.52; P < 0.001). When comparing the AChE levels with DNA damage and structural CA frequencies, there was a negative linear correlation. Therefore based on these findings, it is concluded that genotoxic biomarkers like CA frequencies, DNA damage data along with AChE levels are important parameters for determining farmer's health who are exposed to pesticides in any situation.	Human & Experimental Toxicology	26	9	723-31	Self-reported exposure	Biomonitoring (blood)		Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	India	lmic
1011	R. O.-G. Recio, G.; Moran-Martinez, J.; Borja-Aburto, V.; Lopez-Cervante, M.; Uribe, M.; Torres-Sanchez, L.; Cebrian, M. E.	Pesticide exposure alters follicle-stimulating hormone levels in Mexican agricultural workers	2005	Organophosphorous pesticides (OPs) are suspected of altering reproductive function by reducing brain acetylcholinesterase activity and monoamine levels, thus impairing hypothalamic and/or pituitary endocrine functions and gonadal processes. Our objective was to evaluate in a longitudinal study the association between OP exposure and serum levels of pituitary and sex hormones. Urinary OP metabolite levels were measured by gas-liquid chromatography, and serum pituitary and sex hormone levels by enzymatic immunoassay and radioimmunoassay in 64 men. A total of 147 urine and blood samples were analyzed for each parameter. More than 80% of the participants had at least one OP metabolite in their urine samples. The most frequent metabolite found was diethylthiophosphate (DETP; 55%), followed by diethylphosphate (DEP; 46%), dimethylthiophosphate (DMTP; 32%), and dimethyldithiophosphate (DMDTP; 31%). However, the metabolites detected at higher concentrations were DMTP, DEP, DMDTP, and dimethylphosphate. There was a high proportion of individuals with follicle-stimulating hormone (FSH) concentrations outside the range of normality (48%). The average FSH serum levels were higher during the heavy pesticide spraying season. However, a multivariate analysis of data collected in all periods showed that serum FSH levels were negatively associated with urinary concentrations of both DMTP and DMDTP, whereas luteinizing hormone (LH) was negatively associated with DMTP. We observed no significant associations between estradiol or testosterone serum levels with OP metabolites. The hormonal disruption in agricultural workers presented here, together with results from experimental animal studies, suggests that OP exposure disrupts the hypothalamic-pituitary endocrine function and also indicates that FSH and LH are the hormones most affected.	Environmental Health Perspectives	113	9	1160-3	Biomonitoring (urine)			Cohort (prospective)	Chemical class	endocrine/nutritional/metabolical	medical test result	Mexico	umic
1012	R. P. Gallagher, C. D. Bajdik, S. Fincham, G. B. Hill, A. R. Keefe, A. Coldman and D. I. McLean	Chemical exposures, medical history, and risk of squamous and basal cell carcinoma of the skin	1996	The role of non-sunlight-related risk factors for squamous cell carcinoma (SCC) and basal cell carcinoma (BCC) of the skin was investigated in a population-based, case-control study conducted among males in Alberta, Canada. In total, 180 SCC and 226 BCC cases and 406 randomly selected male controls, frequency matched by 5-year age groups to the cases, were interviewed by trained personnel using a standardized etiological questionnaire. Data were analyzed using conditional logistic regression techniques. After adjustment for age, skin and hair color, mother's ethnic origin, and sunlight exposure, elevated risks for SCC were seen in subjects exposed to insecticides [odds ratio (OR), highest tertile, 2.8; 95% confidence interval (CI), 1.4-5.6], herbicides (OR, highest tertile, 3.9; 95% CI, 2.2-6.9), and fungicides and seed treatments (OR, highest tertile, 2.4; 95% CI, 1.4-4.0), as well petroleum products, grease, and several other exposures. Elevated risks of BCC were seen in subjects exposed to fiberglass dust (OR, 2.0; 95% CI, 1.0-3.9) and dry cleaning agents (OR, 4.6 95% CI, 1.1-19.7). Prior nondiagnostic X-ray treatment for skin conditions increased risk of both cancers. Although solar UV radiation is known to be the major environmental exposure causing nonmelanocytic skin cancer, results of this study suggest that nonsolar factors may also be important.	Cancer Epidemiology, Biomarkers & Prevention	5	6	419-24	Self-reported exposure			Case-control	Type of pesticide	cancer	doctor-diagnosed	Canada	hic

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1013	R. Payan-Renteria, G. Garibay-Chavez, R. Rangel-Ascencio, V. Preciado-Martinez, L. Munoz-Islas, C. Beltran-Miranda, S. Mena-Munguia, L. Jave-Suarez, A. Feria-Velasco and R. De Celis	Effect of chronic pesticide exposure in farm workers of a Mexico community	2012	Pesticides are frequently used substances worldwide, even when the use of some of them is forbidden due to the recognized adverse effect they have on the health of not only the people who apply the pesticides, but also of those that consume the contaminated products. The objectives of this study were to know the health issues of farm workers chronically exposed to pesticides, to evaluate possible damage at genetic level, as well as to explore some hepatic, renal, and hematological alterations. A transversal comparative study was performed between 2 groups, one composed of 25 farm workers engaged in pesticide spraying, and a control group of 21 workers not exposed to pesticides; both groups belonged to the Nextipac community in Jalisco, Mexico. Each member of both groups underwent a full medical history. Blood samples were taken from all farm workers in order to obtain a complete blood count and chemistry, clinical chemistry, lipid profile, liver and kidney function tests, erythrocyte cholinesterase quantification, lipid peroxidation profile, and free DNA fragment quantification. For the information analysis, central tendency and dispersion measurements were registered. In order to know the differences between groups, a cluster multivariate method was used, as well as prevalence reasons. The most used pesticides were mainly organophosphates, triazines and organochlorine compounds. The exposed group showed acute poisoning (20% of the cases) and diverse alterations of the digestive, neurological, respiratory, circulatory, dermatological, renal, and reproductive system probably associated to pesticide exposure. More importantly, they presented free DNA fragments in plasma (90.8 vs 49.05 ng/mL) as well as a higher level of lipid peroxidation (41.85 vs. 31.91 nmol/mL) in comparison with those data from unexposed farm workers. These results suggest that there exist health hazards for those farm workers exposed to pesticides, at organic and cellular levels.	Archives of Environmental & Occupational Health	67	1	22-30	Job title	Self-reported exposure		Cross-sectional	Job title	genetic (biomarkers)	medical test result	Mexico	umic
1014	R. Perumalla Venkata, M. F. Rahman, M. Mahboob, S. Indu Kumari, S. Chinde, B. M, N. Dumala and P. Grover	Assessment of genotoxicity in female agricultural workers exposed to pesticides	2017	OBJECTIVE: This study was designed to determine the genotoxic effect of exposure to a mixture of pesticides in 106 female agricultural workers employed in cotton fields from India. METHODS: Comet, micronucleus and chromosomal aberrations tests were carried out in peripheral blood lymphocytes. Micronucleus test was also performed in buccal epithelial cells. Levels of antioxidant enzymes, RBC acetylcholinesterase and hematological parameters were analyzed in the blood samples of the study subjects. RESULTS: The results indicated significant DNA damage, increased frequency of micronuclei and chromosomal aberrations in the exposed subjects (p<0.05). The levels of antioxidant enzymes were significantly lowered and the rate of lipid peroxidation was elevated in the exposed subjects. CONCLUSION: The outcome of the study revealed an increased risk of genotoxicity and health implications in female agricultural workers.	Biomarkers	22	5	446-454	Biomonitoring (blood)			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	India	lmic
1015	R. Polimanti, S. Piacentini, M. Barone, F. Porreca and M. Fuciarelli	Serum proteins and work habits in a group of farm-workers exposed to EBDCs	2010	BACKGROUND: Study of the association between genetic variability and individual susceptibility can help to characterize occupational or environmental risks due to xenobiotics. AIM: This study evaluates the influence of genetic components and environmental factors in relation to pesticide exposure. SUBJECTS AND METHODS: The study population consisted of 37 non-occupationally exposed workers and 74 farm-workers exposed to pesticide. Exposure was assessed through the measurement of urine concentration of ethylenethiourea (ETU). Genetic differences in drug metabolism were detected by a qualitative variability in serum proteins. The environmental factors were recorded by using a questionnaire. RESULTS: The results show a difference between ETU levels in farm-workers and in non-occupationally exposed workers. In the non-exposed group a relationship between ETU urinary concentration and lifestyle habits is present. In farm-workers ETU urinary concentration is less correlated with lifestyle habits, but is associated, rather, with their work. In the exposed individuals the serum protein analyses show a possible link between ETU urinary concentration and the polymorphism of group-specific component (Gc). CONCLUSIONS: The association between Gc polymorphism and ETU urinary concentration of subjects exposed to EBDCs could be due to the immunological function of Gc and the effects on the immune system of EBDCs.	Annals of Human Biology	37	3	440-50	Biomonitoring (urine)			Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	Italy	hic
1016	R. Presutti, S. A. Harris, L. Kachuri, J. J. Spinelli, M. Pahwa, A. Blair, S. H. Zahm, K. P. Cantor, D. D. Weisenburger, P. Pahwa, J. R. McLaughlin, J. A. Dosman and L. B. Freeman	Pesticide exposures and the risk of multiple myeloma in men: An analysis of the North American Pooled Project	2016	Multiple myeloma (MM) has been consistently linked with agricultural activities, including farming and pesticide exposures. Three case-control studies in the United States and Canada were pooled to create the North American Pooled Project (NAPP) to investigate associations between pesticide use and haematological cancer risk. This analysis used data from 547 MM cases and 2700 controls. Pesticide use was evaluated as follows: ever/never use; duration of use (years); and cumulative lifetime-days (LD) (days/year handled x years of use). Odds ratios (ORs) and 95% confidence intervals (CIs) were estimated using logistic regression adjusted for age, province/state of residence, use of proxy respondents and selected medical conditions. Increased MM risk was observed for ever use of carbaryl (OR=2.02, 95% CI=1.28-3.21), captan (OR=1.98, 95% CI=1.04-3.77) and DDT (OR=1.44, 95% CI=1.05-1.97). Using the Canadian subset of NAPP data, we observed a more than threefold increase in MM risk (OR=3.18, 95% CI=1.40-7.23) for <=10 cumulative LD of carbaryl use. The association was attenuated but remained significant for >10 LD of carbaryl use (OR=2.44; 95% CI=1.05-5.64; ptrend =0.01). For captan, <=17.5 LD of exposure was also associated with a more than threefold increase in risk (OR=3.52, 95% CI=1.32-9.34), but this association was attenuated in the highest exposure category of >17.5 LD (OR=2.29, 95% CI=0.81-6.43; ptrend =0.01). An increasing trend (ptrend =0.04) was observed for LD of DDT use (LD>22; OR=1.92, 95% CI=0.95-3.88). In this large North American study of MM and pesticide use, we observed significant increases in MM risk for use of carbaryl, captan and DDT.	International Journal of Cancer	139	8	1703-14	Self-reported exposure			Case-control	Specific active ingredient	cancer	doctor-diagnosed	USA/Canada	AHIC

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1017	R. Quansah, J. R. Bend, A. Abdul-Rahaman, F. A. Armah, I. Luginaah, D. K. Essumang, S. Iddi, J. Chevrier, S. J. Cobbina, E. Nketiah-Amponsah, S. Adu-Kumi, G. Darko and S. Afful	Associations between pesticide use and respiratory symptoms: A cross-sectional study in Southern Ghana	2016	BACKGROUND: Indiscriminate use of pesticides is a common practice amongst farmers in Low and Middle Income Countries (LMIC) across the globe. However, there is little evidence defining whether pesticide use is associated with respiratory symptoms. OBJECTIVES: This cross-sectional study was conducted with 300 vegetable farmers in southern Ghana (Akumadan). Data on pesticide use was collected with an interviewed-administered questionnaire. The concentration of seven organochlorine pesticides and 3 pyrethroid pesticides was assayed in urine collected from a sub-population of 100 vegetable farmers by a gas chromatograph equipped with an electron capture detector (GC-ECD). RESULTS: A statistically significant exposure-response relationship of years per day spent mixing/applying fumigant with wheezing [30-60 days/year: prevalence ratio (PR)=1.80 (95% CI 1.30, 2.50); >60days/year: 3.25 (1.70-6.33), p for trend=0.003] and hours per day spent mixing/applying fumigant with wheezing [1-2h/day: 1.20 (1.02-1.41), 3-5h/day: 1.45 (1.05-1.99), >5h/day: 1.74 (1.07-2.81), p for trend=0.0225]; days per year spent mixing/applying fungicide with wheezing [30-60 days/year: 2.04 (1.31-3.17); >60days/year: 4.16 (1.72-10.08), p for trend=0.0017] and h per day spent mixing/applying fungicide with phlegm production [1-2h/day: 1.25 (1.05-1.47), 3-5h/day: 1.55 (1.11-2.17), >5h/day: 1.93 (1.17-3.19), p for trend=0.0028] and with wheezing [1-2h/day: 1.10 (1.00-1.50), 3-5h/day: 1.20 (1.11-1.72), >5h/day: 1.32 (1.09-2.53), p for trend=0.0088]; h per day spent mixing/applying insecticide with phlegm production [1-2h/day: 1.23 (1.09-1.62), 3-5h/day: 1.51 (1.20-2.58), >5h/day: 1.85 (1.31-4.15), p for trend=0.0387] and wheezing [1-2h/day: 1.22 (1.02-1.46), 3-5h/day: 1.49 (1.04-2.12), >5h/day: 1.81 (1.07-3.08), p for trend=0.0185] were observed. Statistically significant exposure-response association was also observed for a combination of activities that exposes farmers to pesticide with all 3 respiratory symptoms. Furthermore, significant exposure-response associations for 3 organochlorine insecticides: beta-HCH, heptachlor and endosulfan sulfate were noted. CONCLUSIONS: In conclusion, vegetable farmers in Ghana may be at increased risk for respiratory symptoms as a result of exposure to pesticides.	Environmental Research	150	NA	245-54	Biomonitoring (urine)			Cross-sectional	Chemical class	NA	self-reported	Ghana	lmic
1018	R. R. B.-A. Jones, F.; Koutros, S.; Lerro, C. C.; Blair, A.; Lubin, J.; Heltshe, S. L.; Hoppin, J. A.; Alavanja, M. C.; Beane Freeman, L. E.	Incidence of solid tumours among pesticide applicators exposed to the organophosphate insecticide diazinon in the Agricultural Health Study: an updated analysis	2015	OBJECTIVE: Diazinon, a common organophosphate insecticide with genotoxic properties, was previously associated with lung cancer in the Agricultural Health Study (AHS) cohort, but few other epidemiological studies have examined diazinon-associated cancer risk. We used updated diazinon exposure and cancer incidence information to evaluate solid tumour risk in the AHS. METHODS: Male pesticide applicators in Iowa and North Carolina reported lifetime diazinon use at enrolment (1993-1997) and follow-up (1998-2005); cancer incidence was assessed through 2010(North Carolina)/2011(Iowa). Among applicators with usage information sufficient to evaluate exposure-response patterns, we used Poisson regression to estimate adjusted rate ratios (RRs) and 95% CI for cancer sites with >=10 exposed cases for both lifetime (LT) exposure days and intensity-weighted (IW) lifetime exposure days (accounting for factors impacting exposure). RESULTS: We observed elevated lung cancer risks (N=283) among applicators with the greatest number of LT (RR=1.60; 95% CI 1.11 to 2.31; P(trend)=0.02) and IW days of diazinon use (RR=1.41; 95% CI 0.98 to 2.04; P(trend)=0.08). Kidney cancer (N=94) risks were non-significantly elevated (RR(LT) days=1.77; 95% CI 0.90 to 3.51; P(trend)=0.09; RR(IW) days 1.37; 95% CI 0.64 to 2.92; P(trend)=0.50), as were risks for aggressive prostate cancer (N=656). CONCLUSIONS: Our updated evaluation of diazinon provides additional evidence of an association with lung cancer risk. Newly identified links to kidney cancer and associations with aggressive prostate cancer require further evaluation.	Occupational & Environmental Medicine	72	7	496-503	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
1019	R. R. Recio, W. A.; Borja-Aburto, V.; Moran-Martinez, J.; Froines, J. R.; Hernandez, R. M.; Cebrian, M. E.	Organophosphorous pesticide exposure increases the frequency of sperm sex null aneuploidy	2001	It has been estimated that 4 of 1,000 live births and 35% of spontaneous abortions are aneuploid and that an important proportion of embryo and newborn aneuploidy is of paternal origin. Exposure to organophosphorous pesticides (OP) has been associated with sperm hyperploidy/polyploidy. Therefore, we aimed to assess the frequency of sperm aneuploidy (X, Y, and 18) and its relationship with urinary OP metabolites in agricultural workers. We performed multicolor fluorescence in situ hybridization on samples from nine men obtained before and during the pesticide spraying season to assess sperm aneuploidy. We measured urinary OP metabolite levels by gas-liquid chromatography. Aneuploidies were found in 0.67% of total sperm nuclei. The most frequent aneuploidy was the lack of a sexual chromosome or sex null (0.19%), followed by XY18 (0.15%) and XY18-18 (0.06%). OP metabolites detected at higher concentrations were dimethylthiophosphate, dimethyldithiophosphate, and diethylphosphate (DEP). There were no differences in average aneuploidy frequency or urinary metabolite levels between samples collected before and after exposure. However, Poisson regression analysis adjusted for age, alcohol intake, and sperm concentration showed significant associations between OP metabolite concentrations and increased frequency of sperm aneuploidies. The association was more evident between DEP and sex null, and the risk increased further during the spraying season. Thus, OP exposure could interfere with sperm chromosome segregation and increase the risk for genetic syndromes, such as Turner's. Further studies are required to assess the prevalence of spontaneous abortions, birth defects, and genetic syndromes in agricultural communities.	Environmental Health Perspectives	109	12	1237-40	Biomonitoring (urine)			Cohort (prospective)	Chemical class	reproductive	medical test result	Mexico	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1020	R. S. Koskela, P. Mutanen, K. Kettunen, S. Rintakoski and M. Klockars	Occupational exposure in the etiology of rheumatoid arthritis	2013	Background Ca. 33,000 Finnish persons of working age are suffering from rheumatoid arthritis (RA). Considerable geographic variations in the age adjusted prevalence of RA were found. Occupational differences were connected with regional variation (ref.). Objectives The aim was to detect exposures in occupations with a high risk of RA. Methods The employed persons of 15-64 years of age receiving specially compensated medicines because of RA or other rheumatic diseases in 1971-2000 (44,190 new cases) were linked with the 5-year periodical census data for person-year calculations. The age- and region-adjusted incidence rate ratios (RR) were estimated by the generalized linear model where the administrative work was used as a reference occupation. Occupational and exposure history, and confounding factors were studied via a questionnaire sent to a sample of 5,000 rheumatic patients and 5,000 referents with hypertension (matched for sex, age, region, main occupation, and calendar period). The conditional logistic regression model was used for the comparison of exposures between the cases and referents. Smoking and familial RA were controlled for. Results The highest age- and region-adjusted incidence rate ratios (RR; 95% CI) were observed for men in mining and quarrying work (2.1; 1.6-2.8), textile work (1.7; 1.3-2.2), iron and metalware work (1.4; 1.3-1.5), road transport work (1.3; 1.2-1.4), and for women in agricultural and horticultural work, animal husbandry (1.4; 1.3-1.5), postal work (1.3; 1.2-1.5), iron and metal ware work (1.3; 1.1-1.5), laundering and pressing work (1.3; 1.1-1.6). The RA patients noticed cold, humidity, and draft (p<0.001) more often than their referents. Also different dusts, such as synthetic mineral fibres, concrete (p<0.01), and carbonate minerals (p<0.05) as well as chemical exposures like pesticides, paints and glues (p<0.05), vulcanization gases, and wet work (p<0.01) were reported by the RA patients more frequently. Other harmful exposures were, e.g., insects, and repetitive work. In some occupational groups the RA patients reported several exposures significantly more often than their referents (OR; 95% CI). Such groups were: Agricultural and horticultural work and animal husbandry: humidity (3.0; 1.4-6.6), draft (2.1; 1.1-4.2), and solitary work (2.8; 1.2-6.7), Iron and metal ware work: humidity (3.3;1.4-7.8), draft (2.1; 1.1-3.8), rubbers and elastomers (8.9; 1.1-71.2), gas mixtures (2.6; 1.2-5.8), and wet work (2.4; 1.0-5.9), Postal work: humidity (2.9; 1.1-7.5), cold (2.0; 1.0-4.1), and low appreciation of the work (3.8;1.0-14.6) Textile work: humidity (7.5; 1.6-34.4), and draft (2.7; 1.1-6.4), and Chemical processing work: cold (5.7; 1.1-29.8), dirty work (10.0; 1.1-92.0). Conclusions The results suggest that occupational exposures contributed to RA. The significant exposures were by the airways (dusts,	Annals of the Rheumatic Disease	71	NA	NA	Self-reported exposure			Case-control	Pesticides in general	muskuloskeletal	doctor-diagnosed	Finland	hic
1021	R. Sapbamrer and S. Nata	Health symptoms related to pesticide exposure and agricultural tasks among rice farmers from Northern Thailand	2014	PURPOSE: The objective of this cross-sectional study was to investigate health symptoms related to occupational pesticide exposure and agricultural tasks in rice farmers. METHODS: Data on demographic variables and health symptoms associated with pesticide exposure were collected from 182 rice farmers (exposed subjects) and 122 non-farmers (controlled group) using interviews and measuring whole blood acetylcholinesterase (AChE) activity during August and October 2012. RESULTS: Rice farmers had a significantly lower median AChE activity than the controls (9,594 vs. 10,530 U/L, respectively) and a significantly higher prevalence of difficulty in breathing and chest pain [odds ratio (OR) 2.8, P < 0.01 and OR 2.5, P < 0.05, respectively]. The prevalence of dry throat and cramp was associated with those farmers who sprayed and mixed pesticides (OR 2.5 and 2.6 for dry throat, OR 2.5 and 2.9 for cramp, respectively; P < 0.01). The prevalence of numbness and diarrhea was associated with those farmers who scattered seed (OR 2.2, P < 0.01 and OR 3.6, P < 0.05, respectively). The prevalence of numbness and increasing anxiety was also associated with those farmers who harvested crops (OR 3.6, P < 0.01 and OR 3.0, P < 0.05, respectively). CONCLUSIONS: Our findings suggest that occupational pesticide exposure and agricultural tasks in the paddy field may be associated with the increasing prevalence of respiratory tract and muscle symptoms. This possibility warrants further investigation in more detail.	Environmental Health & Preventive Medicine	19	1	43454	Biomonitoring (blood)			Cross-sectional	Chemical class	NA	self-reported	Thailand	umic
1022	R. Scarpato, A. Hirvonen, L. Migliore, G. Falck and H. Norppa	Influence of GSTM1 and GSTT1 polymorphisms on the frequency of chromosome aberrations in lymphocytes of smokers and pesticide-exposed greenhouse workers	1997	The influence of polymorphic glutathione S-transferases mu (GSTM1) and theta (GSTT1) on the rate of chromosome aberrations (CA) in peripheral lymphocytes of 30 pesticide-exposed floriculturists and 32 control subjects was studied. Pesticide exposure was not associated with elevated frequencies of CA. Among cigarette smokers, a statistically significant (p = 0.026) increase in baseline CA frequencies was observed in subjects with a homozygous deletion of the GSTM1 gene (GSTM1 null, n = 36) in comparison with those having at least one copy of the gene (GSTM1 positive, n = 26). This effect was mainly due to an excess of chromatid-type aberrations (p = 0.006). In addition, the few individuals (n = 5) deficient for both GSTM1 and GSTT1 showed significantly higher (p = 0.012) CA counts than GSTM1 positive GSTT1 nulls. Despite the limited number of subjects genotyped, the results seem to indicate an association between smoking induced CA frequencies and GSTM1 polymorphism, and a possible interaction between the GSTM1 and GSTT1 genotypes. The findings may be explained by the reduced detoxification capacity of GSTM1 null and GSTT1 null individuals.	Mutation Research	389	2	227-35	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	NA	NA
1023	R. Scarpato, L. Migliore, A. Hirvonen, G. Falck and H. Norppa	Cytogenetic monitoring of occupational exposure to pesticides: characterization of GSTM1, GSTT1, and NAT2 genotypes	1996	Occupational exposure of floriculturists is characterized by alternating periods of intense pesticide spraying and reduced or no activity. Induction of sister chromatid exchanges (SCE), structural chromosome aberrations (CA) and micronuclei (MN) was investigated in peripheral lymphocytes of a group of 23 Italian floriculturists and 22 matched controls. Blood sampling was performed during and one month after the end of intensive pesticide treatments, in order to cover a period of high and low exposure, respectively. Each donor was genotyped for glutathione S-transferase M1 (GSTM1), T1 (GSTT1), and N-acetyltransferase 2 (NAT2), three polymorphic genes involved in xenobiotic metabolism, to assess their potential role in individual genotoxic response to the pesticide exposure. No effect of the pesticide exposure on the cytogenetic parameters were detected. Smoking, however, was found to increase SCE levels. The only significant influence of phenotype composition on cytogenetic response was an increase in SCE levels in the GSTT1 positive individuals compared with the GSTT1 nulls (P=0.02). This finding was, however, based on only four GSTT1 null donors (n=41 for GSTT1 positive donors). In addition, a possible interaction was observed between smoking and GSTM1 genotype in the CA assay, GSTM1 null smokers, earlier reported to have an elevated risk for lung cancer, showing higher CA frequencies than GSTM1 positive smokers.	Environmental & Molecular Mutagenesis	27	4	263-9	Self-reported exposure			Cohort (prospective)	Pesticides in general	genetic (biomarkers)	medical test result	Italy	hic
1024	R. Scarpato, L. Migliore, G. Angotzi, A. Fedi, L. Miligi and N. Loprieno	Cytogenetic monitoring of a group of Italian floriculturists: no evidence of DNA damage related to pesticide exposure	1996	The induction of sister chromatid exchanges (SCE), structural chromosome aberrations (CA) or micronuclei (MN) was investigated in peripheral lymphocytes of a group of Italian floriculturists exposed to a mixture of pesticides. No statistically significant difference in the frequencies of cytogenetic damage was detected between exposed and control subjects. Assessment of the effect of confounding factors indicated that smoking affected both SCE and CA frequencies. Multiple regression analysis showed that in heavy smokers (> or = 20 cigarettes/day), SCE and CA levels increased significantly by 17% and 54%, respectively, as compared to non-smokers.	Mutation Research	367	2	73-82	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Italy	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1025	R. Stephens, A. Spurgeon and H. Berry	Organophosphates: the relationship between chronic and acute exposure effects	1996	The relationship between chronic (nonreversing) neuropsychological effects and acute exposure effects was investigated in 77 organophosphate exposed male sheep-dippers. Acute exposure effects were assessed prospectively using a purpose-constructed symptoms questionnaire administered pre-, and 24 h postexposure. Urine was analysed for dialkylphosphate levels to confirm recent exposure. Chronic effects were assessed in a cross-sectional neuropsychological study in the absence of recent exposure using computerised neuropsychological tests, the General Health Questionnaire, and the Subjective Memory Questionnaire. Simple correlation and multiple linear regression analyses (adjusting for confounders) were used to assess relationships between the change in total symptom reporting from baseline to 24 h after exposure and chronic effect outcomes. There was no evidence of any association between reported symptom levels and chronic neuropsychological effects. This suggests that chronic effects of OP exposure appear to occur independently of symptoms that might immediately follow acute OP exposure. This has implications for exposure control: individuals may experience chronic effects without the benefit of earlier warning signs of toxic effects during acute exposures.	Neurotoxicology & Teratology	18	4	449-53	Biomonitoring (urine)			Cohort (prospective)	Chemical class	pesticide-related symptoms	self-reported	UK	hic
1026	R. Stephens, A. Spurgeon, I. A. Calvert, J. Beach, L. S. Levy, H. Berry and J. M. Harrington	Neuropsychological effects of long-term exposure to organophosphates in sheep dip	1995	Organophosphate-based pesticides are widely used throughout the world. The acute effects of over-exposure to such compounds are well known. Concern has also been expressed that long-term exposure may result in damage to the nervous system. In a cross-sectional study, we compared neuropsychological performance in 146 sheep farmers who were exposed to organophosphates in the course of sheep dipping with 143 non-exposed quarry workers (controls). The farmers performed significantly worse than controls in tests to assess sustained attention and speed of information processing. These effects remained after adjustment for covariates. The farmers also showed greater vulnerability to psychiatric disorder than did the controls as measured by the General Health Questionnaire. There were no observed effects on short-term memory and learning. Repeated exposure to organophosphate-based pesticides appears to be associated with subtle changes in the nervous system. Measures should be taken to reduce exposure to organophosphates as far as possible during agricultural operations.	Lancet	345	8958	1135-9	Self-reported exposure	Biomonitoring (urine)		Cross-sectional	Chemical class	neurological	medical test result	NA	NA
1027	R. W. Bretveld, M. Hooiveld, G. A. Zielhuis, A. Pellegrino, I. A. van Rooij and N. Roeleveld	Reproductive disorders among male and female greenhouse workers	2008	The aim of this study was to evaluate reproductive disorders in male and female greenhouse workers. In 2002, data were collected from 4872 Dutch greenhouse workers and 8133 referents through postal questionnaires with detailed questions on reproductive disorders of the most recent pregnancy, lifestyle habits, and occupational exposures (e.g. pesticides) prior to conception. Different reproductive outcome measures were compared between 957 male and 101 female greenhouse workers and 1408 referents by means of logistic regression analyses. The analyses of primigravidous couples showed a slightly elevated risk of prolonged TTP (OR(women)=1.9; 95% CI: 0.8-4.4) and an increased risk of spontaneous abortion among female greenhouse workers (OR(women)=4.0; 95% CI: 1.1-14.0). A decreased risk of preterm birth was found among male greenhouse workers (OR(men)=0.1; 95% CI: 0.03-0.5). This study may offer some evidence for the hypothesis that pesticide exposure affects human reproduction leading to spontaneous abortion and possibly to prolonged time-to-pregnancy.	Reproductive Toxicology	25	1	107-14	Self-reported exposure			Cross-sectional	Pesticides in general	reproductive	self-reported	Netherlands	hic
1028	R. W. Clapp	Update of cancer surveillance of veterans in Massachusetts, USA	1997	NA	International Journal of Epidemiology	26	3	679-81	Registers			Cohort (prospective)	Pesticides in general	cancer	doctor-diagnosed	USA	hic
1029	R. Zepeda-Arce, A. E. Rojas-Garcia, A. Benitez-Trinidad, J. F. Herrera-Moreno, I. M. Medina-Diaz, B. S. Barron-Vivanco, G. P. Villegas, I. Hernandez-Ochoa, M. J. Solis Heredia and Y. Y. Bernal-Hernandez	Oxidative stress and genetic damage among workers exposed primarily to organophosphate and pyrethroid pesticides	2017	The indiscriminate use of pesticides in agriculture and public health campaigns has been associated with an increase of oxidative stress and DNA damage, resulting in health outcomes. Some defense mechanisms against free radical-induced oxidative damage include the antioxidant enzyme systems. The aim of this study was to determine the levels of malondialdehyde (MDA), superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), glutathione reductase (GR), and the relationship of antioxidant enzyme levels with DNA damage among sprayers (workers) occupationally exposed to pesticides. The determinations of MDA and antioxidant enzymes were performed spectrophotometrically. The genotoxic effects were evaluated using the comet assay. The results showed a marginally significant decrease in SOD and CAT activities in the high exposure group compared to the control group. For MDA, statistically significant differences were found among people working long term vs. those working temporarily (P=0.02) as sprayers. In the moderate exposure group, a positive correlation was observed between MDA levels and GPx activity. In the high exposure group, a negative correlation was observed between GR and CAT activities, and between MDA levels and GPx activities. Furthermore, in the high exposure group, a positive correlation between DNA damage parameters and MDA levels was observed. The results suggest an important role of antioxidant enzymes for the protection of DNA damage caused by occupational exposure to pesticides.	Environmental Toxicology	32	6	1754-1764	Biomonitoring (blood)	Self-reported exposure		Cross-sectional	Specific active ingredient	genetic (biomarkers)	medical test result	Mexico	umic
1030	S. A. Corral, V. de Angel, N. Salas, L. Zniga-Venegas, P. A. Gaspar and F. Pancetti	Cognitive impairment in agricultural workers and nearby residents exposed to pesticides in the Coquimbo Region of Chile	2017	Chronic exposure to organophosphate pesticides is a worldwide public health concern associated with several psychiatric disorders and dementia. Most existing studies on the effects of pesticides only evaluate agricultural workers. Therefore, this study sought to establish if individuals indirectly exposed to pesticides, such as residents in agricultural areas, also suffer cognitive impairments. Neuropsychological evaluations were carried out on three groups (n = 102): agricultural workers directly exposed to pesticides (n = 32), individuals living in agricultural areas indirectly (i.e. environmentally) exposed to pesticides (n = 32), and an unexposed control group (n = 38). The assessed cognitive processes included memory, executive functions, attention, language praxis, and visuoconstruction. The direct exposure group performed significantly lower in executive function, verbal fluency, and visual and auditory memory tests than the indirect exposure group, which, in turn, performed worse than the unexposed group. Even after adjusting for age, gender, and educational level, both exposure groups showed higher rates of cognitive deficit than control individuals. In conclusion, both direct and indirect chronic exposure to pesticides affects cognitive functioning in adults and, consequently, actions should be taken to protect the health of not only agricultural workers, but also of residents in agricultural areas.	Neurotoxicology and Teratology	62	NA	13-19	Job title			Cross-sectional	Job title	mental disorders	doctor-diagnosed	Chile	hic
1031	S. A. Khan and S. A. Ali	Assessment of certain hematological responses of factory workers exposed to pesticides	1993	NA	Bulletin of Environmental Contamination & Toxicology	51	5	740-7	Expert case-by-case assessment			Cohort (prospective)	Pesticides in general	hematological	medical test result	India	lmic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1032	S. A. Korrick, C. Chen, A. I. Damokosh, J. Ni, X. Liu, S. I. Cho, L. Altshul, L. Ryan and X. Xu	Association of DDT with spontaneous abortion: a case-control study	2001	PURPOSE: Spontaneous abortion (SAB), the most common adverse pregnancy outcome, affects approximately 15% of clinically recognized pregnancies. Except for advanced maternal age and smoking, there are not well-established risk factors for SAB. Animal models associate increased fetal resorption or abortion with exposure to the pesticide dichlorodiphenyl trichloroethane (DDT), but epidemiologic investigations of DDT and SAB are inconsistent. We undertook a pilot investigation of the hypothesized association of DDT with SAB. METHODS: Participants in this case-control study were selected from a longitudinal study of reproductive effects of rotating shifts among female Chinese textile workers who were married, ages 22-34, nulliparous without history of SAB or infertility, and planning pregnancy. From 412 pregnancies, 42 of which ended in SAB, 15 SAB cases and 15 full-term controls were randomly selected and phlebotomized. Serum was analyzed for p,p'-DDT, o,p'-DDT, their metabolites (DDE and DDD), and other organochlorines including polychlorinated biphenyls. RESULTS: Cases and controls were nonsmokers and did not differ in age (mean 25 years), body mass index (BMI), passive smoke exposure, or workplace exposures. Cases had significantly ($p < 0.05$) higher serum levels of p,p'-DDE (22 vs.12 ng/g) and o,p'-DDE (0.09 vs. 0.05 ng/g) than controls. After adjustment for age and BMI, each ng/g serum increase in p,p'-DDE was associated with a 1.13 (CI, 1.02-1.26) increased odds of SAB. With adjustment of serum DDE levels for excretion via breastfeeding, DDE-associated increased odds of SAB remained significant with up to 7% declines in maternal serum DDE levels for each month of breastfeeding. CONCLUSIONS: A potential increased risk of SAB is associated with maternal serum DDE levels.	Annals of Epidemiology	11	7	491-6	Biomonitoring (blood)			Case-control	Specific active ingredient	reproductive	self-reported	China	umic
1033	S. A. Martin, Jr., D. P. Sandler, S. D. Harlow, D. L. Shore, A. S. Rowland and M. C. Alavanja	Pesticide use and pesticide-related symptoms among black farmers in the Agricultural Health Study	2002	BACKGROUND: Health effects of pesticides have not been well studied in black farmers. We describe agricultural practices and pesticide-related symptoms in North Carolina black and white farmers participating in the Agricultural Health Study. METHODS: Self-administered questionnaires were completed by 891 black and 11,909 white farmers licensed to apply restricted pesticides. Regression models were used to compare characteristics by race. RESULTS: Black farmers reported lower lifetime pesticide use, less use of each class of pesticides (e.g., herbicides, insecticides), less use of high exposure application methods, and fewer pesticide-related symptoms such as headaches or dizziness, skin irritation, chest discomfort and feeling nervous or depressed than did white farmers. CONCLUSIONS: Differences between black and white farmers may be explained by farm characteristics or economics. Despite lower use of pesticides, black farmers may have other work practices that affect exposure and risk.	American Journal of Industrial Medicine	41	3	202-9	Self-reported exposure			Cross-sectional	Specific active ingredient	NA	self-reported	USA	hic
1034	S. A. Martin, Jr., S. D. Harlow, M. F. Sowers, M. P. Longnecker, D. Garabrant, D. L. Shore and D. P. Sandler	DDT metabolite and androgens in African-American farmers	2002	BACKGROUND: The ubiquitous dichlorodiphenyltrichloroethane (DDT) metabolite 1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene (DDE) is an androgen receptor antagonist. Data on potential antiandrogenic activity of DDE in humans are limited. METHODS: The relations between concentrations of plasma DDE and several serum androgens (total testosterone, bioavailable testosterone, 5alpha-dihydrotestosterone, and free androgen index) were examined in 137 North Carolina black male farmers, using multiple linear regression. RESULTS: Participants ranged in age from 30 to 88 years (mean = 62 years). Most had farmed for about 30 years and 27% reported having used DDT. The median DDE level was 7.7 microg per liter (1213 microg per kg lipid), slightly higher than in other recent studies. Overall, concentrations of DDE and androgens were unrelated. Total testosterone decreased 2% (95% confidence limits [CL] = -9%, 5%) per increase in interquartile distance of lipid-adjusted DDE. The percentage change in other hormones was similarly negligible. However, among those whose DDE level was in the top tenth percentile, compared with all others, total testosterone and free androgen index were lower by 23% (CL= -40%, 1%) and 22% (CL =-41%, 4%) respectively. Plasma androgen levels decreased with age, a relation that has previously been studied only in whites. CONCLUSIONS: Studies of more highly exposed populations may be needed to evaluate effects, if any, of DDE.	Epidemiology	13	4	454-8	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	endocrine/nutritional/metabolical	medical test result	USA	hic
1035	S. A. Petralia, W. H. Chow, J. McLaughlin, F. Jin, Y. T. Gao and M. Dosemeci	Occupational risk factors for breast cancer among women in Shanghai	1998	Although female breast cancer rates are lower in China than in Western countries, rates have been rising rapidly in China. This increase may be due to changes in established breast cancer risk factors, but it is possible that exposure to occupational and environmental carcinogens in Shanghai also have contributed to the rise in incidence. We used data collected by the Shanghai Cancer Registry and the Chinese Third National Census to study the risk of breast cancer by occupation and by occupational exposures. Standardized incidence ratios (SIRs) were used to compare observed cases to expected numbers of cases, based on the incidence rates for Shanghai and the number of women in each occupation according to the 1982 census. Statistically elevated SIRs for breast cancer were seen for a number of professional occupational categories, with the greatest risk seen among scientific research workers (SIR = 3.3). Administrative clerks, political and security personnel, and makers of rubber and plastics products also had significant excesses. Significant deficits of risk were seen for the categories of production and related workers, construction workers, and transportation equipment operators. For specific occupations, the highest SIRs were observed among doctors of Chinese-Western medicine (SIR = 14.7, 95% CI = 5.9-30.3) and doctors of Chinese medicine (SIR = 7.2, 95% CI = 4.4-11.4). We also found excesses among teachers at each level of education, librarians, clerical workers, electrical and electronic engineers, nurses, lab technicians, accountants and bookkeepers, rubber manufacturing products makers, weavers, and knitters. SIRs were significantly elevated for high probability of exposure to organic solvents (SIR = 1.4). For benzene exposure, we found significant excesses for overall exposure (SIR = 1.1) and for medium level of exposure (SIR = 1.3). There was no evidence of an association between risk and electromagnetic fields (EMF) exposure. Based on a small number of exposed, SIRs were elevated for both medium probability and high level of exposure to pesticides. The elevations in occupations reported here support some previous reports. Our finding of an increased risk associated with benzene also has been reported previously; the finding for organic solvents is new. However, the literature on the risk of breast cancer related to occupational exposures is limited and there is no consistent body of literature for any of the exposures studied here. Further, many comparisons were made and the problem of multiple hypothesis testing cannot be ignored in a survey such as ours.	American Journal of Industrial Medicine	34	5	477-83	Job exposure matrix			Cohort (prospective)	Pesticides in general	cancer	doctor-diagnosed	China	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1036	S. A. Quandt, F. O. Walker, J. W. Talton, P. Summers, H. Chen, D. K. McLeod and T. A. Arcury	Olfactory Function in Latino Farmworkers: Subclinical Neurological Effects of Pesticide Exposure in a Vulnerable Population	2016	OBJECTIVES: We compared olfactory function in pesticide-exposed Latino farmworkers and nonfarmworkers to explore its use as a subclinical indicator of neurological pesticide effects. METHODS: We recruited 304 current farmworkers and 247 nonfarmworkers. All completed odor identification (14 odors) and threshold tests (16 concentrations of n-butanol) using a well-established methodology. RESULTS: Farmworkers reported significantly greater lifetime pesticide exposure. Performance on both olfactory tests declined with age. Odor identification performance did not differ between groups. For odor threshold, farmworkers needed significantly higher concentrations to detect the odor. Results were unchanged when adjusted for sex, age, and smoking. CONCLUSION: Olfactory function differences between farmworkers and nonfarmworkers suggest possible neurological effects. Because declining olfactory function is an early symptom of Parkinson disease and related conditions, it is a possible subclinical indicator of neurodegenerative disease in this vulnerable worker population.	Journal of Occupational & Environmental Medicine	58	3	248-53	Self-reported exposure			Cohort (prospective)	Pesticides in general	other	other	USA	hic
1037	S. A. Quandt, H. Chen, J. G. Grzywacz, Q. M. Vallejos, L. Galvan and T. A. Arcury	Cholinesterase depression and its association with pesticide exposure across the agricultural season among Latino farmworkers in North Carolina	2010	BACKGROUND: Farmworkers can be exposed to a wide variety of pesticides. Assessing cholinesterase activity over time can be used to monitor exposure to organophosphorus and carbamate pesticides. OBJECTIVES: The goal of this study was to document patterns and variation in cholinesterase levels across the agricultural season (May-August) among field-workers, and to explore the association of cholinesterase depression with pesticide exposure across the agricultural season. METHODS: Dried blood samples collected from 231 migrant farmworkers sampled from camps in eastern North Carolina up to four times across a summer agricultural season were analyzed for cholinesterase activity, and urine samples were analyzed for metabolites of organophosphorus and carbamate pesticides. Reductions of >or= 15% from an individual's highest value were identified and considered evidence of meaningful cholinesterase activity depression. RESULTS: The average cholinesterase activity levels were lowest in June, with significantly higher mean values in July and August. When adjusted for age, sex, minutes waited to shower, and days worked in the fields, the number of organophosphorus and carbamate pesticides detected in urine predicted reductions in cholinesterase activity. CONCLUSIONS: These data demonstrate that workers are experiencing pesticide exposure. Greater enforcement of existing safety regulations or strengthening of these regulations may be warranted. This study demonstrates that serial measurements of cholinesterase activity across an agricultural season can detect exposure to pesticides among field-workers.	Environmental Health Perspectives	118	5	635-9	Biomonitoring (urine)			Cohort (prospective)	Chemical class	neurological	medical test result	USA	hic
1038	S. A. W. Quandt, F. O.; Talton, J. W.; Chen, H.; Arcury, T. A.	Olfactory Function in Latino Farmworkers over 2 Years: Longitudinal Exploration of Subclinical Neurological Effects of Pesticide Exposure	2017	Objective: We compared patterns of olfactory function over 2 years in pesticide-exposed male Latino farmworkers and male Latino workers in industries without pesticide exposure. Methods: At five points over 2 years, workers completed tests of odor threshold (16 concentrations of n-butanol) using a well-established methodology. Tests at two or more time points were completed by 156 farmworkers and 118 non-farmworkers. Results: Farmworkers required significantly higher odorant concentrations at Contact 1 and across the 2-year follow-up to detect the odor. When adjusted for Contact 1, between-group differences persisted, but odor threshold performance did not worsen over time. Conclusions: Pesticide exposure has been linked to neurodegenerative disease, as has declining olfactory function. Persistently poorer olfactory function among pesticide-exposed workers suggests the need to monitor neurological function in this vulnerable worker population.	Journal of Occupational and Environmental Medicine	59	12	1148-1152	Self-reported exposure			Cohort (prospective)	Pesticides in general	other	other	USA	hic
1039	S. A. Yaqub, S. K. Rahamon and O. G. Arinola	Haematological and immunological indices in Nigerian farmworkers occupationally exposed to organophosphate pesticides	2014	Experimental studies have shown numerous health disorders associated with occupational exposure to organophosphate pesticides but evidence of impaired immune functions by pesticides in humans is scarce. This study determined complete blood count (CBC), serum immunoglobulin classes (IgE, IgA, IgM, IgG),acetylcholinesterase (AChE) activity and skin sensitivity prick test to common environmental allergens in 60 farm workers (30 pesticide applicators and 30 farmers) exposed to organophosphate (OP) pesticides compared with30 apparently healthy, non-exposed workers. Serum AChE activity, mean PCV level, total white blood cell count (TWBC) and neutrophil count were significantly reduced while the mean lymphocyte count and eosinophil count were significantly raised in both pesticides applicators (PA) and farmers compared with controls. However, mean monocyte count was significantly raised in PA compared with controls. Also, serum activityof AChE and mean serum IgM level were significantly reduced while the mean monocyte count was significantly raised in PA compared with farmers. This study shows that pesticides applicators are more exposed to effects of organophosphate than farmers.	European Journal of General Medicine	11	2	109-114	Job title	Biomonitoring (blood)		Cross-sectional	Job title	immunological	medical test result	Nigeria	lmic
1040	S. Abhishek, N. Kaur, S. Kaur, M. Lata, J. K. Sharma and A. Sharma	Association of GSTM1 and GSTT1 gene deletions with susceptibility to DNA damage in the pesticide-exposed workers of Punjab	2010	The main aim of this study was to evaluate genotoxic effects of pesticides in association with glutathione S-transferase (GST) polymorphism. To achieve this aim, DNA damage and the genotypes of the GSTM1 and GSTT1 genes were studied from blood lymphocytes of pesticide-exposed and unexposed (control) agricultural workers of the Punjab region of northwestern India. The blood samples were collected from 40 exposed and 27 unexposed subjects from the Kakrala and Sanour villages of Patiala district. DNA damage was evaluated by using an alkaline comet assay. The analysis of the comets was done through visual scoring and image analysis software (Tritek's CometScore). Damage Index (DI), Damage Frequency (DF) (calculated by visual scoring method), and % DNA in tail (measured by image analysis software) were considered for assessing DNA damage. The DNA extraction from blood cells was done using proteinase K and the phenol-chloroform method, and genotyping of GSTM1 and GSTT1 was done using multiplex PCR. It was found that all the pesticide-exposed subjects showed higher DI, DF, and % DNA in tail in comparison to the controls. The statistical comparison of DNA damage between the exposed group and unexposed group revealed highly significant differences ($p < 0.05$; Mann-Whitney U-test). In addition, the GSTT1 gene deletion and simultaneous deletions of GSTM1 and GSTT1 genes in increasing DNA damage were observed in the exposed group.	Rejuvenation Research	13	2	281-4	EAM not reported			Cross-sectional	NA	genetic (biomarkers)	medical test result	India	lmic
1041	S. Amr, R. Dawson, D. A. Saleh, L. S. Magder, D. M. St George, M. El-Daly, K. Squibb, N. N. Mikhail, M. Abdel-Hamid, H. Khaled and C. A. Loffredo	Pesticides, gene polymorphisms, and bladder cancer among Egyptian agricultural workers	2015	UNLABELLED: This study examined the associations between pesticide exposure, genetic polymorphisms for NAD(P)H: quinone oxidoreductase I (NQO1) and superoxide dismutase 2 (SOD2), and urinary bladder cancer risk among male agricultural workers in Egypt. Logistic regression was used to analyze data from a multicenter case-control study and estimate adjusted odds ratio (OR) and 95% confidence interval (CI). Exposure to pesticides was associated with increased bladder cancer risk (odds ratio (95% confidence interval): 1.68 (1.23-2.29)) in a dose-dependent manner. The association was slightly stronger for urothelial (1.79 (1.25-2.56)) than for squamous cell (1.55 (1.03-2.31)), and among participants with combined genotypes for low NQO1 and high SOD2 (2.14 (1.19-3.85)) activities as compared with those with high NQO1 and low SOD2 genotypes (1.53 (0.73-3.25)). In conclusion, among male agricultural workers in Egypt, pesticide exposure is associated with bladder cancer risk and possibly modulated by genetic polymorphism.	Archives of Environmental & Occupational Health	70	1	19-26	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Egypt	lmic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1042	S. Aroonvilairat, W. Kespichayawattana, T. Sornprachum, P. Chaisuriya, T. Siwadune and K. Ratanabanangkoon	Effect of pesticide exposure on immunological, hematological and biochemical parameters in thai orchid farmers- a cross-sectional study	2015	Various studies have found that many Thai orchid farmers used excessive amounts of pesticides without proper protective gear, but no toxicological study has been made. This cross-sectional study aimed to evaluate the immunological, hematological and biochemical statuses of these farmers. Sixty four orchid farmers and 60 controls were studied. Plasma cholinesterase activity, the percentage and absolute number of B lymphocytes (CD19+) were significantly lower in the farmers group (3966.32+/-1165.48 U/L, 11.61+/-4.09% and 312.26+/-164.83 cells/mm3, respectively) as compared to those of controls (5048.85+/-1139.40 U/L, 14.32+/-4.23%, 420.34+/-195.18 cells/mm3, respectively). There was a statistically significant higher level of serum IgE among the orchid farmers (0.031+/-0.011 mg/dL vs. 0.018+/-0.007 mg/dL) but not IgG, IgA and IgM, levels. Serum lysozyme level, lymphocyte proliferative responses to mitogens, hematological parameters and kidney function test, were not significantly different between the two groups. The liver function profiles showed significantly lower levels of albumin and serum protein in the farmer group. Thus frequent pesticide exposure resulted in subtle changes of some biological parameters. These changes, though may not be clinically significant, strongly indicated that caution in handing pesticides by these farmers is warranted.	International Journal of Environmental Research & Public Health [Electronic Resource]	12	6	5846-61	Job title			Cross-sectional	Job title	immunological	medical test result	Thailand	umic
1043	S. B. Dayton, D. P. Sandler, A. Blair, M. Alavanja, L. E. Beane Freeman and J. A. Hoppin	Pesticide use and myocardial infarction incidence among farm women in the agricultural health study	2010	OBJECTIVE: To evaluate the relationship between pesticide use and myocardial infarction (MI) among farm women. BACKGROUND: Little is known about the potential association between pesticide use and cardiovascular outcomes. METHODS: We used logistic regression to evaluate pesticide use and self-reported incident nonfatal MI among women in the Agricultural Health Study. RESULTS: Of those MI-free at enrollment (n = 22,425), 168 reported an MI after enrollment. We saw no association with pesticide use overall. Six of 27 individual pesticides evaluated were significantly associated with nonfatal MI, including chlorpyrifos, coumaphos, carbofuran, metalaxyl, pendimethalin, and trifluralin, which all had odds ratios >1.7. These chemicals were used by <10% of the cases, and their use was correlated, making it difficult to attribute the risk elevation to a specific pesticide. CONCLUSION: Pesticides may contribute to MI risk among farm women.	Journal of Occupational & Environmental Medicine	52	7	693-7	Self-reported exposure			Case-control	Specific active ingredient	circulatory	doctor-diagnosed	USA	hic
1044	S. B. G. Larsen, A.; Spano, M.; Bonde, J. P.	A longitudinal study of semen quality in pesticide spraying Danish farmers. The ASCLEPIOS Study Group	1998	It was hypothesized that occupational exposure to pesticides during a spraying season causes changes in semen quality that might be detected in a longitudinal study. We analyzed the within-person changes in semen quality and reproductive hormones across a spraying season in groups of farmers using and not using pesticides. A total of 248 men collected two semen samples (participation rate: 32%). The median sperm concentration declined significantly from the first to the second sample in both groups, but there was no statistical difference in the decline between the two groups, unadjusted or adjusted. Only minor changes were found in sperm morphology, vitality, motility, sperm chromatin denaturation (SCSA), and reproductive hormones, and the differences in changes between the two groups were nonsignificant, or, in the opposite direction to the expected. There was no relation between the changes in sperm parameters in relation to pesticide exposure variables. In conclusion, use of pesticides by Danish farmers is not a likely cause of short-term effects on semen quality and reproductive hormones.	Reproductive Toxicology	12	6	581-9	Self-reported exposure			Cohort (prospective)	Pesticides in general	reproductive	medical test result	Denmark	hic
1045	S. B. K. Koh, T. H.; Min, S.; Lee, K.; Kang, D. R.; Choi, J. R.	Exposure to pesticide as a risk factor for depression: A population-based longitudinal study in Korea	2017	Background Exposure to pesticides is associated with mental disorders, including depression, especially among occupationally exposed populations, such as farmers. The results of experimental studies ascribed the negative effects of pesticides on mental health to their neurotoxic and endocrine-disrupting activities. Purpose This study aimed to investigate the association between the risk of depression and high- or low-level exposure to pesticides in a rural population. Methods This longitudinal study was performed in 2005<U+201A><U+00C4><U+00EC>2008 (baseline) and 2008<U+201A><U+00C4><U+00EC>2012 (follow-up) to evaluate the risk of depression among 2151 Korean adults. A standardized questionnaire was used to obtain information on depression upon self-reported exposure to pesticide based on the Center for Epidemiologic Studies Depression Scale. Logistic regression analysis was performed to evaluate the association between pesticide exposure and depression. We adjusted the data for age, cigarette smoking status, current alcohol use, monthly income, educational level, marriage status, and religion. Results Among the individuals who reported depression, the number of participants who used pesticides was significantly higher than that who did not (N<U+00AC><U+2020>=<U+00AC><U+2020>61 [7.2%] vs. N<U+00AC><U+2020>=<U+00AC><U+2020>54 [4.2%], P<U+00AC><U+2020>=<U+00AC><U+2020>0.003). A positive association was noted between >20-year period of pesticide use and depression (odds ratio [OR], 2.35; 95% confidence interval [CI], 1.41<U+201A><U+00C4><U+00EC>3.88). Individuals who reported depression showed greater odds of being exposed to higher pesticide concentrations (OR, 2.33; 95% CI, 1.40<U+201A><U+00C4><U+00EC>3.88) and experiencing pesticide poisoning (OR, 5.83; 95% CI, 1.80<U+201A><U+00C4><U+00EC>18.86) than those who did not. Conclusion Exposure to pesticides at a high concentration was found to be associated with depressive symptoms among Korean adults.	NeuroToxicology	62	NA	181-185	Self-reported exposure			Cohort (prospective)	Pesticides in general	mental disorders	self-reported	Korea	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1046	S. B. Singh, P. K. Pokharel, P. Raut and K. Mehta	Study of the effects of pesticide exposure among the workers of tea estates	2015	Background: Tea workers have the risk of being exposed to agro chemicals. Farm workers engaged in pesticide spraying reported symptoms potentially associated with exposures to pesticides. Diverse morbid conditions and deviation in blood parameters have been reported. Effect of pesticide exposure and safety precaution among farm workers is alarming in developing countries. Aim: To find out health problems and level of alanine aminotransferase (ALT), aspartate aminotransferase (AST), haemoglobin, white blood cells, creatinine, blood sugar and acetyl cholinesterase among tea workers. Methods: A cross-sectional study was done to enroll voluntarily participated 262 tea workers of Haldibari, Danabari and Kanyam tea estates of Nepal They were interviewed by using semi-structured questionnaire. General health check-up and measurement of blood pressure, height and weight were done. Laboratory investigations comprised acetyl cholinesterase, alanine transaminase, asparate transaminase, haemoglobin, white blood cell, creatinine and blood sugar. Data was analyzed in SPSS V 16.0. Findings: Among 262 workers, maximum number of workers (60.7%) had work experience of more than 10 years. Most common personal protective equipment used by the workers (10.3%) was simple cloth masks. Eye irritation (34.4%), headache (30.9%), nausea (15.6%), low back pain (32.4%), gastritis and duodenitis (17.6%), arthralgia (14.9%), injury (14%), underweight (11.1%), mild anaemia (31.9%) and leucopenia (9.3%) were prevalent. The difference in means of creatinine level between directly exposed group of workers and those who were not was statistically significant. The ALT level or AST level between directly exposed group of workers and those who were not was statistically significant. The difference in means of acetyl cholinesterase level between directly exposed group of workers and those who were not was statistically non-significant. Interpretation: Workers reported symptoms potentially associated with exposures to pesticides. Musculoskeletal problems, gastritis and duodonitis, injury and anaemia were common among tea workers. Pesticides might have affected liver and kidney function of the workers. Abnormal liver function of the workers might be a hint to guess the effect of organophosporus or carbamates pesticides in the workers exposed to the pesticides. A worker with history of exposure to pesticides and abnormal alanine aminotranferase (ALT) and aspartate aminotransferease level (AST) might be looked with suspicion as a case suffering from adverse effect of pesticides Effect of organophosphates or carbamates on cholinesterase activity could not be shown among tea workers. We could not ignore falsely depressed blood parameters which could have happen because of co-morbid conditions. However, the possible	Annals of Global Health	81	1	229-230	Job title	Self-reported exposure		Cross-sectional	Job title	NA	self-reported	Nepal	lic
1047	S. Brenner, E. Tur, J. Shapiro, V. Ruocco, M. D'Avino, E. Ruocco, N. Tsankov, S. Vassileva, K. Drenovska, P. Brezoev, M. A. Barnadas, M. J. Gonzalez, G. Anhalt, H. Nousari, M. Ramos-e-Silva, K. T. Pinto and M. F. Miranda	Pemphigus vulgaris: environmental factors. Occupational, behavioral, medical, and qualitative food frequency questionnaire.[Erratum appears in Int J Dermatol. 2003 Sep;42(9):760 Note: Silva MR [corrected to Ramos-e-Silva M]]	2001	BACKGROUND: There have been reports suggesting the involvement of environmental factors in the disease process of pemphigus. Factors suggested include exposure to pesticides or certain drugs. OBJECTIVE: To analyze the association of pemphigus with environmental exposure to various agents, including smoking, recreational and occupational insults, drugs, and food. DESIGN AND SETTING: In-person interviews of pemphigus patients and control subjects were conducted by trained medical investigators using a structured questionnaire. Questions included occupational, behavioral, medical, and qualitative food frequency details. The multicenter study was conducted at outpatient services of teaching hospitals in Bulgaria, Brazil, India, Israel, Italy, Spain, and the USA. PARTICIPANTS: A total of 126 pemphigus patients (55 men, 71 women; age, 54 +/- 17 years) and 173 healthy controls (87 men, 86 women; age 50 +/- 19 years) were interviewed in the period between October 1, 1999 and March 31, 2000. The diagnosis of pemphigus was based on clinical, histologic, immunohistologic, and immunohistochemical criteria. The disease duration was 2-27 years (8.4 +/- 7.2 years). Individuals with skin diseases other than pemphigus were selected as control subjects. MAIN OUTCOME MEASURE: Information on drugs, foods, and occupational, environmental, constitutional, and other possible risk factors was analyzed by t-tests and chi-squared tests as applicable. A multivariate logistic regression model was applied to the data to study simultaneously the independent relationship between each risk factor and pemphigus vulgaris. RESULTS: The risk for pemphigus vulgaris was lower for ex-smokers and current smokers than for patients who had never smoked. Exposure to pesticides and occupational exposure to metal vapor were associated with an increased risk of pemphigus. Pemphigus patients had more pregnancies than controls. There were differences in environmental factors between countries, with exposure to gardening materials and pesticides being highest among patients from Bulgaria, followed by Israel. Disease characteristics also exhibited differences between countries. Bulgarian patients less frequently had oral mucous membrane lesions: 66% compared to 92% for Israeli patients and 83% for Italians. The distribution of the disease in skin and mucous membranes was similar among patients from all countries. Exclusive skin involvement was seen in 50% of patients, mucous membranes alone in 23% of patients, and both skin and mucous membranes in 27% of patients. CONCLUSIONS: The beneficial effect of smoking on pemphigus might be explained by its effect on the immune system. In addition, smoking has an antiestrogenic effect, while pesticides have an estrogenic effect. The lower numbers of smokers among patients, the higher exposure rates to pesticides,	International Journal of Dermatology	40	9	562-9	Self-reported exposure			Case-control	Pesticides in general	dermatological	doctor-diagnosed	SHIC	SHIC
1048	S. C. Sharma-Wagner, A. P.; Malker, H. S.; Stone, B. J.; McLaughlin, J. K.; Hsing, A. W.	Occupation and prostate cancer risk in Sweden	2000	To provide new leads regarding occupational prostate cancer risk factors, we linked 36,269 prostate cancer cases reported to the Swedish National Cancer Registry during 1961 to 1979 with employment information from the 1960 National Census. Standardized incidence ratios for prostate cancer, within major (1-digit), general (2-digit), and specific (3-digit) industries and occupations, were calculated. Significant excess risks were seen for agriculture-related industries, soap and perfume manufacture, and leather processing industries. Significantly elevated standardized incidence ratios were also seen for the following occupations: farmers, leather workers, and white-collar occupations. Our results suggest that farmers; certain occupations and industries with exposures to cadmium, herbicides, and fertilizers; and men with low occupational physical activity levels have elevated prostate cancer risks. Further research is needed to confirm these findings and identify specific exposures related to excess risk in these occupations and industries.	Journal of Occupational & Environmental Medicine	42	5	517-25	Job title			Cohort (prospective)	Job title	cancer	doctor-diagnosed	Sweden	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1049	S. C. Tual, B.; Leveque-Morlais, N.; Raherison, C.; Baldi, I.; Lebailly, P.	Agricultural exposures and chronic bronchitis: findings from the AGRICAN (AGRIculture and CANcer) cohort	2013	PURPOSE: Livestock farming has been recognized as a risk factor for chronic bronchitis (CB). The role of crop farming, however, has been less studied. We sought to assess the role of a large range of farming activities on the risk of CB in the French agricultural cohort AGRICAN (AGRIculture and CANcer). METHODS: Data on respiratory health and farming activities were collected by questionnaire from 2005 to 2007. Associations between farming activities and self-reported doctor's diagnosis of CB were estimated by a logistic regression adjusted for confounders. RESULTS: CB was reported by 1207 farmers (8.4%). Two farming activities were associated with CB: cattle raising (odds ratio [OR] 1.24, 95% confidence interval 1.03-1.48), and potato production (OR 1.33, 95% confidence interval 1.13-1.57). Associations were more pronounced in small-scale cattle raising and in large-scale potato production, in particular among the longest exposed workers (>=20 years). Pesticide poisoning and exposure to pesticides in potato farmers were significantly associated with CB risk (OR 1.64 and OR 1.63, respectively). CONCLUSIONS: This analysis suggests that other agricultural settings not previously reported, such as potato production, may be a risk factor for CB. The nature and circumstances of exposure to hazardous agents need to be further explored.	Annals of Epidemiology	23	9	539-45	Self-reported exposure			Cross-sectional	Pesticides in general	respiratory	doctor-diagnosed	France	hic
1050	S. Chakraborty, S. Mukherjee, S. Roychoudhury, S. Siddique, T. Lahiri and M. R. Ray	Chronic exposures to cholinesterase-inhibiting pesticides adversely affect respiratory health of agricultural workers in India	2009	OBJECTIVE: The impact of long term exposure to cholinesterase (ChE)-inhibiting organophosphate (OP) and carbamate (C) pesticides on the respiratory health of agricultural workers in India was investigated. METHODS: Three hundred and seventy-six nonsmoking agricultural workers (median age 41 yr) from eastern India who sprayed OP and C pesticides in the field and 348 age- and sex-matched control subjects with non-agricultural occupations from the same locality were enrolled. Prevalence of respiratory symptoms was obtained by questionnaire survey, and pulmonary function tests were carried out by spirometry. Chronic obstructive pulmonary disease (COPD) was diagnosed by the Global Obstructive Lung Disease (GOLD) criteria, and erythrocyte acetylcholinesterase (AChE) was measured by the Ellman method. RESULTS: Agricultural workers had greater prevalences of upper and lower respiratory symptoms, and appreciable reduction in spirometric measurements. Overall, lung function reduction was noted in 48.9% of agricultural workers compared with 22.7% of control, and a restrictive type of deficit was predominant. COPD was diagnosed in 10.9% of agricultural workers compared with 3.4% of controls ($p<0.05$ in chi(2) test), and the severity of the disease was greater in agricultural workers. Red blood cell (RBC) AChE was lowered by 34.2% in agricultural workers, and the fall in AChE level was positively associated with respiratory symptoms, lung function decrement and COPD after controlling for education and income as potential confounders. CONCLUSIONS: Long-term exposure to cholinesterase-inhibiting agricultural pesticides currently in use in India is associated with a reduction in lung function, COPD and a rise in respiratory symptoms.	Journal of Occupational Health	51	6	488-97	Biomonitoring (blood)			Cross-sectional	Chemical class	respiratory	self-reported	India	lmic
1051	S. Ciesielski, D. P. Loomis, S. R. Mims and A. Auer	Pesticide exposures, cholinesterase depression, and symptoms among North Carolina migrant farmworkers	1994	OBJECTIVES: We conducted a clinic-based study of erythrocyte cholinesterase levels, pesticide exposures, and health effects among farmworkers and nonfarmworkers to determine risks for exposure and associated morbidity. METHODS: Two hundred two farmworkers and 42 nonfarmworkers were recruited sequentially at two community health centers. Erythrocyte cholinesterase levels were measured colorimetrically. Questionnaires obtained data on demographics, occupational history, exposures, and symptoms. RESULTS: Cholinesterase levels were significantly lower among farmworkers (30.28 U/g hemoglobin) than among nonfarmworkers (32.3 U/g hemoglobin). Twelve percent of farmworkers, but no nonfarmworkers, had very low levels. Farmworkers applying pesticides also had lower cholinesterase levels. One half of farmworkers reported being sprayed by pesticides and working in fields with an obvious chemical smell. Of reported symptoms, only diarrhea was associated with cholinesterase levels. Reported exposures, however, were strongly associated with symptoms. CONCLUSIONS: Farmworkers reported many pesticide exposures that violate state and federal regulations. Farmworkers had cholinesterase levels significantly lower than those of nonfarmworkers, although only spraying pesticides was associated with very low levels.	American Journal of Public Health	84	3	446-51	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	USA	hic
1052	S. Dabrowski, W. Hanke, K. Polanska, T. Makowiec-Dabrowska and W. Sobala	Pesticide exposure and birthweight: an epidemiological study in Central Poland	2003	The aim of this study was to evaluate the influence of maternal exposure to pesticides in the 1st and 2nd trimesters of pregnancy on infant birthweight in a population of Polish farmers. The subjects were women who delivered in 25 maternity hospitals in the region of Lodz (Central Poland), including 117 women who delivered infants with low birthweight (LBW) and 377 infants with birthweight > or = 2500 g delivered on randomly selected 70 days between 31 January 1998 and 30 June 2001. A questionnaire on maternal demographic and anthropometric characteristics as well as the occurrence of several occupational hazards, including pesticide use and involvement in heavy physical work on the farm in each of pregnancy trimesters, was administered by a physician 1-2 days after delivery. The pesticides used most frequently included: phenoxyacetic acid derivatives, organophosphates, ureas, triazines, synthetic pyrethroids and N-phenylamides (anilides). Infants born to women exposed to pesticides in 1st or 2nd trimester had birthweight lower by 189 g than that of infants of the non-exposed women. When adjusted for pregnancy duration, the women exposed to pesticides were found to deliver infants with birthweight lower by about 100 g ($p = 0.067$) than that of infants of the non-exposed women. After adjusting for the variables that may have impact on pregnancy duration, we noted that mothers exposed to pesticides, on average delivered half a week earlier than those non-exposed. Our results indicate that maternal exposure to pesticides may contribute to a slight reduction in the duration of pregnancy. A slower pace of fetal development, corresponding to the small-for-gestational-age effect, was observed, but the increment in the risk was of borderline significance.	International Journal of Occupational Medicine & Environmental Health	16	1	11567	Self-reported exposure			Cross-sectional	Pesticides in general	offspring	medical test result	Poland	hic

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1053	S. Daoud, A. Sellami, M. Bouassida, S. Kebaili, L. Ammar Keskes, T. Rebai and N. Chakroun Feki	Routine assessment of occupational exposure and its relation to semen quality in infertile men: A cross-sectional study	2017	Background/aim: Concerns about the detrimental effects of occupational and environmental exposure on male reproductive function have been raised by reports of declining sperm quality over the last decades. The aim of this study was to investigate the association between altered semen parameters and exposure to occupational risk factors as assessed by questionnaire. Materials and methods: We conducted a cross-sectional questionnaire-based study among a population of 2122 men who underwent andrological investigation for couple infertility. All participants were interviewed and their semen samples were analyzed. Information about medical history and occupational exposure was used to classify participants into exposed and unexposed groups. Results: Exposure to pesticides was associated with a significantly higher risk of asthenozoospermia (adjusted odds ratio [OR] = 1.6; 95% CI, 1.0<U+201A><U+00C4><U+00EC>2.4) and necrozoospermia (OR = 2.6; 95% CI, 1.4<U+201A><U+00C4><U+00EC>4.7). Exposure to cement was found to be correlated with a higher risk of oligozoospermia (OR = 1.1; 95% CI, 0.9<U+201A><U+00C4><U+00EC>1.4). There was no association between semen impairment and exposure to solvents, excess heat, or mechanical vibrations. Conclusion: We found an association between self-reported occupational exposure and altered semen parameters. These results support the usefulness of questionnaires for routine assessment and management of occupational exposures in infertile men.	Turkish Journal of Medical Sciences	47	3	902-907	Self-reported exposure			Cross-sectional	Pesticides in general	reproductive	medical test result	Tunisia	lmic
1054	S. De Wit, R. Bretveld, L. Wijers, C. Van Veldhoven, M. Van Tongeren, M. Van Gelder and N. Roeleveld	Occupational exposure to endocrine disrupting chemicals and the risk of testicular cancer	2011	The worldwide incidence of testicular cancer (TC) doubled over the past 50 years and endocrine disrupting chemicals (EDCs) are thought to play a role in this increase. The objective of this case-referent study was to assess the effects of occupational exposure to EDCs on the development of testicular cancer (TC). TC cases were approached through the Comprehensive Cancer Centre East (IKO) in the Netherlands, while referents were men whose female partner delivered a child in the Radboud University Nijmegen Medical Centre. Cases and referents were asked to fill out a questionnaire to assess current and past exposure, including job history. A Job Exposure Matrix (JEM) was used to determine occupational exposure to ten different groups of EDCs. A total of 261 cases and 670 referents completed the questionnaire of which 63.2% experienced occupational exposure to EDCs. Adjusted odds ratios (ORs) with 95% confidence intervals (CIs) were increased for the JEM summary score (OR = 1.4, 95%CI 1.0-2.1) and for 7 of the 10 EDC groups: polycyclic aromatic hydrocarbons (OR = 1.5, 95%CI 0.8-2.6), polychlorinated organic compounds (OR = 3.3, 95%CI 1.3-8.3), pesticides (OR = 1.7, 95%CI 1.0-2.7), phthalates (OR = 1.5, 95%CI 1.0-2.4), organic solvents (OR = 1.4, 95%CI 0.8-2.5), alkylphenolic compounds (OR = 1.6, 95%CI 1.0-2.5), and metals (OR = 1.4, 95%CI 1.0-2.1). There seems to be an association between testicular cancer and occupational exposure to certain groups of endocrine disrupting chemicals, mainly occurring among farmers, carpenters, and electricians, but most risk estimates are small to moderate.	American Journal of Epidemiology	173	NA	S71	Job exposure matrix	Self-reported exposure		Case-control	Pesticides in general	cancer	doctor-diagnosed	Netherlands	hic
1055	S. Dick, S. Semple, F. Dick and A. Seaton	Occupational titles as risk factors for Parkinson's disease	2007	BACKGROUND: Job title or employment sector may be associated with Parkinson's disease (PD). METHODS: In a case-control study, in four European centres, lifetime occupational histories were coded using modified International Standard Industrial Classification (ISIC) and Dictionary of Occupational Titles (DOT). We employed multiple logistic regression analyses adjusting for age, gender, smoking and family history of PD. RESULTS: A total of 649 cases and 1587 controls were recruited. Scottish data showed a non-significant increased risk for agriculture (DOT: OR 1.32, 95% CI 0.81-2.16; ISIC: OR 1.30, 95% CI 0.84-2.02) and reduced risk for 'transport and communication' (ISIC: OR 0.60, 95% CI 0.37-0.97). Subsequent four-centre analyses showed reduced risk for processing occupations (DOT: OR 0.69, 95% CI 0.5-0.95). An association with pesticide exposure, found using detailed exposure assessment, was not apparent using job classification. CONCLUSIONS: In contrast to retrospective exposure assessment, job or industrial sector is a weak indicator of toxic exposures such that true associations may be missed.	Occupational Medicine (Oxford)	57	1	18415	NA			NA	NA	neurological	doctor-diagnosed	SHIC	SHIC
1056	S. Dutta and M. Bahadur	Cytogenetic analysis of micronuclei and cell death parameters in epithelial cells of pesticide exposed tea garden workers	2016	Buccal micronucleus cytome assay was carried out in 47 exposed (sprayers and leaf harvesters), 47 non-exposed (controls) to determine the extent of damage working in the tea plantations of Terai region of West Bengal, India. As the pesticide exposed male workers were found to consume alcohol and smoked cigarettes/bidis, 35 smokers and 30 alcoholics were also included for comparison. Results showed a significant difference in micronuclei (9.91+/-2.74, p<=.001), nuclear bud (4.98+/-1.31, p<=.001), binucleate (6.26+/-2.84, p<=.001), karyorrhectic (8.36+/-2.28, p<=.001), pyknotic (5.62+/-1.78, p<=.05) as well as karyolytic (6.81+/-3.00, p<=.001) nuclei compared with control. Comparison also revealed a higher frequency of micronuclei (6.11+/-2.55, p<=.01), nuclear bud (4.06+/-1.97, p<=.05), binucleate (4.34+/-1.85, p<=.001), karyorrhectic (6.83+/-2.12, p<=.001), and karyolytic (6.20+/-2.54, p<=.001) nuclei except pyknotic cell in the smoker than control. Frequency of binucleate (3.80+/-1.73, p<=.05), karyorrhectic (5.57+/-2.34, p<=.05), pyknotic (5.50+/-1.36, p<=.05), and karyolytic (6.30+/-2.71, p<=.001) nuclei was higher in the alcoholics than control (non-alcoholics), whereas the micronuclei and nuclear bud were found to be non-significant compared with the control. Our analyses also revealed a higher proportion of the micronucleus and the cell death parameters in the pesticide exposed males than females, which indicated that pesticide, smoking, and alcohol may act synergistically to cause more damage to the buccal epithelial cells. However, age and the exposure duration have no influence on the micronucleus and other cell death parameters.	Toxicology Mechanisms & Methods	26	8	627-634	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	India	lmic

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1057	S. E. Starks, F. Gerr, F. Kamel, C. F. Lynch, M. C. Alavanja, D. P. Sandler and J. A. Hoppin	High pesticide exposure events and central nervous system function among pesticide applicators in the Agricultural Health Study	2012	PURPOSE: While acute pesticide poisoning can be associated with persistent adverse central nervous system (CNS) effects, little is known about the effect of one or more episodic and unusually high pesticide exposure events (HPEE) that typically do not result in acute poisoning. The objective of this investigation was to examine the association between ever having an HPEE and CNS function among licensed pesticide applicators enrolled in the Agricultural Health Study (AHS). METHODS: In 2006-2008, 693 male participants with no history of a physician-diagnosed pesticide poisoning completed nine neurobehavioral tests to assess memory, motor speed, sustained attention, verbal learning, and visual scanning and processing. Information on ever having an HPEE and pesticide poisonings was obtained from previous AHS interviews. Associations between ever having an HPEE and neurobehavioral outcomes were estimated with linear regression controlling for age and outcome-specific covariates. RESULTS: A history of ever having an HPEE was reported by 156 (23%) participants. Adverse associations were observed between ever having an HPEE and two of the nine neurobehavioral tests. On a test of visual scanning and processing (Digit-Symbol), participants who ever had an HPEE were 4.2 s slower (95% CI: -7.27, -1.11) than those without an HPEE, equivalent to the effect of 3.9 years of age in this population. On a test of visual scanning and motor speed (Sequences A), participants who ever had an HPEE were 2.5 s slower (95% CI: -4.53, -0.41) than those without an HPEE, equivalent to the effect of 3.9 years of age. No significant associations were observed between participants who ever had an HPEE and the remaining neurobehavioral tests. CONCLUSIONS: One or more HPEE may contribute to adverse CNS outcomes independent of diagnosed pesticide poisoning.	International Archives of Occupational & Environmental Health	85	5	505-15	Self-reported exposure			Cross-sectional	Specific active ingredient	neurological	self-reported	USA	hic
1058	S. E. Starks, F. Gerr, F. Kamel, C. F. Lynch, M. P. Jones, M. C. Alavanja, D. P. Sandler and J. A. Hoppin	Neurobehavioral function and organophosphate insecticide use among pesticide applicators in the Agricultural Health Study	2012	Although persistent decrements in cognitive function have been observed among persons who have recovered from clinically overt organophosphate (OP) pesticide poisoning, little is known about the cognitive effects of chronic OP exposures that do not result in acute poisoning. To examine associations between long-term pesticide use and neurobehavioral (NB) function, NB tests were administered to licensed pesticide applicators enrolled in the Agricultural Health Study (AHS) in Iowa and North Carolina. Between 2006 and 2008, 701 male participants completed nine NB tests to assess memory, motor speed and coordination, sustained attention, verbal learning and visual scanning and processing. Data on ever-use and lifetime days of use of 16 OP pesticides were obtained from AHS interviews conducted before testing between 1993 and 2007 and during the NB visit. The mean age of participants was 61 years (SD=12). Associations between pesticide use and NB test performance were estimated with linear regression controlling for age and outcome-specific covariates. NB test performance was associated with lifetime days of use of some pesticides. Ethoprop was significantly associated with reduced performance on a test of motor speed and visual scanning. Malathion was significantly associated with poor performance on a test of visual scanning and processing. Conversely, we observed significantly better test performance for five OP pesticides. Specifically, chlorpyrifos, coumaphos, parathion, phorate, and tetrachlorvinphos were associated with better verbal learning and memory; coumaphos was associated with better performance on a test of motor speed and visual scanning; and parathion was associated with better performance on a test of sustained attention. Several associations varied by state. Overall, we found no consistent evidence of an association between OP pesticide use and adverse NB test performance among this older sample of pesticide applicators. Potential reasons for these mostly null results include a true absence of effect as well as possible selective participation by healthier applicators.	Neurotoxicology & Teratology	34	1	168-76	Self-reported exposure			Cohort (prospective)	Specific active ingredient	neurological	medical test result	USA	hic
1059	S. E. Starks, J. A. Hoppin, F. Kamel, C. F. Lynch, M. P. Jones, M. C. Alavanja, D. P. Sandler and F. Gerr	Peripheral nervous system function and organophosphate pesticide use among licensed pesticide applicators in the Agricultural Health Study	2012	BACKGROUND: Evidence is limited that long-term human exposure to organophosphate (OP) pesticides, without poisoning, is associated with adverse peripheral nervous system (PNS) function. OBJECTIVE: We investigated associations between OP pesticide use and PNS function by administering PNS tests to 701 male pesticide applicators in the Agricultural Health Study (AHS). METHODS: Participants completed a neurological physical examination (NPx) and electrophysiological tests as well as tests of hand strength, sway speed, and vibrotactile threshold. Self-reported information on lifetime use of 16 OP pesticides was obtained from AHS interviews and a study questionnaire. Associations between pesticide use and measures of PNS function were estimated with linear and logistic regression controlling for age and outcome-specific covariates. RESULTS: Significantly increased odds ratios (ORs) were observed for associations between ever use of 10 of the 16 OP pesticides and one or more of six NPx outcomes. Most notably, abnormal toe proprioception was significantly associated with ever use of 6 OP pesticides, with ORs ranging from 2.03 to 3.06; monotonic increases in strength of association with increasing use was observed for 3 of the 6 pesticides. Mostly null associations were observed between OP pesticide use and electrophysiological tests, hand strength, sway speed, and vibrotactile threshold. CONCLUSIONS: This study provides some evidence that long-term exposure to OP pesticides is associated with signs of impaired PNS function among pesticide applicators.	Environmental Health Perspectives	120	4	515-20	Self-reported exposure			Cohort (prospective)	Specific active ingredient	neurological	medical test result	USA	hic
1060	S. El-Zaemey, J. Heyworth, D. C. Glass, S. Peters and L. Fritschi	Household and occupational exposure to pesticides and risk of breast cancer	2014	The association between breast cancer in women and the use of household or occupational pesticides was examined in a population-based case-control study. This study was conducted in Western Australia in 2009-2011 and included 1,789 controls and 1,205 cases. Information on household pesticide exposure was collected from questionnaires. For occupational pesticide exposure, job-specific modules (JSMs) were used. To evaluate potential recall bias, we stratified the analysis by belief about whether pesticides contribute to breast cancer. Unconditional logistic regression was used to calculate odds ratios (ORs) and 95% confidence intervals (CIs). Women's exposures to pesticides in households and workplaces were not related to increased risk of breast cancer (OR = 1.10; CI: 0.86-1.37) and (OR = 0.77; CI: 0.45-1.32), respectively. The prevalence of occupational exposure to pesticides among women in our study was low. In the stratified analyses, the odd ratios associated with household pesticide use were similar among participants who believed pesticides increased breast cancer risk and those who did not. The results of our study did not show associations between breast cancer and household or occupational exposure to pesticides.	International Journal of Environmental Health Research	24	2	91-102	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Australia	hic

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1061	S. Ezzat, M. Abdel-Hamid, S. A. Eissa, N. Mokhtar, N. A. Labib, L. El-Ghorory, N. N. Mikhail, A. Abdel-Hamid, T. Hifnawy, G. T. Strickland and C. A. Loffredo	Associations of pesticides, HCV, HBV, and hepatocellular carcinoma in Egypt	2005	The rate of hepatocellular carcinoma (HCC) is increasing in Egypt where the major risk factors are chronic infections with hepatitis B and C viruses (HBV and HCV). A major segment of the population is employed in agriculture, raising the possibility that exposure to pesticides is an additional risk factor for HCC. The objective of this study is to investigate pesticides as environmental risk factors for HCC while taking into account viral risk factors. We conducted a case-control study of 236 subjects with confirmed HCC recruited from the National Cancer Institute, Cairo University, Egypt, and 236 controls matched on sex, age group and urban-rural status recruited from orthopedic department, Cairo University Hospital, Egypt. Patients who agreed to participate signed a consent form, answered a questionnaire and gave a blood sample for hepatitis virus testing. The manuals of the Ministry of Agriculture for approved use and type of pesticides since 1965 were linked to the questionnaire data for types of crops and pests that the subject had to combat, to attribute specific pesticides that were used by each subject. Subjects also reported duration of the exposure (years). Case-control comparisons in these data were stratified by sex, age group, and urban vs. rural residence. Data were analyzed using unconditional logistic regression models adjusting for age, HCV RNA, and current hepatitis B infection. Among rural males, the adjusted odds ratio (OR) for organophosphorus compounds was 2.7 (95% CI = 1.3-5.3) and for carbamates it was 2.9 (95% CI = 1.4-5.8). No statistically significant associations between HCC and pesticides were observed for urban males or for females. As expected, the strongest risk factors for HCC in this study were HCV RNA (OR = 16-17) and current HBV infection (OR = 27-28). This study therefore suggests that exposures to organophophorus and carbamate pesticides are additive risk factors to current HCV and HBV infection among rural males. Future investigation should address the possible hepatocarcinogenicity of pesticides using biomarkers of exposure and other techniques to better estimate dose-response relationships.	International Journal of Hygiene & Environmental Health	208	5	329-39	Self-reported exposure			Case-control	Chemical class	cancer	doctor-diagnosed	Egypt	lmic
1062	S. Ezzat, W. Rashed, S. Salem, M. El-Daly, M. Abdel-Hamid, A. El-Haddad, I. Sedhom, C. Loffredo and S. Amr	Risk factors for TEL-AML fusion gene and childhood acute lymphoblastic leukemia in Egypt	2012	Background: Childhood acute lymphocytic leukemia (ALL) is the most common pediatric cancer. The exact cause is not known in most individual cases, but past epidemiological research has suggested a number of potential environmental and genetic risk factors. This study aimed to: (1) Evaluate environmental (such as pesticides exposure and smoking) risk factors for ALL risk in Egyptian children. (2) Study the associations between polymorphisms in MTHFR, and NQO1genes and environmental exposures on the risk of ALL in Egypt. Material and Method: The source study, Risk Factors for TEL/AML1 fusion gene and ALL in Egypt (Ezzat S. et al., R03 CA133960), uses a case-control design. Cases (N = 295) were recruited from the Children's Cancer Hospital, Egypt in the period from 2009 to 2012. Controls (N = 333) were randomly selected from the general population to frequency-match the cases by sex, age and residence. Mothers provided answers to an administered questionnaire about their medical, environmental exposures and occupational history. Blood sample from the mother and the child was drawn to test mutations in studied genes. A TEL-AML fusion genes was tested by florescent in situ hybridization technique. Mutations in MTHFR and NQO1 genes were tested by PCR using the specific primers. Odds ratios (ORs) and 95% confidence interval (CI) were calculated using unconditional logistic regression models adjusting for age of the child, maternal age, urban/rural residence and education of parents. Results and Discussion: Comparing cases to controls, it was found that having normal delivery was a protective factor (OR = 0.65; 95% CI 0.45-0.93). Use of fertility medication prior to pregnancy in the index child was associated with increased risk (OR = 2.65; 95% CI 1.24-5.66). Exposure of mothers during pregnancy to Environmental Tobacco Smoke at work or home (other sources than the husband) was associated with increased risk (OR = 16.24; 95% CI 6.24-42.25). Having a mutant allele of MTHFR 2 in mothers was associated with increased risk (OR = 1.38; 95% CI 0.95-2.0). TEL-AML fusion gene was positive in 18.3 of the cases. We did not find any significant difference in the studied environmental and genetic factors in the case-case analysis when comparing cases who have the fusion genes with those who do not have it. Conclusion: Our study showed that normal delivery is a protective factor, while intake of medication that helps in fertility was associated with increased risk. Exposure to ETS during pregnancy was also associated with increased risk. Future studies are encouraged to integrate the use of biomarkers to assess exposures and to elucidate the biological mechanisms for those factors whenever possible.	European Journal of Cancer	48	NA	S275	Self-reported job history			Case-control	Job title	offspring	doctor-diagnosed	Egypt	lmic
1063	S. G. Berent, B.; Albers, J. W.; Garabrant, D. H.; Cohen, S. S.; Garrison, R. P.; Richardson, R. J.	Effects of occupational exposure to chlorpyrifos on neuropsychological function: a prospective longitudinal study	2014	BACKGROUND: Exposure to chlorpyrifos (CPF), an organophosphorus (OP) anticholinesterase insecticide, occurs typically in settings where multiple agents are present (e.g., agriculture) and quantitative dose measures may be absent (e.g., pesticide application). Such exposures allow few opportunities to study potential neurobehavioral effects of CPF alone. We studied the relationship between CPF exposure and behavioral function among CPF manufacturing workers, which allowed identification, measurement, and estimation of exposure and important non-exposure variables that potentially could affect study findings. METHODS: A prospective longitudinal study design was used to compare neurobehavioral function over a one-year period among 53 CPF workers and 60 referent workers. Quantitative and qualitative measures were used, and potential confounders were identified and tested for possible inclusion in our statistical models. Neurobehavioral function was assessed by neuropsychological tests covering various behavioral domains that may be adversely affected by exposure to CPF in sufficient amount. RESULTS: CPF workers had significantly greater CPF exposures during the study period than did referents at levels where physiologic effects on plasma butyrylcholinesterase (BuChE) activity were apparent and with higher 3,5,6-trichloro-2-pyridinol (TCPy/Cr) urinary excretion (p<0.0001) and lower average BuChE activity (p<0.01). No evidence for impaired neurobehavioral domains by either group of workers was observed at baseline, on repeat examination, or between examinations. CPF workers scored higher than referent workers on the verbal memory domain score (p=0.03) at baseline, but there were no significant changes in verbal memory over time and no significant group-by-time interactions. CONCLUSIONS: The study provides important information about CPF exposure in the workplace by not supporting our working hypothesis that CPF exposure associated with various aspects of the manufacturing process would be accompanied by adverse neurobehavioral effects detectable by quantitative neurobehavioral testing. Some aspects making this workplace site attractive for study and also present limitations for the generalization of results to other situations that might have exposures that vary widely between and within different facilities and locations. For example, these results might not apply to occupations such as applicators with higher exposure or to workers with low educational levels.	Neurotoxicology	41	NA	44-53	Biomonitoring (urine)			Cohort (prospective)	Specific active ingredient	neurological	medical test result	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1064	S. Gomez-Arroyo, Y. Diaz-Sanchez, M. A. Meneses-Perez, R. Villalobos-Pietrini and J. De Leon-Rodriguez	Cytogenetic biomonitoring in a Mexican floriculture worker group exposed to pesticides	2000	The cytogenetic damage in floriculturists of Morelos State, Mexico, exposed to pesticides, was evaluated by mean of biological tests based on sister chromatid exchanges (SCE) in lymphocytes of peripheral blood and micronuclei (MN) in exfoliated cells of the buccal mucosa. Besides the cytogenetic analysis, the effects of pesticides exposure on the cell proliferation kinetics (CPK) by the replication index (RI) were also studied. The mitotic index (MI) to detect cytotoxic effects was also determined. Greenhouses of the towns of Santa Catarina, Jiutepec and Yecapixtla were selected for the study, because the application of chemicals to the flowers is uncontrolled. As non-exposed group, people of the town of Temisco were chosen; their activity was not related to pesticides. The SCE were analyzed in the peripheral blood of 30 persons, 22 women and 8 men, with 10 and 1.5 years of exposure to pesticides, respectively, and of 30 persons, 28 women and 2 men, that were considered as the non-exposed group. Samples of buccal mucosa were also taken from each person. Significant differences between exposed and non-exposed groups were found in SCE, CKP and MI. Besides, the MN frequencies in the exposed group were three times higher than in the non-exposed group.	Mutation Research	466	1	117-24	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Mexico	umic
1065	S. Grufferman, P. J. Lupo, R. I. Vogel, H. E. Danysh, E. B. Erhardt and S. Ognjanovic	Parental military service, agent orange exposure, and the risk of rhabdomyosarcoma in offspring	2014	OBJECTIVE: To evaluate the role of parental military service-related exposures and rhabdomyosarcoma (RMS) risk in offspring using data from a large case-control study of childhood RMS. STUDY DESIGN: Cases (n = 319) were enrolled from the third trial run by the Intergroup Rhabdomyosarcoma Study Group. Population-based controls (n = 319) were pair-matched to cases on race, sex, and age. Conditional logistic regression was used to evaluate parental military service-related exposures and their associations with childhood RMS by generating aORs and 95% CIs. Statistical significance was defined as P < .05. RESULTS: There were no significant associations between parental military service and childhood RMS. The strongest association was with maternal military service; however, this association was attenuated and did not remain significant after adjusting for covariates (aOR = 2.75, 95% CI 0.71, 10.62). An elevated effect estimate was found when assessing paternal exposure to Agent Orange (AO) and childhood RMS but was not statistically significant (aOR = 1.72, 95% CI 0.55, 5.41). CONCLUSIONS: We found little evidence that parental military service of AO exposure influences the risk of RMS in offspring. These findings are notable in light of the continuing controversies surrounding the intergenerational effects of AO exposure.	Journal of Pediatrics	165	6	1216-21	Self-reported exposure			Case-control	Chemical class	offspring	doctor-diagnosed	USA	hic
1066	S. H. S. Horowitz, A.; Marshall, E.; Mauer, M. P.	A multi-modality assessment of peripheral nerve function in organophosphate-pesticide applicators	1999	Health effects from chronic, low-level exposure to organophosphate pesticides have not been studied extensively and are not well-established. This report follows up a study in New York State in which a cohort of 90 male pesticide applicators were found to have increased vibration sensitivity thresholds, compared with a matched sample drawn from the general population. This investigation examined the nature and extent of peripheral nerve abnormalities in a small subgroup of the original cohort. Of the nine subjects studied, four had clinical evidence of peripheral neuropathic dysfunction, and one who was normal physiologically showed electrophysiological abnormalities. The remaining four showed no clinical, electrophysiologic, or quantitative signs or other abnormalities. This study adds to the growing evidence that organophosphates are toxic to the peripheral nervous system at levels of exposure that do not induce acute or subacute symptomatology.	Journal of Occupational & Environmental Medicine	41	5	405-8	Job title			Cross-sectional	Job title	neurological	medical test result	USA	hic
1067	S. H. Zahm	Mortality study of pesticide applicators and other employees of a lawn care service company	1997	In response to reports linking non-Hodgkin's lymphoma (NHL) and the herbicide 2,4-dichlorophenoxyacetic acid, a retrospective cohort mortality study of 32,600 employees of a lawn care company was conducted. The cohort was generally young with short-duration employment and follow-up. In comparison to the US population, the cohort had significantly decreased mortality from all causes of death combined (307 deaths), arteriosclerotic heart disease, and accidents. There were 45 cancer deaths (59.6 expected, standardized mortality ratio [SMR] = 0.76, 95% confidence interval [CI] = 0.55, 1.01). Bladder cancer mortality was significantly increased, but two of the three observed deaths had no direct occupational contact with pesticides. There were four deaths due to NHL (SMR = 1.14, CI = 0.31, 2.91); three were male lawn applicators (SMR = 1.63, CI = 0.33, 4.77), with two of the applicators employed for three or more years (SMR = 7.11, CI = 1.78, 28.42). No other cause of death was significantly elevated among lawn applicators as a group or among those employed for three or more years. Although based on very small numbers and perhaps due to chance, the NHL excess is consistent with several earlier studies.	Journal of Occupational & Environmental Medicine	39	11	1055-67	Self-reported job history	Registers	Cohort (prospective)	Pesticides in general	mortality (all cause)	doctor-diagnosed	USA	hic
1068	S. H. Zahm, D. D. Weisenburger, R. C. Saal, J. B. Vaught, P. A. Babbitt and A. Blair	The role of agricultural pesticide use in the development of non-Hodgkin's lymphoma in women	1993	Non-Hodgkin's lymphoma has been found to be associated with agricultural pesticide use in men, but little is known about the risk in women. In a recent population-based, case-control study conducted in eastern Nebraska, no increased risk of non-Hodgkin's lymphoma was found in women who had ever lived or worked on a farm (odds ratio [OR] = 1.0). Neither the use of insecticides (OR = 0.8) nor herbicides (OR = 0.7) on the farm was associated with non-Hodgkin's lymphoma; however, the number of women who mixed or applied pesticides was small, particularly in comparison to men on farms. Small nonsignificant associations were observed among the women who personally handled insecticides (OR = 1.3) or herbicides (OR = 1.2). Women who personally handled organophosphate insecticides had a significant 4.5-fold increased risk of non-Hodgkin's lymphoma. Use of chlorinated hydrocarbon insecticides was associated with an OR of 1.6; however, the use on dairy cattle was associated with a 3-fold increased risk. Pesticide-related risks were greater among women with a family history of cancer, particularly a history of lymphatic or hematopoietic cancer among first-degree relatives.	Archives of Environmental Health	48	5	353-8	Self-reported exposure			Case-control	Chemical class	cancer	doctor-diagnosed	USA	hic
1069	S. Hoar Zahm, D. D. Weisenburger, K. P. Cantor, F. F. Holmes and A. Blair	Role of the herbicide atrazine in the development of non-Hodgkin's lymphoma	1993	Atrazine is the most commonly used herbicide in the United States and is a wide-spread groundwater contaminant in the Midwest. The role of atrazine in the development of human non-Hodgkin's lymphoma (NHL) was investigated in three case-referent studies conducted in four midwestern states in the United States. A total of 993 white men with NHL and 2918 population-based referents were interviewed concerning their agricultural practices. When the results of the three studies were combined, atrazine use was associated with an odds ratio of 1.4 [95% confidence interval (95% CI) 1.1-1.8, 130 cases, 249 referents) for NHL. However, adjustments for the use of 2,4-dichlorophenoxyacetic acid and organophosphate insecticides reduced the apparent association between NHL and atrazine in all but one state and reduced the associations for the long-term and frequent users in Nebraska. Detailed analyses suggested that there was little or no increase in the risk of NHL attributable to the agricultural use of atrazine.	Scandinavian Journal of Work, Environment & Health	19	2	108-14	Self-reported exposure			Case-control	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

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1070	S. Hongsibsong, N. Sittitoon and R. Sapbamrer	Association of health symptoms with low-level exposure to organophosphates, DNA damage, AChE activity, and occupational knowledge and practice among rice, corn, and double-crop farmers	2017	OBJECTIVES: This study aims to determine (1) total dialkylphosphate (SIGMADAP) levels, occupational knowledge and practice, DNA damage, AChE activity, and health symptoms in rice, corn, and double-crop farmers; (2) the association of health symptoms with SIGMADAP levels, occupational knowledge and practice, DNA damage, and AChE activity in farmers; and (3) the prevalence of health symptoms between farmers and non-farmers. METHODS: A cross-sectional study was conducted by interviewing as well as analyzing urine and blood samples during July to August 2014. RESULTS: There were no differences in SIGMADAP levels, AChE activity, and occupational knowledge and practice scores among all farmer groups. In terms of health symptoms related to SIGMADAP, AChE activity, DNA damage, and occupational knowledge and practice, pesticide-related symptoms were determined, including breathlessness, chest pain, dry throat, numbness, muscle weakness, cramp, headache, dizziness, eye irritation, white/red rash, and white/red pimple, which were classified as respiratory, muscle, nervous, and epithelial symptoms. A remarkable finding was that farmers had a significantly higher prevalence of muscle weakness (odds ratio (OR)=3.79) and numbness (OR=3.45) as compared with non-farmers. CONCLUSION: Our findings, therefore, suggest that a long-term low-level exposure to organophosphates (OPs) may be associated with an increasing prevalence of muscle symptoms. However, a further cohort study incorporating sensitive health outcomes and measurement of multiple pesticides monitoring on a larger scale is warranted.	Journal of Occupational Health	59	2	165-176	Biomonitoring (blood)	Biomonitoring (urine)		Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	Thailand	umic
1071	S. Issaragrisil, D. W. Kaufman, T. Anderson, K. Chansung, P. E. Leaverton, S. Shapiro and N. S. Young	The epidemiology of aplastic anemia in Thailand	2006	Aplastic anemia has been linked to environmental exposures, from chemicals and medical drugs to infectious agents. The disease occurs more frequently in Asia than in the West, with incidence rates 2- to 3-fold higher. We report updated results of an epidemiologic study conducted in Thailand from 1989 to 2002, in which 541 patients and 2261 controls were enrolled. Exposures were determined by in-person interview. We observed significantly elevated relative risk estimates for benzene (3.5) and other solvents (2.0) and for sulfonamides (5.6), thiazides (3.8), and mebendazole (3.0). Chloramphenicol use was infrequent, and no significant association was observed. Agricultural pesticides were implicated in Khonkaen (northeastern Thailand). There were significant associations with organophosphates (2.1), DDT (6.7), and carbamates (7.4). We found significant risks for farmers exposed to ducks and geese (3.7) and a borderline association with animal fertilizer (2.1). There was a significant association in Khonkaen with drinking other than bottled or distilled water (2.8). Nonmedical needle exposure was associated in Bangkok and Khonkaen combined (3.8). Most striking was the large etiologic fraction in a rural region accounted for by animal exposures and drinking of water from sources such as wells, rural taps, and rainwater, consistent with an infectious etiology for many cases of aplastic anemia in Thailand.	Blood	107	4	1299-307	Self-reported exposure			Case-control	Specific active ingredient	circulatory	doctor-diagnosed	Thailand	umic
1072	S. Issaragrisil, K. Chansung, D. W. Kaufman, J. Sirijirachai, T. Thamprasit and N. S. Young	Aplastic anemia in rural Thailand: its association with grain farming and agricultural pesticide exposure. Aplastic Anemia Study Group	1997	OBJECTIVES: A population-based case-control study was conducted to elucidate the incidence and etiology of aplastic anemia in Thailand. METHODS: Case patients and hospital control patients were enrolled in three regions from 1989 to 1994; data were collected by interview. RESULTS: Forty-six percent of 81 case patients and 19% of 295 control patients from Khonkaen were grain farmers (estimated relative risk [RR] = 2.7, 95% confidence interval [CI] = 1.4, 5.2). Sixteen percent of case patients and 6% of control patients used agricultural pesticides (estimated RR = 2.7, 95% CI = 1.1, 6.6). The association with grain farming remained among those not exposed to pesticides. In Songkla, 16% of 43 case patients and 2% of 181 control patients were grain farmers (crude RR estimate = 11, 95% CI = 3.4, 35). CONCLUSIONS: The relation of aplastic anemia to grain farming may partly explain the high incidence of aplastic anemia in Thailand.	American Journal of Public Health	87	9	1551-4	Self-reported exposure			Case-control	Pesticides in general	circulatory	doctor-diagnosed	Thailand	umic
1073	S. J. B. Mackenzie Ross, C. R.; Curran, H. V.; Furlong, C. E.; Abraham-Smith, K. M.; Harrison, V.	Neuropsychological and psychiatric functioning in sheep farmers exposed to low levels of organophosphate pesticides	2010	The study aim was to determine whether low level exposure to organophosphate pesticides (OPs) causes neuropsychological or psychiatric impairment. Methodological weaknesses of earlier studies were addressed by: recruiting participants who had retired on ill health grounds; excluding participants with a history of acute poisoning, medical or psychiatric conditions that might account for ill health; and exploring factors which may render some individuals more vulnerable to the effects of OPs than others. Performance on tests of cognition and mood of 127 exposed sheep farmers (67 working, 60 retired) was compared with 78 unexposed controls (38 working, 40 retired) and published test norms derived from a cross section of several thousand adults in the general population. Over 40% of the exposed cohort reported clinically significant levels of anxiety and depression compared to less than 23% of controls. Exposed subjects performed significantly worse than controls and standardisation samples on tests of memory, response speed, fine motor control, mental flexibility and strategy making, even after controlling for the effects of mood. The pattern was similar for both working and retired groups. The cognitive deficits identified cannot be attributed to mood disorder, malingering, a history of acute exposure or genetic vulnerability in terms of PON1(192) polymorphisms. Results suggest a relationship may exist between low level exposure to organophosphates and impaired neurobehavioural functioning and these findings have implications for working practice and for other occupational groups exposed to OPs such as aviation workers and Gulf War veterans.	Neurotoxicology & Teratology	32	4	452-9	Self-reported exposure			Cross-sectional	Pesticides in general	neurological	medical test result	UK	hic
1074	S. J. Emam, M. Salehcheh, M. H. Haghighizadeh and S. M. H. M. Jazayeri	Occupational exposure to pesticides among farmers	2012	Objective: Agricultural workers are at risk of exposure to occupational hazardous such as pesticides. Exposure to pesticides may result in some health problems. Aim of this study was evaluation of pesticides effect on hematological parameters among farm workers of Southwest Iran. Methodology: In this case control study, 54 male farmers exposed to pesticides and 54 healthy male were enrolled. Blood parameters (Hemoglobin, Hematocrit, MCV, MCH, MCHC, and ESR), cell counts (Erythrocyte, Leukocyte, and Platelet) and coagulation factors (PT, PTT) were measured among case and control groups. Results: Subjects were in the age between of 17 -65 years of age (35<U+00AC><U+00B1>8).Data showed that all the hematological parameters which assayed were in normal range. The values of Hb, Hct, RBC, Platelet and PT in case group were more than control. Conclusion: In this study, hematological indexes were changed in case group but these were not meaningful compared to normal range (p>0.005). It was concluded that RBC, Hb, platelet and PT are useful indexes as warning signals for quick diagnosis of poisoning due to pesticides.	Pakistan Journal of Medical Sciences	28	1	120-123	Job title			Case-control	Job title	hematological	medical test result	Iran	umic

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1075	S. J. Reynolds, A. Tadevosyan, L. Fuortes, J. A. Merchant, A. M. Stromquist, L. F. Burmeister, C. Taylor and K. M. Kelly	Keokuk County rural health study: self-reported use of agricultural chemicals and protective equipment	2007	The Keokuk County Rural Health Study is a population-based study of an agricultural community in Iowa. The study includes in-depth evaluations of respiratory disease, injury, and other health outcomes in relation to environmental and occupational exposures. This article reports descriptive findings on pesticide use from among the 1191 participants completing occupational surveys. Fifty-one percent (612) of respondents (farmers and non-farmers) had applied insecticides including lawn and garden chemicals at home during the past year. Thirty-three percent (395) of respondents had personally mixed or applied farm chemicals during their life. One-hundred and four had a current pesticide applicator's license. Information on the specific types of pesticides and protective measures used was obtained for the 144 individuals who had mixed or applied pesticides on farms within the previous year. Of these individuals, 67% worked with fertilizers, 49% used herbicides, 48% used crop insecticides, 28% used crop storage insecticides, 45% applied livestock insecticides, and 9% worked with fungicides. The use of personal protective equipment such as gloves, aprons, and respirators varied depending on the chemical. A substantial proportion did not use gloves even for mixing. Thirty-five percent reported at least one suspected work-related symptom after working with pesticides during the previous year. The lack of differences in protective equipment use between applicators who have completed pesticide applicator training courses and those who have not suggests a need to develop more effective training methods. The increased use of protective equipment when applying odorous agrochemicals suggests that addition of an odorant to more toxic pesticides may be a successful intervention strategy.	Journal of Agromedicine	12	3	45-55	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	USA	hic
1076	S. J. Sohn and J. S. Choi	Pesticide poisoning among farmers in a rural province of Korea	2001	Pesticide poisoning is one of the most important occupational health hazards for farmers, but the exact prevalence or incidence of the poisoning has not been fully investigated in Korea. The present study assessed the pesticide poisoning in a rural province of Korea based on episodes reported by farmers. The total number of interviewees in this survey was 8,831. Of these, only 8,420 farmers who worked longer than one hour every day during the past one year were included in the analysis. Questionnaires collected from 8,420 persons were analyzed by means of a SAS statistical package. The average days spent for pesticide spraying was 6.8; the farmers at work experienced pesticide-related symptoms during the last one-year period at the rate of 7.0%; the average length of a hospital stay was 4.4 d: and the period of clinic visit averaged 1.7 d. Pesticide poisoning was statistically related with age, sex, region of residence and degree of pesticide use. Among the complaints in the farmers' syndrome, pesticide poisoning was significantly related with shoulder stiffness, sleeplessness, dizziness and a feeling of abdominal fullness, but not with lumbago, limb paresthesia, nocturnal frequency or dyspnea. The present data offer the baseline for the health resources planning and rural health program.	Journal of Occupational Health	43	2	101-105	Self-reported exposure			Cross-sectional	Pesticides in general	pesticide-related illness	self-reported	Korea	hic
1077	S. K. K. Park, D.; Beane-Freeman, L.; Blair, A.; Hoppin, J. A.; Sandler, D. P.; Lynch, C. F.; Knott, C.; Gwak, J.; Alavanja, M.	Cancer incidence among paraquat exposed applicators in the agricultural health study: prospective cohort study	2009	Paraquat (1,1'-dimethyl-4, 4'-bipyridinium dichloride) is a nonselective herbicide that is extremely toxic after acute exposure. It was once widely used in North America and is still used in some countries, including the United States. Although there is little firm evidence that paraquat is a carcinogen, previous studies have suggested a potential relationship with some cancers. This prospective cohort study was performed to evaluate the association between lifetime paraquat exposure and cancer incidence among licensed pesticide applicators with 9.1 years of median follow-up. The lifetime ever-use of paraquat was evaluated in 56,224 subjects at baseline and exposure-response relationship was evaluated in 24,667 subjects (44%) who provided detailed information on total life-time paraquat exposure in a second questionnaire. Among the total subjects, the risk for non-Hodgkin's lymphoma (NHL) in the exposed group was marginally elevated (Relative risk [RR], 1.47; 95% confidence interval [CI], 0.97-2.23) compared to the non-exposed group. However, among the 24,667 applicators who supplied total life-time exposure days, the highest tertile of lifetime exposure-days (LE) and intensity-weighted lifetime exposure-days (IWLE) was not significantly associated with NHL risk (RR, 1.57; 95%CI, 0.57-4.23 for LE; RR, 1.42; 95%CI, 0.40-4.71 for IWLE, respectively) and there was no significant exposure-response trend (p-trend > 0.1). There was some suggestion of a possible link between paraquat exposure and NHL risk in humans, but the inconsistency in exposure level trend suggests that this could be a chance finding.	International Journal of Occupational & Environmental Health	15	3	274-81	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
1078	S. K. Park, K. A. Kong, E. S. Cha, Y. J. Lee, G. T. Lee and W. J. Lee	Occupational exposure to pesticides and nerve conduction studies among Korean farmers	2012	This study aimed to determine whether occupational exposure to pesticides was associated with decreased nerve conduction studies among farmers. On 2 separate occasions, the authors performed a cross-sectional study of a group of 31 male farmers who periodically applied pesticides. The study included questionnaire interviews and nerve conduction studies on the median, ulnar, posterior tibial, peroneal, and sural nerves. Although all mean values remained within laboratory normal limits, significant differences between the first and second tests were found in sensory conduction velocities on the median and sural nerves, and motor conduction velocities on the posterior tibial nerve. Lifetime days of pesticide application was negatively associated with nerve conduction velocities at most nerves after adjusting for potential confounders. These findings may reflect a link between occupational pesticide exposure and peripheral neurophysiologic abnormality that deserves further evaluation.	Archives of Environmental & Occupational Health	67	2	78-83	Self-reported exposure			Cross-sectional	Pesticides in general	neurological	medical test result	Korea	hic
1079	S. K. Rastogi, P. V. V. Satyanarayan, D. Ravishankar and S. Tripathi	A study on oxidative stress and antioxidant status of agricultural workers exposed to organophosphorus insecticides during spraying	2009	Oxidative stress status and Acetylcholinesterase (AChE) activity were studied in blood samples obtained from 61 agricultural workers engaged in spraying organophosphorus (OP) insecticides in the mango plantation, with a minimum work history of one year, in the age range of 12-55 years. Controls were age-matched, unexposed workers, who never had any exposure to OP pesticides. They were evaluated for oxidative stress markers MDA (end product of lipid peroxidation), reduced glutathione (GSH), and Acetylcholinesterase (AChE) and butyrylcholinesterase (BChE) levels in blood. The results showed a marked inhibition of the AChE and BChE activities in the sprayers as compared to the controls. The malondialdehyde(MDA), the last product of lipid peroxidation was found to be increased significantly in sprayers(p 0.05), while depletion in the concentration of antioxidant glutathione(GSH) was also observed in the sprayers but the difference was statistically not significant. It was concluded on the basis of biochemical analysis that pesticides sprayers are exposed to more oxidative stress as evidenced by the changes in antioxidant status. The measurement of the AChE and BChE activities in agricultural workers who spray OPs could be a good biomonitoring factor and is recommended to be performed on a regular basis.	Indian Journal of Occupational and Environmental Medicine	13	3	131-134	Biomonitoring (blood)			Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	India	lmic

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1080	S. Kab, F. Moisan and A. Elbaz	Farming and incidence of motor neuron disease: French nationwide study	2017	BACKGROUND AND PURPOSE: The association of farming with motor neuron disease (MND) is unclear, with conflicting studies. We performed a French nationwide study of the association of farming with MND incidence, and compared findings with those for Parkinson's disease (PD), which has been shown to be more frequent in farmers. METHODS: We used the French national health insurance and hospital discharge databases to identify MND/PD incident cases. The Mutualite Sociale Agricole (MSA) guarantees health insurance for farmers and agricultural workers. We compared the incidence of MND (2010-2014) and PD (2011-2012) in MSA farmers, MSA workers and non-MSA affiliates, and estimated relative risks (RRs) and 95% confidence intervals (CIs). Probabilistic sensitivity analyses were used for external smoking adjustment. RESULTS: Analyses relied on 8931 MND (MSA, 9%) and 45 409 PD (MSA,11%) cases. There was a trend towards higher MND incidence in MSA farmers compared with non-MSA affiliates (RR,1.08; 95% CI,0.99-1.18) and MSA workers (RR, 1.13; 95% CI, 0.97-1.31) that strengthened after smoking adjustment (if associated with MND). PD incidence was higher in MSA farmers than non-MSA affiliates (RR, 1.13; 95% CI, 1.08-1.17) and MSA workers (RR, 1.10; 95% CI, 1.02-1.18); this association remained after smoking adjustment (RR, 1.09; 95% CI, 1.05-1.14). CONCLUSIONS: This French nationwide study suggested an association between farming and MND, and confirmed higher PD incidence in farmers in France, a country with high pesticide use.	European Journal of Neurology	24	9	1191-1195	Registers			Cohort (prospective)	Job title	neurological	doctor-diagnosed	France	hic
1081	S. Karami, G. Andreotti, S. Koutros, K. H. Barry, L. E. Moore, S. Han, J. A. Hoppin, D. P. Sandler, J. H. Lubin, L. A. Burdette, J. Yuenger, M. Yeager, L. E. Freeman, A. Blair and M. C. Alavanja	Pesticide exposure and inherited variants in vitamin d pathway genes in relation to prostate cancer	2013	BACKGROUND: Vitamin D and its metabolites are believed to impede carcinogenesis by stimulating cell differentiation, inhibiting cell proliferation, and inducing apoptosis. Certain pesticides have been shown to deregulate vitamin D's anticarcinogenic properties. We hypothesize that certain pesticides may be linked to prostate cancer via an interaction with vitamin D genetic variants. METHODS: We evaluated interactions between 41 pesticides and 152 single-nucleotide polymorphisms (SNP) in nine vitamin D pathway genes among 776 prostate cancer cases and 1,444 male controls in a nested case-control study of Caucasian pesticide applicators within the Agricultural Health Study. We assessed Pinteraction values using likelihood ratio tests from unconditional logistic regression and a false discovery rate (FDR) to account for multiple comparisons. RESULTS: Five significant interactions (P < 0.01) displayed a monotonic increase in prostate cancer risk with individual pesticide use in one genotype and no association in the other. These interactions involved parathion and terbufos use and three vitamin D genes (VDR, RXRB, and GC). The exposure-response pattern among participants with increasing parathion use with the homozygous CC genotype for GC rs7041 compared with unexposed participants was noteworthy [low vs. no exposure: OR, 2.58, 95% confidence interval (CI), 1.07-6.25; high vs. no exposure: OR, 3.09, 95% CI, 1.10-8.68; Pinteraction = 3.8 x 10(-3)]. CONCLUSIONS: In this study, genetic variations in vitamin D pathway genes, particularly GC rs7041, an SNP previously linked to lower circulating vitamin D levels, modified pesticide associations with prostate cancer risk. IMPACT: Because our study is the first to examine this relationship, additional studies are needed to rule out chance findings.	Cancer Epidemiology, Biomarkers & Prevention	22	9	1557-66	Self-reported exposure	Algorithm/model		Case-control	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
1082	S. Karami, P. Boffetta, N. Rothman, R. J. Hung, T. Stewart, D. Zaridze, M. Navritalova, D. Mates, V. Janout, H. Kollarova, V. Bencko, N. Szeszenia-Dabrowska, I. Holcatova, A. Mukeria, J. Gromiec, S. J. Chanock, P. Brennan, W. H. Chow and L. E. Moore	Renal cell carcinoma, occupational pesticide exposure and modification by glutathione S-transferase polymorphisms	2008	This study investigated associations between occupational pesticide exposure and renal cell carcinoma (RCC) risk. To follow-up on a previous report by Buzio et al., we also considered whether this association could be modified by glutathione S-transferase M1 and T1 (GSTM1 and GSTT1) genotypes. About 1097 RCC cases and 1476 controls from Central and Eastern Europe were interviewed to collect data on lifetime occupational histories. Occupational information for jobs held for at least 12 months duration was coded for pesticide exposures and assessed for frequency and intensity of exposure. GSTM1 and GSTT1 gene deletions were analyzed using TaqMan assays. A significant increase in RCC risk was observed among subjects ever exposed to pesticides [odds ratio (OR): 1.60; 95% confidence interval (CI): 1.00-2.55]. After stratification by genotypes, increased risk was observed among exposed subjects with at least one GSTM1 active allele (OR: 4.00; 95% CI: 1.55-10.33) but not among exposed subjects with two GSTM1 inactive alleles compared with unexposed subjects with two inactive alleles (P-interaction: 0.04). Risk was highest among exposed subjects with both GSTM1 and GSTT1 active genotypes (OR: 6.47; 95% CI: 1.82-23.00; P-interaction: 0.02) compared with unexposed subjects with at least one GSTM1 or T1 inactive genotype. In the largest RCC case-control study with genotype information conducted to date, we observed that risk associated with pesticide exposure was exclusive to individuals with active GSTM1/T1 genotypes. These findings further support the hypothesis that glutathione S-transferase polymorphisms can modify RCC risk associated with occupational pesticide exposure.	Carcinogenesis	29	8	1567-71	Algorithm/model			Case-control	Pesticides in general	cancer	doctor-diagnosed	Romania/Poland/Russia/Czech Republic	SHIC
1083	S. Kenkel, C. Rolf and E. Nieschlag	Occupational risks for male fertility: an analysis of patients attending a tertiary referral centre	2001	The impact of environment and occupation on male fertility is still under debate. We investigated whether certain occupations may be over- or under-represented among men attending our infertility clinic in relation to the entire population of the area. Diagnoses and semen parameters of 2054 infertile men from the district of Munster were analysed retrospectively. The patients were categorized into 29 occupational groups. The relative size of each group was compared with that of the entire population in the district of Munster. Farmers were over-represented compared with the general population. Farmers and painters/varnishers showed a significantly higher proportion of reduced sperm counts [odds ratios (OR): 2.13 and 2.17, 95% confidence intervals: 1.18-3.88 and 1.02-4.65] and severely reduced sperm concentrations compared with the entire group of infertile men; in addition, significantly more farmers presented with a history of maldescended testes than other occupational groups (OR: 2.76 and 2.84; CI: 1.12-6.75 and 1.27-6.34). Metal workers/welders formed significantly higher proportions of patients with reduced sperm motility (OR: 5.99; CI: 1.38-26.00). The relatively poor semen parameters of the painters/varnishers could be caused by exposure to toxins. This may also apply to the farmers (fertilizers, herbicides); however, the elevated rate of maldescended testes suggests an effect of exposure during prenatal development or a genetic cause. The findings for metal workers/welders may be because of heat or toxins at the workplace. The study demonstrates that certain occupations are preferentially associated with male infertility.	International Journal of Andrology	24	6	318-26	Job title			Case-control	Job title	reproductive	medical test result	Germany	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1084	S. Koutros, G. Andreotti, S. I. Berndt, K. Hughes Barry, J. H. Lubin, J. A. Hoppin, F. Kamel, D. P. Sandler, L. A. Burdette, J. Yuenger, M. Yeager, M. C. Alavanja and L. E. Freeman	Xenobiotic-metabolizing gene variants, pesticide use, and the risk of prostate cancer	2011	BACKGROUND: To explore associations with prostate cancer and farming, it is important to investigate the relationship between pesticide use and single nucleotide polymorphisms (SNPs) in xenobiotic metabolic enzyme (XME) genes. OBJECTIVE: [corrected] We evaluated pesticide-SNP interactions between 45 pesticides and 1913 XME SNPs with respect to prostate cancer among 776 cases and 1444 controls in the Agricultural Health Study. METHODS: We used unconditional logistic regression to estimate odds ratios (ORs) and 95% confidence intervals (CIs). Multiplicative SNP-pesticide interactions were calculated using a likelihood ratio test. RESULTS: A positive monotonic interaction was observed between petroleum oil/petroleum distillate use and rs1883633 in the oxidative stress gene glutamate cysteine ligase (GCLC; P interaction=1.0x10(-4)); men carrying at least one variant allele (minor allele) experienced an increased prostate cancer risk (OR=3.7, 95% CI: 1.9-7.3). Among men carrying the variant allele for thioredoxin reductase 2 (TXNRD2) rs4485648, microsomal epoxide hydrolase 1 (EPHX1) rs17309872, or myeloperoxidase (MPO) rs11079344, an increased prostate cancer risk was observed with high, compared with no, petroleum oil/petroleum distillate (OR=1.9, 95% CI: 1.1-3.2, P interaction=0.01; OR=2.1, 95% CI: 1.1-4.0, P interaction=0.01), or terbufos (OR=3.0, 95% CI: 1.5-6.0, P interaction=2.0x10(-3)) use, respectively. No interactions were deemed noteworthy at the false discovery rate=0.20 level; the number of observed interactions in XMEs was comparable with the number expected by chance alone. CONCLUSION: We observed several pesticide-SNP interactions in oxidative stress and phase I/II enzyme genes and risk of prostate cancer. Additional work is needed to explain the joint contribution of genetic variation in XMEs, pesticide use, and prostate cancer risk.	Pharmacogenetics and Genomics	21	10	615-23	Self-reported exposure			Case-control	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
1085	S. Koutros, L. E. Beane Freeman, J. H. Lubin, S. L. Heltshe, G. Andreotti, K. H. Barry, C. T. DellaValle, J. A. Hoppin, D. P. Sandler, C. F. Lynch, A. Blair and M. C. Alavanja	Risk of total and aggressive prostate cancer and pesticide use in the Agricultural Health Study	2013	Because pesticides may operate through different mechanisms, the authors studied the risk of prostate cancer associated with specific pesticides in the Agricultural Health Study (1993-2007). With 1,962 incident cases, including 919 aggressive prostate cancers among 54,412 applicators, this is the largest study to date. Rate ratios and 95% confidence intervals were calculated by using Poisson regression to evaluate lifetime use of 48 pesticides and prostate cancer incidence. Three organophosphate insecticides were significantly associated with aggressive prostate cancer: fonofos (rate ratio (RR) for the highest quartile of exposure (Q4) vs. nonexposed = 1.63, 95% confidence interval (CI): 1.22, 2.17; P(trend) < 0.001); malathion (RR for Q4 vs. nonexposed = 1.43, 95% CI: 1.08, 1.88; P(trend) = 0.04); and terbufos (RR for Q4 vs. nonexposed = 1.29, 95% CI: 1.02, 1.64; P(trend) = 0.03). The organochlorine insecticide aldrin was also associated with increased risk of aggressive prostate cancer (RR for Q4 vs. nonexposed = 1.49, 95% CI: 1.03, 2.18; P(trend) = 0.02). This analysis has overcome several limitations of previous studies with the inclusion of a large number of cases with relevant exposure and detailed information on use of specific pesticides at 2 points in time. Furthermore, this is the first time specific pesticides are implicated as risk factors for aggressive prostate cancer.	American Journal of Epidemiology	177	1	59-74	Algorithm/model	Self-reported exposure		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
1086	S. Koutros, L. E. Beane Freeman, S. I. Berndt, G. Andreotti, J. H. Lubin, D. P. Sandler, J. A. Hoppin, K. Yu, Q. Li, L. A. Burdette, J. Yuenger, M. Yeager and M. C. Alavanja	Pesticide use modifies the association between genetic variants on chromosome 8q24 and prostate cancer	2010	Genome-wide association studies have identified 8q24 region variants as risk factors for prostate cancer. In the Agricultural Health Study, a prospective study of licensed pesticide applicators, we observed increased prostate cancer risk with specific pesticide use among those with a family history of prostate cancer. Thus, we evaluated the interaction among pesticide use, 8q24 variants, and prostate cancer risk. The authors estimated odds ratios (OR) and 95% confidence intervals (95% CI) for interactions among 211 8q24 variants, 49 pesticides, and prostate cancer risk in 776 cases and 1,444 controls. The ORs for a previously identified variant, rs4242382, and prostate cancer increased significantly (P<0.05) with exposure to the organophosphate insecticide fonofos, after correction for multiple testing, with per allele ORnonexposed of 1.17 (95% CI, 0.93-1.48), per allele OR[low] of 1.30 (95% CI, 0.75-2.27), and per allele ORhigh of 4.46 (95% CI, 2.17-9.17; P-interaction=0.002, adjusted P-interaction=0.02). A similar effect modification was observed for three other organophosphate insecticides (coumaphos, terbufos, and phorate) and one pyrethroid insecticide (permethrin). Among ever users of fonofos, subjects with three or four risk alleles at rs7837328 and rs4242382 had approximately three times the risk of prostate cancer (OR, 3.14; 95% CI, 1.41-7.00) compared with subjects who had zero risk alleles and never used fonofos. We observed a significant interaction among variants on chromosome 8q24, pesticide use, and risk of prostate cancer. Insecticides, particularly organophosphates, were the strongest modifiers of risk, although the biological mechanism is unclear. This is the first report of effect modification between 8q24 and an environmental exposure on prostate cancer risk.	Cancer Research	70	22	9224-33	Self-reported exposure			Case-control	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
1087	S. Koutros, M. C. Alavanja, J. H. Lubin, D. P. Sandler, J. A. Hoppin, C. F. Lynch, C. Knott, A. Blair and L. E. Freeman	An update of cancer incidence in the Agricultural Health Study	2010	OBJECTIVE: Our objective is to reevaluate cancer incidence among Agricultural Health Study participants. METHODS: Standardized incidence ratios (SIRs) and relative standardized ratios were calculated. RESULTS: A significant excess of prostate cancer was seen for private and commercial applicators (SIR = 1.19, 95% CI 1.14, 1.25 and SIR = 1.28, 95% CI = 1.00, 1.61, respectively). Excesses were observed for lip cancer (SIR = 1.97, 95% CI = 1.02, 3.44) and multiple myeloma (SIR = 1.42, 95% CI = 1.00, 1.95) among private applicators from North Carolina and for marginal zone lymphoma among Iowa spouses (SIR = 2.34, 95% CI = 1.21, 4.09). CONCLUSIONS: Although lower rates of smoking and increased physical activity probably contribute to the lower overall cancer incidence, agricultural exposures including pesticides, viruses, bacteria, sunlight, and other chemicals may increase risks for specific cancer sites.	Journal of Occupational & Environmental Medicine	52	11	1098-105	Self-reported exposure			Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
1088	S. Krstev, D. Baris, P. Stewart, M. Dosemeci, G. M. Swanson, R. S. Greenberg, J. B. Schoenberg, A. G. Schwartz, J. M. Liff and R. B. Hayes	Occupational risk factors and prostate cancer in U.S. blacks and whites	1998	Although prostate cancer is a major disease, causal factors are only partially understood. We examined occupational risk factors for this disease in a large case control study among U.S. blacks and whites. The study included 981 new pathologically confirmed prostate cancer cases (479 blacks and 502 whites) diagnosed between 1986 and 1989, and 1,315 population controls (594 blacks and 721 whites) who resided in Atlanta, Detroit, and 10 countries in New Jersey, covered by population-based cancer registries. Information on occupation, including a lifetime work history, was collected by in-person interview. No clear patterns of risk were found for U.S. whites versus blacks, nor for white-collar versus blue-collar jobs. Farming was related to prostate cancer (OR = 2.17; 95% CI = 1.18-3.98). Risk was restricted, however, to short-term workers and workers in crop production. Risk was not limited to those farming after 1950, when widespread use of pesticides started. Risks increased with increasing years of employment in firefighting (chi 2trend, p = 0.02) and power plant operations (chi 2trend, p = 0.03), and were elevated among long-term railroad line-haulers (OR = 5.85; 95% CI = 1.25-27.4); jobs with potential polycyclic aromatic hydrocarbon (PAH) exposures. Risk was elevated among athletes (OR = 5.38; 95% CI = 1.48-19.6). However, most of the cases were athletes before 1960, so the potential use of anabolic steroids was excluded. Although some clues about potential occupational associations were found, the overall results show that occupation is not a major determinant of prostate cancer risk.	American Journal of Industrial Medicine	34	5	421-30	Self-reported job history			Case-control	Job title	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1089	S. L. C. Farr, J.; Savitz, D. A.; Sandler, D. P.; Hoppin, J. A.; Cooper, G. S.	Pesticide exposure and timing of menopause: the Agricultural Health Study	2006	Age at menopause has implications for fertility and risk of hormonally related chronic diseases. Some pesticides disrupt reproductive hormones or are toxic to the ovary, but little is known about the association between pesticide exposure and timing of menopause. Cox proportional hazards modeling was used to examine the association between use of pesticides and age at menopause among 8,038 women living and working on farms in Iowa and North Carolina. Premenopausal women aged 35-55 years were followed from enrollment (1993-1997) to the date of their last menstrual period, or their follow-up interview (1999-2003) if still premenopausal. Women who experienced surgical menopause were censored at the date of surgery. Approximately 62% of the women reported ever mixing or applying pesticides; women who had never used pesticides were the comparison group for all analyses. After control for age, smoking status, and past use of oral contraceptives, the median time to menopause increased by approximately 3 months for women who used pesticides (hazard ratio = 0.87, 95% confidence interval: 0.78, 0.97) and by approximately 5 months for women who used hormonally active pesticides (hazard ratio = 0.77, 95% confidence interval: 0.65, 0.92). Pesticide use may be associated with a later age at menopause.	American Journal of Epidemiology	163	8	731-42	Self-reported exposure			Cohort (prospective)	Pesticides in general	reproductive	self-reported	USA	hic
1090	S. L. Farr, G. S. Cooper, J. Cai, D. A. Savitz and D. P. Sandler	Pesticide use and menstrual cycle characteristics among premenopausal women in the Agricultural Health Study	2004	Menstrual cycle characteristics may have implications for women's fecundability and risk of hormonally related diseases. Certain pesticides disrupt the estrous cycle in animals. The authors investigated the cross-sectional association between pesticide use and menstrual function among 3,103 women living on farms in Iowa and North Carolina. Women were aged 21-40 years, premenopausal, not pregnant or breastfeeding, and not taking oral contraceptives. At study enrollment (1993-1997), women completed two self-administered questionnaires on pesticide use and reproductive health. Exposures of interest were lifetime use of any pesticide and hormonally active pesticides. Menstrual cycle characteristics of interest included cycle length, missed periods, and intermenstrual bleeding. The authors used generalized estimating equations to assess the association between pesticide use and menstrual cycle characteristics, controlling for age, body mass index, and current smoking status. Women who used pesticides experienced longer menstrual cycles and increased odds of missed periods (odds ratio = 1.5, 95% confidence interval: 1.2, 1.9) compared with women who never used pesticides. Women who used probable hormonally active pesticides had a 60-100% increased odds of experiencing long cycles, missed periods, and intermenstrual bleeding compared with women who had never used pesticides. Associations remained after control for occupational physical activity.	American Journal of Epidemiology	160	12	1194-204	Self-reported exposure			Cross-sectional	Specific active ingredient	reproductive	self-reported	USA	hic
1091	S. L. Pastor, L.; Gutierrez, S.; Durban, R.; Gomez, C.; Parron, T.; Creus, A.; Marcos, R.	A follow-up study on micronucleus frequency in Spanish agricultural workers exposed to pesticides	2002	To determine whether occupational exposure to a complex mixture of pesticides results in a significant increase in the level of cytogenetic damage, a follow-up study was planned on 39 greenhouse workers from Almeria (southeastern Spain). Taking into account that pesticide exposure can be season-related, two blood samples were taken from each individual at different times: one in a period of high exposure (sample A, spring-summer) and the other in a period of lower exposure (sample B, autumn-winter). Using the cytokinesis block micronucleus technique the frequency of binucleated cells with micronuclei (BNMN) and the cytokinesis blocked proliferation index (CBPI) were determined in peripheral blood lymphocytes. The results obtained indicate that there were no statistically significant differences in BNMN frequencies between the two sampling periods nor between exposed and controls. ANCOVA analysis of repeated measures revealed that the age of the individuals showed a direct relation with BNMN in the first study period. With regard to CBPI, a significant and season-related effect was found.	Mutagenesis	17	1	79-82	Job title			Cohort (prospective)	Job title	genetic (biomarkers)	medical test result	Spain	hic
1092	S. L. Roulland, P.; Lecluse, Y.; Briand, M.; Pottier, D.; Gauduchon, P.	Characterization of the t(14;18) BCL2-IGH translocation in farmers occupationally exposed to pesticides	2004	Increasing incidence of non-Hodgkin's lymphoma have been associated repeatedly with farming occupation and particular attention focused on the role of pesticide exposure to potentially explain part of this trend. A genetic hallmark of non-Hodgkin's lymphoma is the presence of recurrent chromosomal translocations involving the immunoglobulin heavy chain gene. Of these, the t(14;18), which deregulates BCL2 expression and inhibits apoptosis, is the most frequent in follicular lymphoma and has been detected consistently in peripheral blood lymphocytes of healthy individuals. As BCL2-IGH translocation represents an early step of the malignant process, we evaluated the occurrence and molecular characteristics of BCL2-IGH translocation in 56 individuals occupationally exposed to pesticides in open field farming They were selected from a representative cohort of farmers with a well-defined assessment of pesticide exposure taking into account potential confounding factors, smoking, sunlight, and age. Our results suggest that occupational exposure to pesticides would increase BCL2-IGH prevalence together with the frequency of BCL2-IGH-bearing cells especially during the high pesticide use period. Distribution of BCL2 or IGH breakpoint positions seemed to be independent of pesticide exposure and was similar to those found in other healthy populations or lymphoma patients. Finally, these results provide additional evidence that BCL2-IGH translocation measurements could be a measure of acquired genetic instability in relation to genotoxic exposure in a gene directly relevant in term of lymphomagenesis.	Cancer Research	64	6	133194	Self-reported exposure			NA	Pesticides in general	cancer	doctor-diagnosed	France	hic
1093	S. L. Sanoff, L. Callejas, C. D. Alonso, Y. Hu, R. E. Colindres, H. Chin, D. R. Morgan and S. L. Hogan	Positive association of renal insufficiency with agriculture employment and unregulated alcohol consumption in Nicaragua	2010	BACKGROUND AND OBJECTIVES: Endemic renal insufficiency (RI) of unknown etiology is a major public health issue with high mortality in the Pacific coastal regions of Central America. We studied RI in Leon and Chinandega, Nicaragua, evaluating associations with known risk factors and hypothesized exposures. METHODS: A cross-sectional survey was conducted with assessment of medical, social, and occupational history and exposures in conjunction with measurement of serum creatinine. Cases were defined by an estimated glomerular filtration rate (eGFR) <or=60 mL/min/1.73 m(2) using the modified four-variable Modification of Diet in Renal Disease (MDRD) study equation for non-African Americans. Logistic regression models controlling for known risk factors of kidney disease were used to evaluate associations between exposures and RI. RESULTS: A total of 124 RI cases were compared to 873 persons without RI. Cases had no significant differences in the odds of having a systolic blood pressure (SBP) > 140 or diastolic blood pressure (DBP) > 90 mmHg, or in reporting diabetes. Agricultural labor was associated with RI (OR = 2.48, 95%CI: 1.59, 3.89, p < 0.0001). There was no association with agricultural non-field work (OR = 0.91, 95%CI: 0.60, 1.38, p = 0.65). Consumption of unregulated alcohol ("lija") was associated with RI (OR = 2.10, 95%CI: 1.31, 3.39, p = 0.0023), as was drinking 5 L or more of water per day (OR = 3.59 vs. 1 L 95%CI: 1.52, 4.46, p = 0.0035). CONCLUSIONS: Agricultural field labor and lija consumption were associated with RI in this region. Water intake may also be important. Identifying specific risk factors for RI within these exposures, such as individual pesticides or lija ingredients, may facilitate prevention in a setting where dialysis and transplantation are limited.	Renal Failure	32	7	766-77	Biomonitoring (blood)	Self-reported exposure		Cross-sectional	Type of pesticide	genitourinary	doctor-diagnosed	Nicaragua	lmic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1094	S. L. Tyas, J. Manfreda, L. A. Strain and P. R. Montgomery	Risk factors for Alzheimer's disease: a population-based, longitudinal study in Manitoba, Canada	2001	BACKGROUND: Current knowledge of risk factors for Alzheimer's disease (AD) is limited. Data from a longitudinal, population-based study of dementia in Manitoba, Canada were used to investigate risk factors for AD.	NA	NA	NA	NA	Self-reported exposure			Cohort (prospective)	Type of pesticide	neurological	doctor-diagnosed	Canada	hic
1095	S. Lin, E. G. Marshall and G. K. Davidson	Potential parental exposure to pesticides and limb reduction defects	1994	OBJECTIVES: The goal of the study was to examine the effects of the potential pesticide exposure of parents on the risk of limb reduction defects in their offspring. METHODS: A case-referent study was conducted utilizing New York State Congenital Malformation Register data. Persons with limb reduction defects and referents were compared in terms of parental occupations and residence counties. Parental occupations and industries reported on birth certificates were qualitatively rated by industrial hygienists to estimate potential pesticide (list four groups) exposures. Residential exposures were estimated from agricultural census data according to county of residence. RESULTS: Neither parental exposure to pesticides [odds ratio (OR) 0.9, 95% confidence interval (95% CI) 0.6-1.4] nor farming occupation (OR 1.1, 95% CI 0.5-2.7) had an effect on the risk of total limb reduction defects. Those persons with limb reduction defects who had additional defects showed weak but consistent elevated risks in relation to parental occupational pesticide exposure. However, isolated cases of limb reduction defects were negatively related to these exposures. Residence in a farming or high pesticide use county was not associated with any type of limb reduction defect. CONCLUSIONS: Cases of limb reduction defect with additional malformations appear to be associated with parental occupational pesticide exposure. Improving exposure classifications and subdividing the limb reduction defects by types in the analyses are suggested for future research.	Scandinavian Journal of Work, Environment & Health	20	3	166-79	Expert case-by-case assessment	Self-reported job history		Case-control	Pesticides in general	offspring	doctor-diagnosed	USA	hic
1096	S. M. Brega, I. Vassilieff, A. Almeida, A. Mercadante, D. Bissacot, P. R. Cury and D. V. Freire-Maia	Clinical, cytogenetic and toxicological studies in rural workers exposed to pesticides in Botucatu, Sao Paulo, Brazil	1998	Pesticides can cause gene mutations and chromosomal aberrations in exposed individuals. We have investigated 24 workers exposed to pesticides. Clinical examinations and cytogenetic and toxicological tests were performed. Ten non-exposed individuals were used as controls. Toxicological dosages of copper, zinc and manganese (metals found in some pesticides), hepatic enzyme dosage (GOT, GPT, AR) and acetylcholinesterase activity were performed in 16 workers and 8 controls. In the exposed workers, the most relevant clinical symptoms were poor digestion with fullness sensation after meals, irritated eyes, headache and fasciculations. The exposed group showed significantly lower manganese dosage and acetylcholinesterase activity, and significantly higher levels of alkaline phosphatase. Cytogenetic studies showed significantly higher chromosomal aberrations in the exposed group compared to the control group. Although the workers used protection against the pesticide's fog, the results revealed that the workers were contaminated with the pesticides. Therefore, the cytogenetic, toxicological studies with clinical examination are necessary for monitoring workers who are exposed to pesticides in any situation.	Cadernos de Saude Publica	14	NA	109-15	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Brazil	umic
1097	S. M. D. Alif, S. C.; Benke, G.; Dennekamp, M.; Burgess, J. A.; Perret, J. L.; Lodge, C. J.; Morrison, S.; Johns, D. P.; Giles, G. G.; Gurrin, L. C.; Thomas, P. S.; Hopper, J. L.; Wood-Baker, R.; Thompson, B. R.; Feather, I. H.; Vermeulen, R.; Kromhout, H.; Walters, E. H.; Abramson, M. J.; Matheson, M. C.	Occupational exposure to pesticides are associated with fixed airflow obstruction in middle-age	2017	RATIONALE: Population-based studies have found evidence of a relationship between occupational exposures and Chronic Obstructive Pulmonary Disease (COPD), but these studies are limited by the use of prebronchodilator spirometry. Establishing this link using postbronchodilator is critical, because occupational exposures are a modifiable risk factor for COPD. OBJECTIVES: To investigate the associations between occupational exposures and fixed airflow obstruction using postbronchodilator spirometry. METHODS: One thousand three hundred and thirty-five participants were included from 2002 to 2008 follow-up of the Tasmanian Longitudinal Health Study (TAHS). Spirometry was performed and lifetime work history calendars were used to collect occupational history. ALOHA plus Job Exposure Matrix was used to assign occupational exposure, and defined as ever exposed and cumulative exposure unit (EU)-years. Fixed airflow obstruction was defined by postbronchodilator FEV₁/FVC <0.7and the lower limit of normal (LLN). Multinomial logistic regressions were used to investigate potential associations while controlling for possible confounders. RESULTS: Ever exposure to biological dust (relative risk (RR)=1.58, 95%CI 1.01 to 2.48), pesticides (RR=1.74,95%CI 1.00 to 3.07) and herbicides (RR=2.09,95%CI 1.18 to 3.70) were associated with fixed airflow obstruction. Cumulative EU-years to all pesticides (RR=1.11,95%CI 1.00 to 1.25) and herbicides (RR=1.15,95%CI 1.00 to 1.32) were also associated with fixed airflow obstruction. In addition, all pesticides exposure was consistently associated with chronic bronchitis and symptoms that are consistent with airflow obstruction. Ever exposure to mineral dust, gases/fumes and vapours, gases, dust or fumes were only associated with fixed airflow obstruction in non-asthmatics only. CONCLUSIONS: Pesticides and herbicides exposures were associated with fixed airflow obstruction and chronic bronchitis. Biological dust exposure was also associated with fixed airflow obstruction in non-asthmatics. Minimising occupational exposure to these agents may help to reduce the burden of COPD.	Thorax	72	11	990-997	Job exposure matrix			Cohort (prospective)	Chemical class	respiratory	medical test result	Australia	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1098	S. M. Dyer, M. Cattani, D. L. Pisaniello, F. M. Williams and J. W. Edwards	Peripheral cholinesterase inhibition by occupational chlorpyrifos exposure in Australian termiticide applicators	2001	Occupational exposure to organophosphorus insecticides (OPs), such as chlorpyrifos, may be monitored by the measurement of the activity of peripheral cholinesterase (ChE) enzymes, including erythrocyte acetylcholinesterase (EAChE) and serum cholinesterase (SChE). Lymphocyte neuropathy target esterase (NTE) is thought to have potential as a predictor of organophosphate-induced delayed neuropathy (OPIDN). This paper describes work performed in 39 Australian pest control operators (PCOs) exposed to a termiticide containing chlorpyrifos, and 34 unexposed control subjects. EAChE activities in PCOs did not differ from those of unexposed control workers. Mean NTE activity was slightly higher in PCOs than in controls and mean SChE was 52% of control activity. These results indicate that exposure of Australian PCOs to termiticides containing chlorpyrifos may be monitored using SChE but not EAChE or NTE, and that workers in this industry have sufficiently high OP exposure to significantly depress SChE activity. SChE inhibition of 70-80% may be associated with symptoms. Although no current symptoms were reported to be associated with occupational OP exposure, these workers may be at increased risk of acute effects following inadvertent spills or self-contamination due to their background level of exposure to OPs. While it is preferable to compare ChE enzyme activities between pre- and post-exposure periods to evaluate OP-related effects in individuals, in some cases there is an absence of pre-exposure data. The results of this study suggest that a screening value for SChE of 550 nmol/min/ml in a single blood sample may be useful to identify potentially OP-exposed individuals in the Australian population. Australian control subjects were similar with respect to EAChE, but displayed activities of NTE and SChE approximately 50 and 23% lower than an unexposed UK reference group. While these comparisons are presently speculative, they suggest that there may be differences in SChE and NTE activities in control populations of the two countries. The routine treatment of Australian homes with termiticides containing OPs, or differences in the availability and use of domestic OP-containing insecticides may explain these population differences. Further work is required to examine whether these differences are real, and if so their likely cause.	Toxicology	169	3	177-85	Biomonitoring (blood)			Cross-sectional	Chemical class	neurological	medical test result	Australia	hic
1099	S. M. Goldman, F. Kamel, C. Meng, M. Korell, D. M. Umbach, J. Hoppin, G. W. Ross, C. Marras, M. Kasten, A. Chade, K. Comyns, D. Sandler, A. Blair and C. M. Tanner	Rotenone and Parkinson's disease (PD): Effect modification by membrane transporter variants	2016	Objective: Determine whether variants in the xenobiotic efflux membrane transporter p-glycoprotein gene (ABCB1, p-gp, MDR1) modify the association of rotenone and PD. Background: Use of the insecticide rotenone has been associated with increased risk of PD (Tanner et al, 2011). A recent report identified rotenone as a substrate of the p-glycoprotein membrane efflux transporter (Lacher et al, 2015). We hypothesized that common ABCB1 variants might modify the association of rotenone and PD. Methods: We recruited people with PD (PwPD) and age-, genderand state-matched controls from the Agricultural Health Study, a cohort of pesticide applicators and their spouses. PD was confirmed by expert consensus. We genotyped single nucleotide polymorphisms (SNPs) in ABCB1 using an Illumina custom array. Prior use of rotenone was determined by questionnaire. For each SNP, we calculated odds ratios (ORs) and 95% confidence intervals (CI) associated with rotenone use using logistic regression adjusting for matching factors and smoking. We assessed multiplicative effect-measure modification by including a genotype x rotenone product term. Results: Genotype and exposure data were available for 93 PwPD and 346 controls. We analyzed 10 ABCB1 SNPs with minor allele frequencies >10% and call rates>95%. 50 subjects endorsed prior use of rotenone. As previously reported, rotenone use was associated with increased risk of PD (OR 2.7, 95%CI 1.4-5.1). Several ABCB1 variants modified this association (Table). Rotenone use was associated with a 5.9-fold increased risk in those with rs1989830 CC genotype, but a nonsignificant 1.9-fold increased risk in those with CT or TT genotype (pinteraction 0.07). Other SNPs similarly modified the association of PD and rotenone, including rs1202172, rs1128503, rs9282564 and rs998671. Differences were particularly evident among men. Conclusions: The association between rotenone and PD differed among variants in the ABCB1 efflux-transporter gene, suggesting a gene-environment interaction. Although statistical power is modest, this finding is consistent with the observation that rotenone may be a p-glycoprotein substrate, and adds to mounting evidence of genetically determined xenobiotic susceptibility in PD etiology. (Table Presented).	Movement Disorders	31	NA	S148-S149	Self-reported exposure			Case-control	Specific active ingredient	neurological	doctor-diagnosed	USA	hic
1100	S. M. Goldman, F. Kamel, G. W. Ross, G. S. Bhudhikanok, J. A. Hoppin, M. Korell, C. Marras, C. Meng, D. M. Umbach, M. Kasten, A. R. Chade, K. Comyns, M. B. Richards, D. P. Sandler, A. Blair, J. W. Langston and C. M. Tanner	Genetic modification of the association of paraquat and Parkinson's disease	2012	Paraquat is one of the most widely used herbicides worldwide. It produces a Parkinson's disease (PD) model in rodents through redox cycling and oxidative stress (OS) and is associated with PD risk in humans. Glutathione transferases provide cellular protection against OS and could potentially modulate paraquat toxicity. We investigated PD risk associated with paraquat use in individuals with homozygous deletions of the genes encoding glutathione S-transferase M1 (GSTM1) or T1 (GSTT1). Eighty-seven PD subjects and 343 matched controls were recruited from the Agricultural Health Study, a study of licensed pesticide applicators and spouses in Iowa and North Carolina. PD was confirmed by in-person examination. Paraquat use and covariates were determined by interview. We genotyped subjects for homozygous deletions of GSTM1 (GSTM1*0) and GSTT1 (GSTT1*0) and tested interaction between paraquat use and genotype using logistic regression. Two hundred and twenty-three (52%) subjects had GSTM1*0, 95 (22%) had GSTT1*0, and 73 (17%; all men) used paraquat. After adjustment for potential confounders, there was no interaction with GSTM1. In contrast, GSTT1 genotype significantly modified the association between paraquat and PD. In men with functional GSTT1, the odds ratio (OR) for association of PD with paraquat use was 1.5 (95% confidence interval [CI]: 0.6-3.6); in men with GSTT1*0, the OR was 11.1 (95% CI: 3.0-44.6; P interaction: 0.027). Although replication is needed, our results suggest that PD risk from paraquat exposure might be particularly high in individuals lacking GSTT1. GSTT1*0 is common and could potentially identify a large subpopulation at high risk of PD from oxidative stressors such as paraquat.	Movement Disorders	27	13	1652-8	Self-reported exposure	Algorithm/model		Case-control	Specific active ingredient	neurological	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1101	S. M. Jones, A. W. Burks, H. J. Spencer, S. Lensing, P. K. Roberson, J. Gandy and R. M. Helm	Occupational asthma symptoms and respiratory function among aerial pesticide applicators	2003	BACKGROUND: Pesticide exposure has been suggested as one causal factor for the rise in asthma prevalence. The goal of this investigation was to determine the effect of pesticide exposure on respiratory symptoms and lung function in workers with occupational exposure to pesticides. METHODS: A prospective, case-controlled study was conducted among pesticide aviators (AV) and community controls (Con). In Phase I, subjects completed an asthma survey and baseline spirometry. In Phase II, subjects reported symptoms, lung function monitoring, and pesticide exposure during two, 14-day periods. RESULTS: Phase I-Self-reported asthma and symptoms were similar among AV (n = 135) and Con (n = 118) with 4-6% prevalence reported but with higher rates among smokers. Baseline lung function was similar; although, a higher proportion of AV had forced expiratory volume in one second (FEV(1)) <80% predicted (8% vs. 2%, P = 0.02). Phase II-Self-reported symptoms were similar with 80% of AV (n = 50) and 73% of Con (n = 49) reporting no symptoms. Only 4% of AV and 6% of controls reported increased symptoms from baseline to spray season. Serial lung function did not differ between group and mean diurnal variation in peak expiratory flow improved in both groups between sampling times (AV 18% vs. 14%; Con 19% vs. 16%, P < 0.001). CONCLUSIONS: This study suggests that among workers with occupational pesticide exposure, asthma symptoms and lung function are similar to those of controls with only community-based exposure.	American Journal of Industrial Medicine	43	4	407-17	Self-reported exposure			Case-control	Pesticides in general	NA	NA	NA	NA
1102	S. M. Koutros, R.; Zheng, T.; Hoppin, J. A.; Ma, X.; Lynch, C. F.; Blair, A.; Alavanja, M. C.	Dichlorvos exposure and human cancer risk: results from the Agricultural Health Study	2008	OBJECTIVES: We evaluated cancer risk from DDVP (2,2-Dichloroethenyl dimethylphosphate) exposure among pesticide applicators enrolled in the Agricultural Health Study (AHS) cohort. METHODS: The AHS is a cohort of 57,311 pesticide applicators in North Carolina and Iowa, enrolled from 1993 to 1997 and followed for cancer through 2004. A comprehensive questionnaire collected information on exposure to DDVP and potential confounders. Among the 49,762 licensed pesticide applicators eligible for analysis, 4,613 reported use of DDVP. DDVP exposure was classified as intensity-weighted cumulative exposure days (IWED), calculated as [years of use x days per year x intensity level]. Poisson regression analysis was used to calculate rate ratios (RR) and 95% confidence intervals (CI) to evaluate the association of DDVP exposure among 2,943 incident cases of cancer. RESULTS: DDVP exposure was not associated with any cancer studied here. We observed no elevation in risk among lymphohematopoietic cancers, RR = 1.00 (95% CI 0.51, 1.96) and a small excess risk associated with exposure among those with a family history of prostate cancer (RR = 1.18 (95% CI 0.73, 1.82). CONCLUSION: We find little evidence of an association between cumulative lifetime use of DDVP and risk of any cancer at this stage of follow up of the AHS.	Cancer Causes & Control	19	1	59-65	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
1103	S. M. Lynch, J. A. Rusiecki, A. Blair, M. Dosemeci, J. Lubin, D. Sandler, J. A. Hoppin, C. F. Lynch and M. C. Alavanja	Cancer incidence among pesticide applicators exposed to cyanazine in the agricultural health study	2006	BACKGROUND: Cyanazine is a common pesticide used frequently in the United States during the 1980s and 1990s. Animal and human studies have suggested that triazines may be carcinogenic, but results have been mixed. We evaluated cancer incidence in cyanazine-exposed pesticide applicators among the 57,311 licensed pesticide applicators in the Agricultural Health Study (AHS). METHODS: We obtained detailed pesticide exposure information from a self-administered questionnaire completed at enrollment (1993-1997). Cancer incidence was followed through January 2002. Over half of cyanazine-exposed applicators had >or=6 years of exposure at enrollment, and approximately 85% had begun using cyanazine before the 1990s. We used adjusted Poisson regression to calculate rate ratios (RRs) and 95% confidence intervals (CIs) of multiple cancer sites among cyanazine-exposed applicators. We calculated ptrend values, and all statistical tests were two-sided. Two exposure metrics were used: tertiles of lifetime days of exposure (LD) and intensity-weighted LD. RESULTS: A total of 20,824 cancer-free AHS applicators reported ever using cyanazine at enrollment. Cancer incidence comparisons between applicators with the lowest cyanazine exposure and those with the highest exposure yielded the following for the LD metric: all cancers, RR=0.99 (95% CI, 0.80-1.24); prostate cancer, RR=1.23 (95% CI, 0.87-1.70); all lymphohematopoietic cancers, RR=0.92 (95% CI, 0.50-1.72); non-Hodgkin lymphoma, RR=1.25 (95% CI, 0.47-3.35); lung cancer, RR=0.52 (95% CI, 0.22-1.25). CONCLUSIONS: We did not find any clear, consistent associations between cyanazine exposure and any cancer analyzed. The number of sites was small for certain cancers, limiting any conclusion with regard to ovarian, breast, and some other cancers.	Environmental Health Perspectives	114	8	1248-52	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
1104	S. M. M. Lynch, R.; Beane Freeman, L. E.; Hoppin, J. A.; Alavanja, M. C.	Cancer incidence among pesticide applicators exposed to butylate in the Agricultural Health Study (AHS)	2009	Although limited, epidemiologic studies suggest possible associations between butylate use and cancer risk, specifically prostate cancer and non-Hodgkin lymphoma (NHL). We examined butylate use and cancer risk more broadly in the AHS, a cohort of licensed pesticide applicators in Iowa and North Carolina. Pesticide use information was collected using self-administered questionnaires. Poisson regression was used to calculate rate ratios (RR) and 95% confidence intervals (CI). Two exposure metrics were used: lifetime exposure days (LD) and intensity-weighted lifetime exposure days (IWLD). We used two referent groups: unexposed to butylate and the lowest butylate usage category. This analysis included 19,655 applicators with complete butylate use information; 5297 applicators were exposed to butylate, making this the largest study of butylate to date. The mean follow-up time since enrollment was 9 years. Prostate cancer risk was significantly elevated among applicators in the highest LD category in both referent groups (low-exposed referent: RR(LD)=2.09, 95% CI=1.27-3.44). We observed a significantly elevated joint effect of prostate cancer family history and high butylate usage across both exposure metrics and both referent groups (low-exposed referent: RR(LD)=2.00, 95% CI=1.07-3.74), and a non-significant, elevated interaction between butylate use and prostate cancer family history, similar to a previous AHS finding. Statistically significant increased risks and exposure-response trends were seen for all lymphohematopoietic cancers (AL) and NHL for both exposure metrics and referent groups (low-exposed referent: AL:RR(LD)=2.27, 95% CI=1.18-4.37; NHL: RR(LD)=3.44, 95% CI=1.29-9.21). Our analysis did not find meaningful associations for other cancers analyzed. Further study is warranted for AL, NHL and prostate cancers.	Environmental Research	109	7	860-8	Algorithm/model	Self-reported exposure		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1105	S. M. Pettigrew, E. M. Bell, A. R. Van Zutphen, C. M. Rocheleau, G. M. Shaw, P. A. Romitti, A. Olshan, P. J. Lupo, A. Soim, J. A. Makelarski, A. M. Michalski, W. Sanderson and S. and the National Birth Defects Prevention	Paternal and joint parental occupational pesticide exposure and spina bifida in the National Birth Defects Prevention Study, 1997 to 2002	2016	BACKGROUND: Because of persistent concerns over the association between pesticides and spina bifida, we examined the role of paternal and combined parental occupational pesticide exposures in spina bifida in offspring using data from a large population-based study of birth defects. METHODS: Occupational information from fathers of 291 spina bifida cases and 2745 unaffected live born control infants with estimated dates of delivery from 1997 to 2002 were collected by means of maternal report. Two expert industrial hygienists estimated exposure intensity and frequency to insecticides, herbicides, and fungicides. Multivariable logistic regression models were used to estimate adjusted odds ratios (aOR) and 95% confidence intervals (CI) for exposure to any pesticide and to any class of pesticide (yes/no; and by median), and exposure to combinations of pesticides (yes/no) and risk of spina bifida. Adjusted odds ratios were also estimated by parent exposed to pesticides (neither, mother only, father only, both parents). RESULTS: Joint parental occupational pesticide exposure was positively associated with spina bifida (aOR, 1.5; 95% CI, 0.9-2.4) when compared with infants with neither maternal nor paternal exposures; a similar association was not observed when only one parent was exposed. There was a suggested positive association between combined paternal insecticide and fungicide exposures and spina bifida (aOR, 1.5; 95% CI, 0.8-2.8), however, nearly all other aORs were close to unity. CONCLUSION: Overall, there was little evidence paternal occupational pesticide exposure was associated with spina bifida. However, the small numbers make it difficult to precisely evaluate the role of pesticide classes, individually and in combination. Birth Defects Research (Part A) 106:963-971, 2016. <U+00AC><U+00A9> 2016 Wiley Periodicals, Inc.	Birth Defects Research	106	11	963-971	Self-reported job history	Expert case-by-case assessment		Case-control	Job title	offspring	doctor-diagnosed	USA	hic
1106	S. M. Piperakis, E. Petrakou, S. Tsilimigaki, M. Sagnou, E. Monogiudis, G. Haniotakis, H. Karkaseli and E. Sarikaki	Biomonitoring with the comet assay of Greek greenhouse workers exposed to pesticides	2003	The pesticides in use in Greek greenhouses include a number of agents known to be mutagens and carcinogens. In the present study, we evaluated whether occupational exposure of agricultural workers to a complex mixture of pesticides resulted in a significant increase in DNA damage in human peripheral blood lymphocytes (PBLs). A total of 116 healthy individuals were divided into groups based on exposure to pesticides, smoking status, and gender. Alkaline comet assays performed on PBLs from these individuals indicated no statistically significant differences in basal DNA damage between the study groups. In addition, exposure of PBLs to a dose of hydrogen peroxide led to a similar degree of DNA damage and subsequent repair for all the study populations. The results of the study indicate that the agricultural workers who participated in this study had no detectable increase in DNA damage or alteration in the cellular response to DNA damage.	Environmental & Molecular Mutagenesis	41	2	104-10	Registers			Cohort (prospective)	Specific active ingredient	genetic (biomarkers)	medical test result	Greece	hic
1107	S. M. Piperakis, K. Kontogianni, C. Siffel and M. M. Piperakis	Measuring the effects of pesticides on occupationally exposed humans with the comet assay	2006	In this study we examine the effects of a mixture of pesticides on occupationally exposed agricultural workers. The study was performed on 149 people, 84 agricultural workers and 65 healthy men from the same area, who served as the control group. The exposed group was divided into a subgroup with 65 individuals moderately exposed (39 men and 26 women) and a highly exposed subgroup consisted of 19 men. The statistical analysis of the comet assay results showed that there were no significant differences in basal DNA damage between pesticide-exposed workers and the control group nor between moderately and highly exposed ones. In addition, exposure of peripheral blood lymphocytes to hydrogen peroxide or gamma-irradiation led to a similar degree of DNA damage and subsequent repair for all the studied populations.	Environmental Toxicology	21	4	355-9	Expert case-by-case assessment	Biomonitoring (blood)		Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	USA	hic
1108	S. M. Piperakis, K. Kontogianni, G. Karanastasi, C. Siffel, A. Cebulska-Wasilewska, R. Markos, Z. Iakovidou-Kritsi and M. M. Piperakis	Effects of pesticides on exposed populations from four European countries	2008	The potential genetic hazard of pesticides to humans is of great concern, in particular in occupational and environmental settings because of their widespread use for domestic and industrial applications. In the present study the genotoxic potentials of commonly applied pesticides have been evaluated using the single cell gel electrophoresis (comet assay). This method was used to quantify the level of DNA damage in lymphocytes of farmers who were occupationally exposed to pesticides. Particularly, we measured the amount of DNA damage in isolated human peripheral lymphocytes from agricultural workers from Spain, Hungary, Poland and Greece in comparison to healthy men from the same areas who had no previous occupational exposure to pesticides. All results indicated no statistically significant differences in basal DNA damage between our study groups. In addition, exposure of peripheral blood lymphocytes to hydrogen peroxide or <U+0152><U+2265>-irradiation led to a similar degree of additional DNA damage and subsequent repair for all our studied populations. In conclusion the greenhouse workers who participated in this study had no detectable increased DNA damage or alteration in their cellular response to DNA damage from our control populations. <U+00AC><U+00A9>PHARMAKON-Press.	Review of Clinical Pharmacology and Pharmacokinetics, International Edition	22	2	291-293	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	NA	NA
1109	S. M. Piperakis, K. Kontogianni, G. Karanastasi, Z. Iakovidou-Kritsi, A. Cebulska-Wasilewska and M. M. Piperakis	Investigation of the genotoxic effect of pesticides on greenhouse workers' lymphocytes	2009	In the present study, the genotoxic effects of commonly applied pesticides were evaluated using the alkaline comet assay (pH > 13). The amount of DNA damage (% DNA in tail) in peripheral lymphocytes of 49 male agricultural workers from Southern Poland were measured and compared to 50 men from the same area who had no previous occupational exposure to pesticides. No statistically significant differences in basal DNA damage were found between the study groups. In addition, exposure of peripheral blood lymphocytes to hydrogen peroxide (100 and 150 microM) or gamma-irradiation (2.5 or 4.2 Gy) led to a similar degree of additional DNA damage and subsequent repair (for 2 hr) for all studied populations. In conclusion, our results indicate that the greenhouse workers who participated in this study had no detectable increased DNA damage or alteration in their cellular response to DNA damage in comparison to our control population.	Environmental & Molecular Mutagenesis	50	2	121-6	Self-reported exposure			Cohort (prospective)	Pesticides in general	genetic (biomarkers)	medical test result	Poland	hic
1110	S. N. Kelada, H. Checkoway, S. L. Kardia, C. S. Carlson, P. Costa-Mallen, D. L. Eaton, J. Firestone, K. M. Powers, P. D. Swanson, G. M. Franklin, W. T. Longstreth, Jr., T. S. Weller, Z. Afsharinejad and L. G. Costa	5' and 3' region variability in the dopamine transporter gene (SLC6A3), pesticide exposure and Parkinson's disease risk: a hypothesis-generating study	2006	The dopamine transporter gene (SLC6A3) is a candidate gene for Parkinson's disease (PD) on the basis of its critical role in dopaminergic neurotransmission. Previously, we identified 22 SNPs in the 5' region of SLC6A3, which segregate as eight haplotypes that differ in transcriptional activity when transfected in rat dopamine-producing cells. In the present work from a case-control study size of 293 cases and 395 controls, we employed a cladistic approach to examine gene-disease association. First, we found strong evidence of balancing selection in this region, as determined by a Tajima's D statistic of 2.97 (P<0.001). Second, we found that the eight haplotypes fit into two main clades and that diplotypes of these clades were marginally associated with PD. Then, after we classified cases and controls by the number of risk alleles, accounting for the well-known 3' region VNTR polymorphism, we found that having two or more risk alleles resulted in a modest but significant increase in PD risk [odds ratio=1.58; 95% confidence interval (CI): 1.03-2.40]. Finally, we detected a significant interaction between occupational pesticide exposure in men and the number of risk alleles. Among pesticide-exposed subjects, the odds ratio for having two or more risk alleles was 5.66 (95% CI: 1.73-18.53). Thus, allelic variants in SLC6A3, which affect gene expression, are associated with PD in this population and may interact with occupational pesticide exposure to increase PD risk.	Human Molecular Genetics	15	20	3055-62	Job title			Case-control	Job title	neurological	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1111	S. Naidoo, L. London, A. Burdorf, R. N. Naidoo and H. Kromhout	Occupational activities associated with a reported history of malaria among women working in small-scale agriculture in South Africa	2011	Malaria-endemic agricultural communities are at risk for this disease because of crop and agricultural activities. A cross-sectional survey among women in small-scale agriculture on irrigated and dryland areas in Makhatini Flats, KwaZulu-Natal South Africa explored associations with self-reported history of malaria, including demographics, crop production, and specific agricultural activities. Ninety-eight (15.2%) of 644 women reported malaria while working in agriculture. More women working in drylands than women working in irrigation scheme reported disease (18.4% versus 10.9%; P < 0.05). Working self or family-owned farms (prevalence ratio [PR] = 2.6, 95% confidence interval [CI] = 1.3-5.2), spraying pesticides (PR = 2.3; 95% CI = 1.4-3.8), cultivating sugar cane (PR = 1.6, 95% CI = 1.1-2.3), and cultivating cotton and mangoes (PR = 1.7, 95% CI = 1.1-2.6) were positively associated with a history of malaria while working in agriculture. This study suggests that certain agricultural activities and types of crop production may increase the risk for malaria among women working in small-scale agriculture.	American Journal of Tropical Medicine & Hygiene	85	5	805-10	Self-reported exposure			Cross-sectional	Pesticides in general	other	self-reported	South Africa	umic
1112	S. Narayan, J. S. Sinsheimer, K. C. Paul, Z. Liew, M. Cockburn, J. M. Bronstein and B. Ritz	Genetic variability in ABCB1, occupational pesticide exposure, and Parkinson's disease	2015	BACKGROUND: Studies suggested that variants in the ABCB1 gene encoding P-glycoprotein, a xenobiotic transporter, may increase susceptibility to pesticide exposures linked to Parkinson's Disease (PD) risk. OBJECTIVES: To investigate the joint impact of two ABCB1 polymorphisms and pesticide exposures on PD risk. METHODS: In a population-based case control study, we genotyped ABCB1 gene variants at rs1045642 (c.3435C/T) and rs2032582 (c.2677G/T/A) and assessed occupational exposures to organochlorine (OC) and organophosphorus (OP) pesticides based on self-reported occupational use and record-based ambient workplace exposures for 282 PD cases and 514 controls of European ancestry. We identified active ingredients in self-reported occupational use pesticides from a California database and estimated ambient workplace exposures between 1974 and 1999 employing a geographic information system together with records for state pesticide and land use. With unconditional logistic regression, we estimated marginal and joint contributions for occupational pesticide exposures and ABCB1 variants in PD. RESULTS: For occupationally exposed carriers of homozygous ABCB1 variant genotypes, we estimated odds ratios of 1.89 [95% confidence interval (CI): (0.87, 4.07)] to 3.71 [95% CI: (1.96, 7.02)], with the highest odds ratios estimated for occupationally exposed carriers of homozygous ABCB1 variant genotypes at both SNPs; but we found no multiplicative scale interactions. CONCLUSIONS: This study lends support to a previous report that commonly used pesticides, specifically OCs and OPs, and variant ABCB1 genotypes at two polymorphic sites jointly increase risk of PD.	Environmental Research	143	NA	98-106	Self-reported exposure	Registers		Case-control	Pesticides in general	neurological	doctor-diagnosed	USA	hic
1113	S. Narayan, Z. Liew, J. M. Bronstein and B. Ritz	Occupational pesticide use and Parkinson's disease in the Parkinson Environment Gene (PEG) study	2017	OBJECTIVE: To study the influence of occupational pesticide use on Parkinson's disease (PD) in a population with information on various occupational, residential, and household sources of pesticide exposure. METHODS: In a population-based case control study in Central California, we used structured interviews to collect occupational history details including pesticide use in jobs, duration of use, product names, and personal protective equipment use from 360 PD cases and 827 controls. We linked reported products to California's pesticide product label database and identified pesticide active ingredients and occupational use by chemical class including fungicides, insecticides, and herbicides. Employing unconditional logistic regression, we estimated odds ratios and 95% confidence intervals for PD and occupational pesticide use. RESULTS: Ever occupational use of carbamates increased risk of PD by 455%, while organophosphorus (OP) and organochlorine (OC) pesticide use doubled risk. PD risk increased 110-211% with ever occupational use of fungicides, herbicides, and insecticides. Using any pesticide occupationally for >10years doubled the risk of PD compared with no occupational pesticide use. Surprisingly, we estimated higher risks among those reporting use of personal protective equipment (PPE). CONCLUSIONS: Our findings provide additional evidence that occupational pesticide exposures increase PD risk. This was the case even after controlling for other sources of pesticide exposure. Specifically, risk increased with occupational use of carbamates, OPs, and OCs, as well as of fungicides, herbicides, or insecticides. Interestingly, some types of PPE use may not provide adequate protection during pesticide applications.	Environment International	107	NA	266-273	Self-reported exposure			Case-control	Type of pesticide	neurological	doctor-diagnosed	USA	hic
1114	S. Narayanan	Clinical, hematological, and cytogenetic profile of adult myelodysplastic syndrome in a tertiary care center	2017	Background: Myelodysplastic syndrome (MDS), a disorder of clonal hematopoiesis, is an important clinical entity, but most of the studies available are conducted among the Western population. Its etiological factors and clinicohematological profile in the Indian population are quite diverse. The information regarding its prognostic factors and cytogenetics is very scarce. Objectives: (1) To assess the clinicohematological profile, cytogenetics, prognostic factors, and outcome of MDS and (2) to study its progression to acute myeloid leukemia (AML) in the selected patients over the study period. Methods: A prospective observational study was performed with patients from Department of Medicine and Hematology, Government Medical College, Kozhikode, who were diagnosed with MDS within the study period (from 1 January 2014 to 31 July 2015). Secondary causes of dysplasia were excluded. In possible cases, the international prognostic scoring system was followed. These patients were followed up for an additional 6 months to assess the progression of MDS to AML based on symptoms, signs, hemogram, or repeat peripheral smear/bone marrow studies. Results: Of the 60 patients, 73% were aged >60 years. Disease was common in males, with a male:female ratio of 7:3. Thirty-five percent of the patients were working in agricultural and allied fields and had pesticide exposure. Patients with prior radiation exposure had significant association with adverse outcome. Fatigue was the prominent symptom and was reported by 90% of the patients. Blasts were >5% in peripheral smear; bone marrow cytopenia and dysplasia at the time of diagnosis had significant association with risk of transforming to AML. Refractory anemia (RA), observed in 22 patients, was the most common type of MDS. Most of the patients with RA with excess blasts type-1 and RA with excess blasts type-2 transformed to AML, and the association was statistically significant. Deletion of short arm of fifth chromosome (5q deletion) was detected in 11 patients. All of them showed good response to treatment with lenalidomide and had a favorable outcome. Conclusion: This study highlights the various etiological factors, and the clinical profile of MDS seen in the Indian population. Cytogenetic analysis and application of the international prognostic scoring system has a significant bearing on the outcome, as exemplified by the response to lenalidomide in patients with 5q deletion. This study also indicates that proper diagnostic and prognostic assessment is necessary to institute appropriate therapeutic options.	Journal of Blood Medicine	8	NA	21-27	Job title			Cohort (prospective)	Job title	cancer	doctor-diagnosed	India	lmic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1115	S. Ogut, F. Gultekin, A. N. Kisioglu and E. Kucukoner	Oxidative stress in the blood of farm workers following intensive pesticide exposure	2011	The aim of this study was to evaluate oxidative stress in workers who formulate organophosphate, synthetic pyrethroid and carbamate pesticides. In this survey, blood erythrocytes from a group of 94 pesticide-formulating workers (at least 5-years experience in pest-control in apple and cherry production) and 45 control subjects were examined for oxidative stress parameters. The control group was composed of 45 healthy people living in the same region with no exposure to pesticides. Lipid peroxidation level, catalase, superoxide dismutase and glutathione peroxidase activities in erythrocytes were analysed as biomarkers of oxidative stress. In addition, the acetylcholinesterase activity was measured as a biomarker of toxicity. Results indicated that chronic exposure to organophosphate, synthetic pyrethroid and carbamate pesticides were associated with increased activities of catalase, SOD and lipid peroxidation in erythrocytes ($p < 0.05$). Acetylcholinesterase activity did not show any significant differences between the two groups ($p > 0.05$). It is concluded that human chronic exposure to pesticides may result in stimulated antioxidant enzymes.	Toxicology & Industrial Health	27	9	820-5	Job title			Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	Turkey	umic
1116	S. P. Cooper, T. Downs, K. Burau, P. A. Buffler, S. Tucker, L. Whitehead, S. Wood, G. Delclos, B. Huang, T. Davidson and et al.	A survey of actinic keratoses among paraquat production workers and a nonexposed friend reference group	1994	Follow-up on two reports of an excess of keratoses among paraquat production workers was conducted to evaluate the contribution of occupational exposures to the prevalence of keratoses among workers in a paraquat production plant in Texas. A cross-sectional study design was used to compare the prevalence of keratoses among current workers to an age, race, and sex frequency-matched group of their friends who had never worked at the plant. The analysis is based on 112 workers and 232 friends. Exposure, outcome, and covariables used in the analyses were obtained from an interview questionnaire, dermatology exam, and company records. Overall, the prevalence proportion of the presence of any actinic keratoses among workers and friends was similar (0.30 and 0.28, respectively). Among high cumulative exposed workers, the prevalence of any actinic keratoses was 0.40 compared to 0.20 among low-exposed workers and 0.28 among friends. These results were further explored using a multiple logistic regression approach to adjust for known risk and possibly confounding variables. Statistically significant high risks of actinic keratoses were demonstrated for freckling before age 16 years, older age, suntanning behaviors, occupational exposure to polycyclic aromatic hydrocarbons (PAH), and Fitzpatrick skin type. There was no significant contribution of overall exposure status (worker vs. friend). Similar to the crude analysis, the odds of actinic keratoses of high-exposed workers compared to friends was 1.9 (confidence interval [CI] = 0.9-4.2) whereas the comparable odds ratio for low-exposed workers vs. friends was 0.6 (CI = 0.2-1.7). These data do not demonstrate an excess of actinic keratoses overall nor any consistent increase in the odds of keratoses with an increase in plant exposure level.	American Journal of Industrial Medicine	25	3	335-47	Self-reported exposure			Cross-sectional	Specific active ingredient	dermatological	doctor-diagnosed	USA	hic
1117	S. Pastor, A. Creus, N. Xamena, C. Siffel and R. Marcos	Occupational exposure to pesticides and cytogenetic damage: results of a Hungarian population study using the micronucleus assay in lymphocytes and buccal cells	2002	The frequency of micronuclei (MN) in peripheral blood lymphocytes and in buccal epithelial cells was used as a biomarker of genotoxic effects resulting from occupational exposure to pesticides. In addition, the cytokinesis-block proliferation index (CBPI) was calculated to detect possible variations in the proliferative kinetics of lymphocytes due to pesticide exposure. This study was performed on 84 pesticide-exposed workers and 65 unexposed controls from Hungary. The pesticide-exposed workers, classified as moderately and highly exposed, were also evaluated separately. Statistical evaluation of the cytogenetic biomarkers indicated that there were no significant differences between pesticide-exposed workers and controls, nor between moderately and highly exposed workers. Nevertheless, the statistical analysis revealed that additional factors such as age, sex, ingestion of raw vegetables, and working as a pesticide applicator affected lymphocyte MN frequency. In addition, age, sex, and smoking affected the frequency of MN in buccal cells. Results from the CBPI analysis showed that the proliferation index decreased with pesticide exposure and that this parameter was also affected by smoking and by the gender of individuals. The results of this study indicate no significant increase in MN in this group of Hungarian workers; however, the reduced CBPI in the highly exposed population suggests a possible genotoxic effect of pesticide exposure.	Environmental & Molecular Mutagenesis	40	2	101-9	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Hungary	hic
1118	S. Pastor, A. Creus, T. Parron, A. Cebulska-Wasilewska, C. Siffel, S. Piperakis and R. Marcos	Biomonitoring of four European populations occupationally exposed to pesticides: use of micronuclei as biomarkers	2003	This paper presents the results obtained within the framework of an EU research project aimed at investigating the relationship between occupational exposure to pesticides and the induction of cytogenetic damage. Populations from Greece, Spain, Poland and Hungary, all of them characterised by intensive agricultural activity, were the subject of the study. A total of 239 agricultural workers and 231 unexposed controls were examined for cytogenetic effects in lymphocytes of peripheral blood and exfoliated cells of the oral mucosa. The frequency of micronuclei (MN) was evaluated in both cell types and their relationship to different confounding factors (e.g. sex, country, smoking habit, etc.) was determined. The cytokinesis block proliferation index (CBPI) was also calculated to detect possible variations in the proliferative kinetics of lymphocytes due to pesticide exposure. The results obtained indicate that there are no increases in MN frequencies in the agricultural workers when compared with the controls for either lymphocytes or buccal cells. However, exposed individuals showed a significant decrease in CBPI when compared with controls. When the effect of the different confounding factors was evaluated, age was positively related with MN in lymphocytes and the Polish population showed a MN frequency significantly higher than those observed in the other populations. For buccal cells, the Spanish population showed a higher MN frequency, attaining significant differences in comparison with the other populations. Finally, the CBPI was found to be inversely influenced by age and Hungarian exposed men were the group that showed the lowest values.	Mutagenesis	18	3	249-58	Self-reported exposure			Cross-sectional	Specific active ingredient	genetic (biomarkers)	medical test result	AHIC	AHIC
1119	S. Pastor, S. Gutierrez, A. Creus, A. Cebulska-Wasilewska and R. Marcos	Micronuclei in peripheral blood lymphocytes and buccal epithelial cells of Polish farmers exposed to pesticides	2001	In this biomonitoring study, we investigated whether an occupational exposure to a complex mixture of chemical pesticides produced a significant increase of micronuclei (MN) in both peripheral blood lymphocytes and buccal cells. Forty-nine male workers exposed to pesticides, from an agricultural area of Malopolska Region in Southern Poland, together with 50 men from the same area without indication of exposure to pesticides that served as controls, were used in this investigation. No statistically significant differences in the frequencies of cytogenetic damage were detected between exposed and control individuals, for either type of cells. The multiple linear regression analysis in the case of lymphocytes indicated that the studied cytogenetic endpoints were inversely influenced by alcohol; whilst a negative binomial regression, in the case of buccal cells, indicated that the MN values were directly influenced by the ingestion of red meat. An inverse negative relationship between the cytokinesis-block proliferation index and age, and a significant increase of miscarriages due to the exposure to pesticides were also observed.	Mutation Research	495	1	147-56	Self-reported exposure			Case-control	Pesticides in general	genetic (biomarkers)	medical test result	Poland	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1120	S. Pastor, S. Gutierrez, A. Creus, N. Xamena, S. Piperakis and R. Marcos	Cytogenetic analysis of Greek farmers using the micronucleus assay in peripheral lymphocytes and buccal cells	2001	The potential cytogenetic damage associated with pesticide use in Greek agricultural workers was evaluated using micronuclei (MN) as biomarkers in lymphocytes of peripheral blood and exfoliated cells of the buccal mucosa. In addition, the effects of pesticide exposure and other variables on the cytokinesis block proliferation index (CBPI) in lymphocytes were also evaluated. Both the exposed and control individuals were selected from Nea Makri, a village near Athens (Greece). This location was selected for its high greenhouse density. Micronuclei were analysed in 50 agricultural workers exposed to pesticides (30 men and 20 women) and in 66 non-exposed individuals that constituted the control group (41 men and 25 women). The comparison between workers and controls did not reveal any statistical significant difference in the MN frequency for either lymphocytes or buccal cells. Nevertheless, the multiple regression analysis revealed that the age and the interaction between gender and the number of X-ray examinations during the last 3 years preceding the sampling increased the number of MN in lymphocytes. Moreover, the results of the negative binomial regression analysis suggested that the level of MN in buccal cells could be reduced by the intake of fish, whilst being increased by olive oil consumption. Regarding CBPI, the value found in the exposed group was lower than in controls, the difference being statistically significant. On the other hand, CBPI was inversely associated with both age and X-ray exposure.	Mutagenesis	16	6	539-45	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Greece	hic
1121	S. Pelaez, I. Hierro, S. Ona, L. Alonso and A. Matilla	[Relationship between pesticide exposure and low-grade superficial bladder urothelial carcinoma]	2004	BACKGROUND AND OBJECTIVE: Few studies have been published analyzing the association between pesticides use and the increased risk of developing urothelial cancer of the bladder (UCB). The aim of this work was to investigate, in a geographical area with a high prevalence of UCB (Axarquia, Malaga province, southern Spain) if a) subjects with occupational exposure to pesticides have greater risk of developing UCB and b) there are histopathological differences with regard to UCB in patients without any exposure. PATIENTS AND METHOD: Case control study. During two years (1994-1996) 96 cases of UCB were included. The histologic grade and the depth of the invasion as well as the associated inflammatory infiltrate were analyzed. A questionnaire was answered by the patients. RESULTS: 58.3% of the case group were working with or had history of exposure to pesticides, compared to 40.6% in the control group (OR = 2.04; 95% CI, 1.1-3.6). The risk increased with a greater time of exposure. In exposed subjects, low grade tumors (OR = 2.6; 95% CI, 1.3-5.2) as well as superficial tumors (OR = 2.3; 95% CI, 1.2-4.4) were more frequent. They were more frequently accompanied by a chronic inflammatory infiltrate (OR = 4.5; 95% CI, 1.8-11.1). CONCLUSIONS: The subjects with occupational exposure to pesticide have greater risk of developing UCB, which is directly proportional to the exposure time. In comparison with the population in the zone without exposure, patients who use pesticides present low grade UCB and less invasive tumors more frequently. These facts were not modified when they were adjusted for tobacco consumption. Exposed patients have UCB with chronic (moderate) inflammatory reaction more frequently than the tumors in non-exposed subjects.	Medicina Clinica	123	15	571-4	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Spain	hic
1122	S. Porru, D. Placidi, A. Carta, U. Gelatti, M. L. Ribero, A. Tagger, P. Boffetta and F. Donato	Primary liver cancer and occupation in men: a case-control study in a high-incidence area in Northern Italy	2001	The objective of our study was to evaluate the association between occupation and risk of liver cancer. A hospital-based case-control study was carried out during 1997-1999 in the Province of Brescia, a highly industrialized area in Northern Italy with a high incidence of this neoplasm. The cases were 144 male patients with incident liver cancer (96% hepatocellular carcinoma). Controls were 283 male patients, matched to cases on age (+/-5 years), period and hospital of admission. Information on lifetime occupational history and alcohol consumption was obtained via interview. Specific occupational exposures to pesticides, solvents and other suspected hepatocarcinogens were evaluated. A blood sample was collected to detect hepatitis B and C infections. Odds ratios (OR) of occupational exposure and 95% confidence intervals (CI), adjusted for age, residence, education, heavy alcohol intake, hepatitis B surface antigen and hepatitis C virus antibodies positivity were computed. A statistically significant increased OR was observed for employment in repair of motor vehicles (OR 3.7; 95% CI 1.1-12.3; 9 exposed cases, 10 exposed controls). Increased ORs, although not statistically significant, were found for field-crop farm workers, food and beverage processors, blacksmiths and machine-tool operators, electrical fitters, clerical workers, manufacture of industrial machinery and personal and household services. A slightly increased OR was noted in workers exposed to toluene and xylene (OR 1.4; 95% CI 0.7-3.0, 23 cases, 36 controls); the OR was 2.8 (95% CI 1.0-7.6, 11 cases, 12 controls) for 20 or more years of exposure and 2.0 (95% CI 0.9-4.1, 21 cases, 28 controls) for 30 or more years of time since first exposure. The increase in OR seemed to be independent from that of alcohol or viral infections. Our study showed that the role of occupational exposures in liver carcinogenesis is limited. However, prolonged exposure to organic solvents such as toluene and xylene may represent a risk factor for liver cancer.	International Journal of Cancer	94	6	878-83	Self-reported exposure			Case-control	Chemical class	cancer	doctor-diagnosed	Italy	hic
1123	S. R. Asp, V.; Hernberg, S.; Pukkala, E.	Mortality and cancer morbidity of Finnish chlorophenoxy herbicide applicators: an 18-year prospective follow-up	1994	An 18-year follow-up for mortality and cancer morbidity was conducted in a cohort of 1,909 men who had started spraying chlorophenoxy herbicides (mixture of 2,4-dichlorophenoxyacetic acid [2,4-D] and 2,4,5-trichlorophenoxyacetic acid [2,4,5-T]) in 1955 through 1971. In all, 384 persons had died during the follow-up, and there was a slight deficit in natural deaths (standardized mortality ratio [SMR] 0.84; 95% confidence interval [CI] 0.75-0.94). By contrast, there was a small, nonsignificant increase in accidental and violent deaths. The overall cancer mortality was slightly less than in the general population (SMR 0.83; 95% CI 0.65-1.02), and not a single case of death of non-Hodgkin's lymphomas (NHL) or soft tissue sarcomas (STS) was detected. With regard to cancer morbidity, the incident cases showed a slight deficit compared to the population figure (standardized incidence ratio [SIR] 0.81; 95% CI 0.67-0.97). One case of NHL was found (2.4 expected with 10 years of latency), but not a single case of STS (0.8 expected with 10 years of latency). While our study does not support the contention that spraying of 2,4-D and 2,4,5-T containing herbicides carries any significant risk of cancer, the medium to low statistical power of the study does not allow any far reaching negative conclusions regarding the carcinogenicity of the agents.	American Journal of Industrial Medicine	26	2	243-53	Job title			Cohort (prospective)	Chemical class	mortality (all cause)	doctor-diagnosed	Finland	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1124	S. R. B. Silver, S. J.; Hines, C. J.; Alavanja, M. C.; Hoppin, J. A.; Lubin, J. H.; Rusiecki, J. A.; Sandler, D. P.; Beane Freeman, L. E.	Cancer incidence and metolachlor use in the Agricultural Health Study: An update	2015	Metolachlor, a widely used herbicide, is classified as a Group C carcinogen by the U.S. Environmental Protection Agency based on increased liver neoplasms in female rats. Epidemiologic studies of the health effects of metolachlor have been limited. The Agricultural Health Study (AHS) is a prospective cohort study including licensed private and commercial pesticide applicators in Iowa and North Carolina enrolled 1993-1997. We evaluated cancer incidence through 2010/2011 (NC/IA) for 49,616 applicators, 53% of whom reported ever using metolachlor. We used Poisson regression to evaluate relations between two metrics of metolachlor use (lifetime days, intensity-weighted lifetime days) and cancer incidence. We saw no association between metolachlor use and incidence of all cancers combined (n = 5,701 with a 5-year lag) or most site-specific cancers. For liver cancer, in analyses restricted to exposed workers, elevations observed at higher categories of use were not statistically significant. However, trends for both lifetime and intensity-weighted lifetime days of metolachor use were positive and statistically significant with an unexposed reference group. A similar pattern was observed for follicular cell lymphoma, but no other lymphoma subtypes. An earlier suggestion of increased lung cancer risk at high levels of metolachlor use in this cohort was not confirmed in this update. This suggestion of an association between metolachlor and liver cancer among pesticide applicators is a novel finding and echoes observation of increased liver neoplasms in some animal studies. However, our findings for both liver cancer and follicular cell lymphoma warrant follow-up to better differentiate effects of metolachlor use from other factors.	International Journal of Cancer	137	11	2630-43	Algorithm/model	Self-reported exposure		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
1125	S. R. Shah, S. J. Freedland, W. J. Aronson, C. J. Kane, J. C. Presti, Jr., C. L. Amling and M. K. Terris	Exposure to Agent Orange is a significant predictor of prostate-specific antigen (PSA)-based recurrence and a rapid PSA doubling time after radical prostatectomy	2009	OBJECTIVE: To investigate and report the clinicopathological characteristics and outcomes after radical prostatectomy (RP) in patients with prostate cancer and previous exposure to Agent Orange (AO), particularly in relationship to race. PATIENTS AND METHODS: In 1495 veterans who had undergone RP the clinicopathological characteristics, biochemical progression rates, and prostate-specific antigen (PSA) doubling time (DT) after recurrence between AO-exposed and unexposed men were compared using logistic and linear regression and Cox proportional hazards analyses, and stratified by race. RESULTS: The 206 (14%) men with AO exposure were more likely to be black (P = 0.001), younger (P < 0.001), treated more recently (P < 0.001), have a higher body mass index (P = 0.001), have clinical stage T1 disease (P < 0.001), and have lower preoperative PSA levels (P = 0.001). After adjusting for several clinical characteristics, AO exposure was not significantly related to adverse pathological features but was significantly associated with biochemical progression risk (relative risk 1.55, 95% confidence interval 1.15-2.09, P = 0.004) and shorter PSADT (P < 0.001) after recurrence (8.2 vs 18.6 months). When stratified by race, these associations were present and similar in both races, with no significant interaction between race and AO exposure for predicting biochemical recurrence or mean adjusted PSADT (P interaction >0.20). CONCLUSIONS: Patients with AO exposure and treated with RP were more likely to be black, present with lower risk features, have an increased risk of biochemical progression, and shorter PSADT after recurrence. When stratified by race, the association between AO exposure and poor outcomes was present in both races. These findings suggest that among selected men who choose RP, AO exposure might be associated with more aggressive prostate cancer.	BJU International	103	9	1168-72	Registers			Cohort (prospective)	Chemical class	cancer	doctor-diagnosed	USA	hic
1126	S. Razi, M. Rezaeian, F. G. Dehkordi, A. Manshoori, R. Goujani and R. Vazirinejad	Exposure to pistachio pesticides and stillbirth: a case-control study	2016	OBJECTIVES: Stillbirth is an undesirable outcome of pregnancy. In light of the increasing use of pesticides and growing concerns about the possible health effects of agricultural pesticides, we investigated the effect of exposure to pistachio pesticides on stillbirth in pregnant mothers. METHODS: This case-control study was conducted in Rafsanjan, Iran from 2011 to 2012. A total of 125 females who had a recent stillbirth were included as the case group, and 250 controls were selected from females who had a recent live birth. For each case, two controls with the nearest propensity score to the case were selected. Data were collected using a protocol developed by the researcher that involved interviewing respondents and reviewing their medical records. Conditional multivariate and univariate logistic regression analysis were performed and odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. RESULTS: The ORs of stillbirth in mothers living in pistachio gardens and those who were exposed to sprayed pesticides, in comparison to the controls, were 14.1 (95% CI, 3.3 to 63.4) and 5.0 (95% CI, 1.2 to 28.6), respectively. No significant differences were found in stillbirth rates according to the distance between the mother's residence and a pistachio garden or involvement in agricultural activities. CONCLUSIONS: The results of our study showed that exposure to pistachio pesticides during pregnancy may increase the likelihood of stillbirth in mothers.	Epidemiology and health	38	NA	e2016016	Self-reported exposure			Case-control	Chemical class	reproductive	self-reported	Iran	umic
1127	S. Riaz, F. Manzoor, N. Mahmood and S. Shahid	Molecular detection of M. tuberculosis and M. bovis and hematological and biochemical analyses in agricultural sprayers exposed to pesticides: A cross-sectional study in Punjab, Pakistan during 2014-2016	2017	We determined the correlation between a pesticide exposure, physical health and susceptibility toward tuberculosis along with hematological indices and liver enzymes' alterations in sprayers exposed to pesticides. Molecular detection of Mycobacterium tuberculosis and Mycobacterium bovis was detected by targeting histone-like protein (hupB) gene. The WBC (white blood cells) and RBC (red blood cells) levels of male sprayers and non-sprayers were significantly different (P<0.05). In female spray workers, the WBC and neutrophils levels were significantly different as compared with non-sprayers. Overall, in both male and female pesticide-exposed sprayers, mean values of alanine amino transferase and aspartate amino transferase were higher as compared with unexposed workers. M. Tuberculosis were detected in 15% male sprayers and 36% female sprayers while, M. bovis was detected in 5% male sprayers and 10% female sprayers. A chi²-test indicated that there existed a significant different (P<0.05) between positive and negative M. tuberculosis and M. bovis in both male/female spray workers out of total. The susceptibility of pesticide-exposed sprayers to tuberculosis and alterations in hematology and liver enzymes is crucial for health. Toxic effects of pesticides may lead to a weak immune system and increased tuberculosis susceptibility.	Journal of Exposure Science & Environmental Epidemiology	27	4	434-443	Job title			Cross-sectional	Job title	pesticide-related symptoms	medical test result	Pakistan	lmic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1128	S. S. Koutros, D. T.; Alavanja, M. C.; Andreotti, G.; Lerro, C. C.; Heltshe, S.; Lynch, C. F.; Sandler, D. P.; Blair, A.; Beane Freeman, L. E.	Occupational exposure to pesticides and bladder cancer risk	2016	BACKGROUND: In the developed world, occupational exposures are a leading cause of bladder cancer. A few studies have suggested a link between pesticide exposures among agricultural populations and bladder cancer. METHODS: We used data from the Agricultural Health Study, a prospective cohort study which includes 57310 pesticide applicators with detailed information on pesticide use, to evaluate the association between pesticides and bladder cancer. We used Poisson regression to calculate rate ratios (RRs) and 95% confidence intervals (CIs) to estimate the association between each of 65 pesticides and 321 incident bladder cancer cases which accrued over the course of follow-up (1993-2011), adjusting for lifestyle and demographic and non-pesticide farm-related exposures, including those previously linked to bladder cancer. We conducted additional analyses stratified by smoking status (never, former, current). RESULTS: We observed associations with bladder cancer risk for two imidazolinone herbicides, imazethapyr and imazaquin, which are aromatic amines. Ever use of imazaquin (RR=1.54, 95% CI: 1.05, 2.26) was associated with increased risk whereas the excess risk among users of imazethapyr was evident among never smokers (RR in highest quartile vs non-exposed=3.03, 95% CI: 1.46, 6.29, P-interaction=0.005). We also observed increased risks overall and among never smokers for use of several chlorinated pesticides including chlorophenoxy herbicides and organochlorine insecticides. CONCLUSIONS: Several associations between specific pesticides and bladder cancer risk were observed, many of which were stronger among never smokers, suggesting that possible risk factors for bladder cancer may be more readily detectable in those unexposed to potent risk factors like tobacco smoke.	International Journal of Epidemiology	45	3	792-805	Self-reported exposure	Algorithm/model		NA	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
1129	S. S. Zaidi, V. K. Bhatnagar, S. J. Gandhi, M. P. Shah, P. K. Kulkarni and H. N. Saiyed	Assessment of thyroid function in pesticide formulators	2000	Thirty male pesticide formulators exposed to the dust and liquid formulation of endosulfan, quinalphos, chlorpyriphos, monocrotophos, lindane, parathion, phorate, and fenvalerate and 20 comparable control subjects from the same area of study were examined for the evaluation of thyroid function tests. The level of TSH was elevated (about 28%) in pesticide formulators as compared to a control group, but the increase was statistically insignificant. Based on the individual TSH measurement, 3 of 30 formulators had isolated elevated levels of TSH and seem to have acquired sub-clinical hypothyroidism; five had TSH values slightly elevated to the upper boarder line (4.03 mulU/ml); and the majority of formulators (N= 22) had TSH values in the normal range varying from 1.29 to 3.9 mulU/ml. Total T3 was suppressed significantly (P< 0.01) in formulators, while marginal decrease (about 7%) was noticed in T4 level. This study indicated thyroid function impairment in few pesticide formulators.	Human & Experimental Toxicology	19	9	497-501	Job title			Cross-sectional	Pesticides in general	endocrine/nutritional/metabolical	medical test result	India	lmic
1130	S. Sathyanarayana, O. Basso, C. J. Karr, P. Lozano, M. Alavanja, D. P. Sandler and J. A. Hoppin	Maternal pesticide use and birth weight in the agricultural health study	2010	Studies examining the association between maternal pesticide exposure and low birth weight yield conflicting results. The authors examined the association between maternal pesticide use and birth weight among women in the Agricultural Health Study, a large study of pesticide applicators and their spouses in Iowa and North Carolina. The authors evaluated self-reported pesticide use of 27 individual pesticides in relation to birth weight among 2246 farm women whose most recent singleton birth occurred within 5 years of enrollment (1993-1997). The authors used linear regression models adjusted for site, preterm birth, medical parity, maternal body mass index, height, and smoking. The results showed that mean infant birth weight was 3586 g (+/- 546 g), and 3% of the infants were low birth weight (<2500 g). First-trimester pesticide-related tasks were not associated with birth weight. Ever use of the pesticide carbaryl was associated with decreased birth weight (-82 g, 95% confidence interval [CI] = -132, -31). This study thus provides limited evidence about pesticide use as a modulator of birth weight. Overall, the authors observed no associations between birth weight and pesticide-related activities during early pregnancy; however, the authors have no data on temporal specificity of individual pesticide exposures prior to or during pregnancy and therefore cannot draw conclusions related to these exposure windows. Given the widespread exposure to pesticide products, additional evaluation of maternal pregnancy exposures at specific time windows and subsequent birth outcomes is warranted.	Journal of Agromedicine	15	2	127-36	Self-reported exposure			Cross-sectional	Specific active ingredient	offspring	medical test result	USA	hic
1131	S. Searles Nielsen, H. Checkoway, J. Zhang, J. N. Hofmann, M. C. Keifer, M. Paulsen, F. M. Farin, T. J. Cook and C. D. Simpson	Blood alpha-synuclein in agricultural pesticide handlers in central Washington State	2015	Epidemiologic studies suggest that occupational exposure to pesticides might increase Parkinson disease risk. Some pesticides, such as the organophosphorus insecticide chlorpyrifos, appear to increase the expression of alpha-synuclein, a protein critically involved in Parkinson disease. Therefore, we assessed total blood cell alpha-synuclein in 90 specimens from 63 agricultural pesticide handlers, mainly Hispanic men from central Washington State, who participated in the state's cholinesterase monitoring program in 2007-2010. Additionally, in age-adjusted linear regression models for repeated measures, we assessed whether alpha-synuclein levels were associated with butyrylcholinesterase-chlorpyrifos adducts or cholinesterase inhibition measured in peripheral blood, or with self-reported pesticide exposure or paraoxonase (PON1) genotype. There was no evidence by any of those indicators that exposure to chlorpyrifos was associated with greater blood alpha-synuclein. We observed somewhat greater alpha-synuclein with the PON1-108T (lower paraoxonase enzyme) allele, and with >= 10 h of exposure to cholinesterase inhibiting insecticides in the preceding 30 days, but neither of these associations followed a clear dose-response pattern. These results suggest that selected genetic and environmental factors may affect alpha-synuclein blood levels. However, longitudinal studies with larger numbers of pesticide handlers will be required to confirm and elucidate the possible associations observed in this exploratory cross-sectional study.	Environmental Research	136	NA	75-81	Biomonitoring (blood)	Self-reported exposure		Cohort (prospective)	Specific active ingredient	neurological	medical test result	USA	hic

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1132	S. Searles Nielsen, S. C. Hu, H. Checkoway, M. Negrete, P. Palmandez, T. Bordianu, B. A. Racette and C. D. Simpson	Parkinsonism Signs and Symptoms in Agricultural Pesticide Handlers in Washington State	2017	OBJECTIVES: Examine associations between pesticide exposure and signs or symptoms of parkinsonism. METHODS: Prior to the 2014 pesticide spray season, the authors examined 38 active pesticide handlers aged 35 to 65 (median: 43.5) who participated in the State of Washington's cholinesterase monitoring program in the Yakima Valley, where cholinesterase-inhibiting insecticides are applied in fruit orchards. A movement disorder specialist assessed the workers using the Unified Parkinson's Disease Rating Scale (UPDRS) motor subscore 3 (UPDRS3). Participants also self-reported work and medical histories, including the UPDRS activities of daily living subscore 2 (UPDRS2). The authors explored the relation between these scores and lifetime occupational pesticide exposure while accounting for age. RESULTS: All participants were Hispanic men born in Mexico who had worked in agriculture for 4 to 43 years (median: 21 years, including 11 years applying pesticides, mostly in the United States). Ten participants (26%) reported difficulty with one or more UPDRS2 activities of daily living (maximum = 2), and nine (24%) had a UPDRS3 >0 (maximum = 10). The most common symptom and sign, respectively, were excess saliva (n = 6) and action tremor (n = 5). UPDRS2 and UPDRS3 scores were unrelated to the number of years applying pesticides, but UPDRS3, especially action tremor, was positively associated with living on or by a farm. CONCLUSIONS: Symptoms and signs of parkinsonism were absent to mild in this small sample of active workers who apply cholinesterase-inhibiting insecticides in Washington State, USA. Future studies should be larger and examine older, retired workers with greater cumulative exposure to agricultural pesticides at work and home, including other types of agricultural pesticides.	Journal of Agromedicine	22	3	215-221	Self-reported exposure			Cross-sectional	Pesticides in general	neurological	doctor-diagnosed	USA	hic
1133	S. Shadnia, E. Azizi, R. Hosseini, S. Khoei, S. Fouladdel, A. Pajoumand, N. Jalali and M. Abdollahi	Evaluation of oxidative stress and genotoxicity in organophosphorus insecticide formulators	2005	The aim of this study was to evaluate genotoxicity and oxidative stress in workers who formulate organophosphorus (OP) pesticides. In this survey, blood leukocytes and erythrocytes of a group of 21 pesticide formulating workers and an equal number of control subjects were examined for genotoxicity and oxidative stress parameters. The mean comet tail length and mean comet length were used to measure DNA damage. Lipid peroxidation level, catalase, superoxide dismutase (SOD) and glutathione peroxidase activities in erythrocytes were analysed as biomarkers of oxidative stress. In addition, the acetylcholinesterase activity was measured as a biomarker of toxicity. The average duration of employment of workers in the factory was 97 months. Results indicated that chronic exposure (multiple-dose, greater than or equal to 6 months duration) to OP pesticides was associated with increased activities of catalase, SOD and glutathione peroxidase in erythrocytes. The level of lipid peroxidation and acetylcholinesterase activity did not show any significant differences between the two groups. The results also indicated that chronic exposure to OP pesticides was associated with increased DNA damage. It is concluded that human chronic exposure to OP pesticides may result in stimulated antioxidant enzymes and increased DNA damage in the absence of depressed acetylcholinesterase levels. Routine genotoxicity monitoring concomitant to acetylcholinesterase activity in workers occupationally exposed to OP insecticides is suggested.	Human & Experimental Toxicology	24	9	439-45	Job title			Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	Iran	umic
1134	S. Singh, V. Kumar, K. Vashisht, P. Singh, B. D. Banerjee, R. S. Rautela, S. S. Grover, D. S. Rawat, S. T. Pasha, S. K. Jain and A. Rai	Role of genetic polymorphisms of CYP1A1, CYP3A5, CYP2C9, CYP2D6, and PON1 in the modulation of DNA damage in workers occupationally exposed to organophosphate pesticides	2011	Organophosphate pesticides (OPs) are primarily metabolized by several xenobiotic metabolizing enzymes (XMEs). Very few studies have explored genetic polymorphisms of XMEs and their association with DNA damage in pesticide-exposed workers. The present study was designed to determine the role of genetic polymorphisms of CYP1A1, CYP3A5, CYP2C9, CYP2D6, and PON1 in the modulation of DNA damage in workers occupationally exposed to OPs. We examined 284 subjects including 150 workers occupationally exposed to OPs and 134 normal healthy controls. The DNA damage was evaluated using the alkaline comet assay and genotyping was done using PCR-RFLP. The results revealed that the PONase activity toward paraoxonase and AChE activity was found significantly lowered in workers as compared to control subjects (p<0.001). Workers showed significantly higher DNA damage compared to control subjects (14.37+/-2.15 vs. 6.24+/-1.37 tail% DNA, p<0.001). Further, the workers with CYP2D6*3PM and PON1 (QQ and MM) genotypes were found to have significantly higher DNA damage when compared to other genotypes (p<0.05). In addition, significant increase in DNA damage was also observed in workers with concomitant presence of certain CYP2D6 and PON1 (Q192R and L55M) genotypes which need further extensive studies. In conclusion, the results indicate that the PON1 and CYP2D6 genotypes can modulate DNA damage elicited by some OPs possibly through gene-environment interactions.	Toxicology & Applied Pharmacology	257	1	84-92	Biomonitoring (blood)	Algorithm/model		Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	India	lmic
1135	S. Singh, V. Kumar, P. Singh, B. D. Banerjee, R. S. Rautela, S. S. Grover, D. S. Rawat, S. T. Pasha, S. K. Jain and A. Rai	Influence of CYP2C9, GSTM1, GSTT1 and NAT2 genetic polymorphisms on DNA damage in workers occupationally exposed to organophosphate pesticides	2012	Previous studies have revealed that organophosphate pesticides (OPs) are primarily metabolized by xenobiotic metabolizing enzymes (XMEs). Very few studies have explored genetic polymorphisms of XMEs and their association with DNA damage in pesticides-exposed workers. Present study was designed to determine the influence of CYP2C9, GSTM1, GSTT1 and NAT2 genetic polymorphisms on DNA damage in workers occupationally exposed to OPs. We examined 268 subjects including 134 workers occupationally exposed to OPs and an equal number of normal healthy controls. The DNA damage was evaluated using alkaline comet assay and genotyping was done using individual polymerase chain reaction (PCR) or polymerase chain reaction-restriction fragment length polymorphism (PCR-RFLP). Acetylcholinesterase and paraoxonase activity were found to be significantly lowered in workers as compared to control subjects which were analyzed as biomarkers of toxicity due to OPs exposure (p<0.001). Workers showed significantly higher DNA tail moment (TM) compared to control subjects (14.32+/-2.17 vs. 6.24+/-1.37 tail % DNA, p<0.001). GSTM1 null genotype was found to influence DNA TM in workers (p<0.05). DNA TM was also found to be increased with concomitant presence of NAT2 slow acetylation and CYP2C9*3/*3 or GSTM1 null genotypes (p<0.05). DNA TM was found increased in NAT2 slow acetylators with mild and heavy smoking habits in control subjects and workers, respectively (p<0.05). The results of this study suggest that GSTM1 null genotypes, and an association of NAT2 slow acetylation genotypes with CYP2C9*3/*3 or GSTM1 null genotypes may modulate DNA damage in workers occupationally exposed to OPs.	Mutation Research	741	1	101-8	Biomonitoring (blood)			Cohort (prospective)	Chemical class	genetic (biomarkers)	medical test result	India	lmic

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1136	S. Singh, V. Kumar, P. Singh, S. Thakur, B. D. Banerjee, R. S. Rautela, S. S. Grover, D. S. Rawat, S. T. Pasha, S. K. Jain and A. Rai	Genetic polymorphisms of GSTM1, GSTT1 and GSTP1 and susceptibility to DNA damage in workers occupationally exposed to organophosphate pesticides	2011	GSTM1, T1 and P1 are important enzymes of glutathione S-transferases (GSTs), involved in the metabolism of many endogenous and exogenous compounds. Individual genetic variation in these metabolizing enzymes may influence the metabolism of their substrates. The present study was designed to determine the genotoxic effects using DNA damage and its association with GSTM1, GSTT1, and GSTP1 (Ile105Val) genetic polymorphisms in workers occupationally exposed to organophosphate pesticides (OPs). We examined 230 subjects including 115 workers occupationally exposed to OPs and an equal number of normal healthy controls. The DNA damage was evaluated using the alkaline comet assay and genotyping was done using individual PCR or PCR-RFLP. Significantly higher DNA tail moment (TM) was observed in workers as compared to control subjects (14.41 +/- 2.25 vs. 6.36 +/- 1.41 tail % DNA, p<0.001). The results revealed significantly higher DNA TM in workers with GSTM1 null genotype than those with GSTM1 positive (15.18 vs. 14.15 tail % DNA, p=0.03). A significantly higher DNA TM was also observed in workers with homozygous Ile-Ile GSTP1 genotype than heterozygous (Ile-Val) and mutant (Val-Val) GSTP1 genotype (p=0.02). In conclusion, the results show that null deletion of GSTM1 and homozygote wild GSTP1 genotype could be related to inter-individual differences in DNA damage arises from the gene-environment interactions in workers occupationally exposed to OPs.	Mutation Research	725	1	36-42	Self-reported job history	Algorithm/model		Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	India	lmic
1137	S. Sundaravadivu, S. Kannan and S. Ramasamy	Improper safety measures and associated health effects of pesticides in farming community: A cross sectional, gender based study in Theni District, Tamil Nadu (India)	2016	Pesticides are chemical substances used to minimize the disease causing insects and pests in world wide. Due to unsafe use of pesticides, the farm workers in the agriculture field are easily incorporated to health problems. This study is mainly focused on the improper safety measures and associated health effects of pesticides on gender difference in the farming community. Human activities in agriculture fields expose synthetic organic pesticides to environmental diversity which remains harmful. To know the effect of pesticides on human being, we collected information regarding the agricultural workers in the age group of 25 to 75. The details collected through questionnaires contains information on gender, age, occupation, food habits, exposed to pesticides, pesticides used, knowledge about pesticide container used to mix the pesticides in the field, safety measures while working in the farm and signs and toxicity symptoms during and after working with pesticides. The pesticide Dimethoate is the most often used insecticides (67%) followed by Copper hydroxyl chloride (59%), Monocrotophos (62%), Copper oxychloride (57.1%), Chlorpyrifos (58%) and Profenofos (48%). The mean age group was 50 in female and 55 in male. 23.5% female workers and 17.5% male workers having 35 to 44 years experience in agriculture field. Among the female and male workers the illiteracy was high in female workers (63%) than male workers (43%). However, there were gender differences in knowledge of pesticides (p<0.001), pesticide container used to mix the pesticides in the field (p<0.001) and safety measures followed by female workers 42% and 33% in male. Also, acute symptoms of pesticides were higher in female workers than male workers. Therefore, creating awareness among on gender difference of farming community through proper education and guidance programs will ensure proper handling and safety measures.	International Journal of Pharmaceutical Sciences Review and Research	37	1	83-91	Self-reported exposure			Cross-sectional	Type of pesticide	NA	self-reported	India	lmic
1138	S. Tual, N. Morlais, B. Clin-Godard, A. S. Lacauve, S. Deant, M. Niez, E. Niez and P. Lebailly	Crop exposures and chronic bronchitis among farmers in the agriculture and cancer cohort	2011	Objectives Livestock farming is a well-known risk factor for chronic bronchitis (CB) but crop farming as a risk factor has been much less studied. Methods The Agriculture and Cancer cohort included <U+201A><U+00E2><U+00E0>184 000 farmers from 11 geographical areas, covering all types of farming in France. A random sample (n=18 395) was used for this cross-sectional analysis. Adjusted associations between agricultural exposures and self-reported history of doctor-diagnosed CB after age 20 were assessed using logistic regression. Results At enrolment (2005-07), 9% reported CB. After adjustment for gender, age, geographical area, smoking, educational level, BMI, history of asthma and atopy, and livestock productions (beef cattle, poultry, swine), two crop farming emerged as risk factors for CB: sunflower (OR 1.5 (1.1-2.0)) and potato (OR 1.4 (1.2-1.7)) productions. An increased risk of CB was observed in the largest potato growers (<U+201A><U+00E2><U+2022>20 hectares vs non-exposed: OR 2.8 (1.7-4.5)). History of pesticide poisoning was also associated with CB (OR 1.7 (1.1-2.6)). Among potato growers, use of pesticides on this crop was associated with a borderline significant increased risk of CB (OR 1.5 (1.0-2.3)). Conclusions Besides excess risk associated with livestock and sunflower productions, a significant increased risk of CB was observed among the largest potato growers in France. These findings suggest deleterious farming exposures, such as the use of pesticides, in their occupational environment. Since these large potato growers were usually involved in other large crop productions (wheat/barley, peas), the effect of tasks nonspecifi cally related to potato could not be excluded (large use of pesticides on all crops).	Occupational and Environmental Medicine	68	NA	A51	Self-reported exposure			Cross-sectional	Pesticides in general	respiratory	self-reported	France	hic
1139	S. Van den Broucke and A. Colemont	Behavioral and nonbehavioral risk factors for occupational injuries and health problems among Belgian farmers	2011	Preventive interventions to reduce occupational injuries and diseases among farmers require an appraisal of the relative importance of the various risk factors. This paper describes the results of a cross-sectional study investigating determinants of occupational health and injuries among 510 Belgian farmers, looking at health-related behaviors (machinery use, animal handling, fall prevention, and pesticide use), as well as nonbehavioral risk factors (demographic characteristics, farm characteristics, and participation in safety training). Education level and number of employees on the farm were identified as nonbehavioral risk factors for injuries, with highly educated farmers and working with one employee associated with a higher injury risk. In contrast, none of the nonbehavioral factors were related to occupational disease. Unsafe machinery use, animal handling, fall prevention, and pesticide use were behavioral risk factors for injuries, with unsafe pesticide use representing the highest risk. Unsafe machinery and pesticide use were also risks for disease. Significant differences in self-reported behavior were found for gender, age, number of employees, and the interaction between age and education. The study highlights the importance of behavioral factors as determinants of occupational injuries and diseases among farmers, and suggests that tailored preventive interventions should be developed to accommodate for differences in these behaviors among subgroups of farmers.	Journal of Agromedicine	16	4	299-310	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	Belgium	hic
1140	S. W. Yi and H. Ohrr	Agent Orange exposure and cancer incidence in Korean Vietnam veterans: a prospective cohort study	2014	BACKGROUND: During the Vietnam War, US and allied military sprayed approximately 77 million liters of tactical herbicides including Agent Orange, contaminated with 2,3,7,8-tetrachlorodibenzo-p-dioxin. To the authors' knowledge, few studies to date have examined the association between Agent Orange exposure and cancer incidence among Korean veterans who were exposed to Agent Orange during the Vietnam War.	NA	NA	NA	NA	Geographical information system (GIS)			Cohort (prospective)	Chemical class	cancer	doctor-diagnosed	USA	hic

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1141	S. W. Yi, S. Y. Ryu, H. Ohrr and J. S. Hong	Agent Orange exposure and risk of death in Korean Vietnam veterans: Korean Veterans Health Study	2014	BACKGROUND: Agent Orange (AO) was a mixture of phenoxy herbicides, containing several dioxin impurities including 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Various military herbicides, including AO, were sprayed by the US military and allied forces for military purposes during the Vietnam War. This study was performed to identify the associations between the AO exposure and mortality in Korean Vietnam veterans.	NA	NA	NA	NA	Geographical information system (GIS)			Cohort (prospective)	Chemical class	mortality (all cause)	doctor-diagnosed	USA	hic
1142	S. Yucra, M. Gasco, J. Rubio and G. F. Gonzales	Semen quality in Peruvian pesticide applicators: association between urinary organophosphate metabolites and semen parameters	2008	BACKGROUND: Organophosphates are broad class of chemicals widely used as pesticides throughout the world. We performed a cross-sectional study of associations between dialkylphosphate metabolites of organophosphates and semen quality among pesticide applicators in Majes (Arequipa), Peru. METHODS: Thirty-one men exposed to organophosphate (OP) pesticides and 31 non-exposed were recruited (age, 20-60 years). In exposed subjects, semen and a blood sample were obtained one day after the last pesticide application. Subjects were grouped according to levels of OP metabolites in urine. Semen samples were analyzed for sperm concentration, percentage of sperm motility, percentage of normal morphology, semen leucocytes and concentrations of fructose and zinc. Exposure to OP was assessed by measuring six urinary OP metabolites (dimethyl and diethyl phosphates and thiophosphates) by gas chromatography using a single flame photometric detector. RESULTS: Diethyldithiophosphate (p = 0.04) and diethylthiophosphate (p = 0.02) better reflected occupational pesticide exposure than other OP metabolites. Semen analysis revealed a significant reduction of semen volume and an increase in semen pH in men with OP metabolites. Multiple regression analysis showed that both occupational exposure to pesticides and the time of exposure to pesticides were more closely related to alterations in semen quality parameters than the single measurement of OP metabolites in urine. CONCLUSION: The study demonstrated that occupational exposure to OP pesticides was more closely related to alterations in semen quality than a single measurement of urine OP metabolites. Current measurement of OP metabolites in urine may not reflect the full risk.	Environmental Health: A Global Access Science Source	7	NA	59	Biomonitoring (urine)			Cross-sectional	Chemical class	reproductive	medical test result	Peru	umic
1143	T. A. Arcury, S. A. Quandt and B. G. Mellen	An exploratory analysis of occupational skin disease among Latino migrant and seasonal farmworkers in North Carolina	2003	Occupational skin disease is highly prevalent among all agricultural workers. However, few data exist on risk factors for occupational skin disease among migrant and seasonal farmworkers. The goal of this analysis was to further document the prevalence of occupational skin disease among Latino farmworkers and delineate risk factors. This exploratory analysis used data collected in repeated survey interviews with Latino farmworkers in North Carolina in June and July (early season) and in August and September (late season), 1999. Respondents were largely male (95%) and from Mexico (95%), with about one-third each age 18-24, 25-34, and 35 and older. About half were in the U.S. on work contracts. Independent variables included the physical environment (crops worked), the social environment (having received pesticide safety training, having a work contract), and behavior and individual characteristics (re-wearing work clothes, showering after work, age). The dependent measures were reporting having had itching or burning skin or a skin rash in the two months prior to each interview; 24% of the respondents in the early season, and 37% in the late season reported skin disease signs and symptoms during the previous two months. Those reporting signs and symptoms in the early season were more likely to report them in late season. Significant independent risk factors for skin signs and symptoms in early season were re-wearing work clothes, showering after work, and being age 35 or older. In late season, those who had not received pesticide safety training had lower odds of reporting skin disease signs and symptoms, after adjusting for other potential risk factors. This exploratory study indicates that Latino migrant and seasonal farmworkers experience a high incidence of occupational skin disease. Further research is required with improved measurement of skin disease signs and symptoms, diagnosis of specific skin disease, and improved measurement of risk factors.	Journal of Agricultural Safety & Health	9	3	221-32	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	USA	hic
1144	T. A. Bullman, K. K. Watanabe and H. K. Kang	Risk of testicular cancer associated with surrogate measures of Agent Orange exposure among Vietnam veterans on the Agent Orange Registry	1994	A case-control analysis was undertaken to examine the association between various surrogate measures of Agent Orange exposure and testicular cancer among Vietnam veterans. Study subjects were selected from the Department of Veterans Affairs Agent Orange Registry. The case patients consisted of 97 veterans with a diagnosis of testicular cancer, and 311 veterans without any clinical diagnosis served as a comparison group. The surrogate measures were branch of service, type of duty, corps area, and location of the individual's unit in relation to recorded Agent Orange spray tracts. Only Navy veterans had a statistically significant increased risk of testicular cancer (odds ratio (OR) = 2.60; 95% confidence interval (CI), 1.08 to 6.24). Risk of testicular cancer was not significantly increased for ground troops (OR = 0.46; 95% CI, 0.25 to 0.86), for combat duty (OR = 0.91; 95% CI, 0.52 to 1.58), for service in the III Corps area (OR = 1.10; 95% CI, 0.66 to 1.84), and for being close to spray tracts within 90 days/8 km (OR = 0.99; 95% CI, 0.54 to 1.84) or 3 days/2 km (OR = 1.39; 95% CI, 0.50 to 3.80). The study results are not consistent with the hypothesis that Agent Orange may be a risk factor for testicular cancer among Vietnam veterans.	Annals of Epidemiology	4	1	43410	Registers			Case-control	Job title	cancer	doctor-diagnosed	USA	hic
1145	T. A. F. Arcury, S. R.; Schulz, M. R.; Vallejos, Q.; Verma, A.; Fleischer, A. B., Jr.; Rapp, S. R.; Davis, S. F.; Preisser, J. S.; Quandt, S. A.	Diagnosed skin diseases among migrant farmworkers in North Carolina: prevalence and risk factors	2007	Skin diseases are common among farmworkers, yet little research documents their prevalence and risk factors. This analysis documents the prevalence of skin diseases among farmworkers in North Carolina, examines variation in the prevalence across the agricultural season, and delineates factors associated with skin disease. Data are from a longitudinal surveillance study with assessments at approximately three-week intervals from May through October 2005. The sample included 304 farmworkers from 45 camps with 1048 data points. Data collection included a structured interview and a standard set often digital photographs. A board-certified dermatologist reviewed the photographs and made specific diagnoses in five categories: inflammatory disease, infection, pigmentary disorder, tumor, and trauma. The prevalences of the five skin disease categories and specific diagnoses are described with counts and frequencies for the entire season and for six time periods. The inflammatory disease and infectious disease categories are modeled with an extension of logistic regression that accounts for repeated measures and clustering of farmworkers within camps. Farmworkers experience high levels of inflammatory skin disease (57.2%) including acne, folliculitis, and contact dermatitis; infectious skin disease (73.8%) including tinea pedis, onychomycosis, and warts; pigmentary disorders (19.1%); and trauma (34.5%). The odds of inflammatory skin disease decreased with age, while those for infectious skin disease increased with age. The odds of inflammatory skin disease increased with pesticide exposure and decreasing housing quality. Skin diseases are highly prevalent among farmworkers. Research is needed to delineate specific factors causing high levels of infection and inflammation in this population.	Journal of Agricultural Safety & Health	13	4	407-18	Self-reported exposure			Cohort (prospective)	Pesticides in general	dermatological	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1146	T. Abu Mourad	Adverse impact of insecticides on the health of Palestinian farm workers in the Gaza Strip: a hematologic biomarker study	2005	To evaluate the health impact of insecticides on Palestinian farm workers in the Gaza Strip, the study assessed biomarkers in farm workers who used organophosphorus insecticides. Serum cholinesterase and complete blood count were determined before and after spraying of organophosphorus insecticides. Burning sensations in eyes/face (62.5%), itching/skin irritation (37.5%), and chest symptoms (29.2%) were reported. Serum butyrylcholinesterase (SBuChE) was significantly decreased at the end of the work day. Burning sensations in eyes/face and skin rash were significantly associated with inhibition of SBuChE activity ($p < 0.05$). Younger workers were more affected. Leukocyte and platelet counts were increased and hemoglobin decreased significantly, reflecting acute poisoning. Monitoring of SBuChE and hematologic parameters of farm workers could be useful to predict and prevent health hazards of pesticides.	International Journal of Occupational & Environmental Health	11	2	144-9	Biomonitoring (blood)			Cohort (prospective)	Chemical class	pesticide-related symptoms	medical test result	Israel	hic
1147	T. Ali, J. A. Bhalli, S. M. Rana and Q. M. Khan	Cytogenetic damage in female Pakistani agricultural workers exposed to pesticides	2008	Bhawalpur is a major cotton-growing area in Pakistan. Cotton picking in Pakistan is carried out by females and as a result of the intensive use of pesticides during the growing season these females are exposed to pesticide residues in the picking season. In the present study, peripheral blood was obtained from 69 cotton pickers and 69 unexposed females and used to assess the effect of pesticide exposure on genetic damage as well as on hepatic enzymes and serum cholinesterase. The subjects were of similar average age in workers and control groups (37.55 +/- 12.75 vs. 37.52 +/- 13.47, $P > 0.05$). Average exposure time of the picker females was 10.26 +/- 6.14 years. Subjects from the exposed group did not use any protective measures during their work activities. Levels of serum cholinesterase were lower, and levels of alkaline phosphatase, alanine aminotransferase, and aspartate aminotransferase were higher in the exposed workers as compared with the control group ($P < 0.001$). The exposed group exhibited significantly increased frequencies of binucleated cells with micronuclei (12.72 +/- 3.48 vs. 4.35 +/- 2.44, $P < 0.001$) and total number of micronuclei in binucleated lymphocytes (16.51 +/- 4.27 vs. 5.86 +/- 3.09, $P < 0.001$) in comparison with subjects of the control group. The binucleated cells with micronuclei frequency also seemed to increase with age in both the groups, however, the magnitude of increase was greater in exposed group than the control. Results from the present study indicate that occupational exposure to pesticide mixtures results in cytogenetic damage in exposed females.	Environmental & Molecular Mutagenesis	49	5	374-80	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Pakistan	lmic
1148	T. B. Tumer, S. Savranoglu, P. Atmaca, G. Terzioglu, A. Sen and S. Arslan	Modulatory role of GSTM1 null genotype on the frequency of micronuclei in pesticide-exposed agricultural workers	2016	In this study, we aimed to investigate the extent of genotoxic risk and the association between null GSTM1/GSTT1 and GSTP1 Ile105Val variants and cellular DNA damage, as measured by micronucleus (MN) assay in a group of agricultural workers from Denizli, Turkey. Peripheral blood samples were collected from 116 subjects, including 58 workers who were occupationally exposed to pesticides and 58 healthy unexposed controls. The MN frequencies of each individual were assessed by cytokinesis-blocked micronuclei assays on lymphocytes. Genotypes for different GST variants were determined using polymerase chain reaction-based methods. A significant 3.4-fold increase in MN frequency was observed in workers compared with the controls ($p < 0.001$). Among the GST genotypes, only the GSTM1 null genotype was found to be significantly associated with an increased MN frequency in workers ($p = 0.01$). Individuals with a concomitant null GSTM1/GSTT1 genotype demonstrated a significant ($p = 0.01$) increase in MN frequency compared with those with functional isozymes in the exposed worker group. The association of the GSTM1 null genotype with higher MN frequency suggests that it may be a modifier of genotoxic risk in individuals exposed to pesticides and may thus be a candidate susceptibility biomarker for human biomonitoring studies.	Toxicology and Industrial Health	32	12	1942-1951	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Turkey	umic
1149	T. Behrens, E. Lynge, I. Cree, J. M. Lutz, M. Eriksson, P. Guenel, F. Merletti, M. Morales-Suarez-Varela, N. Afonso, A. Stengrevics, J. Fevotte, S. Sabroe, A. Llopis-Gonzalez, G. Gorini, L. Hardell, A. Stang and W. Ahrens	Pesticide exposure in farming and forestry and the risk of uveal melanoma	2012	PURPOSE: Since pesticides are disputed risk factors for uveal melanoma, we studied the association between occupational pesticide exposure and uveal melanoma risk in a case-control study from nine European countries. METHODS: Incident cases of uveal melanoma and population as well as hospital controls were included and frequency-matched by country, 5-year age groups and sex. Self-reported exposure was quantified with respect to duration of exposure and pesticide application method. We calculated the exposure intensity level based on application method and use of personal protective equipment. Odds ratios (OR) and 95% confidence intervals (95% CI) were estimated by unconditional logistic regression analyses and adjusted for several potential confounders. RESULTS: 293 case and 3,198 control subjects were interviewed. We did not identify positive associations with activities in farming or forestry, pesticide application or pesticide mixing. No consistent positive associations were seen with exposure intensity level scores either. The only statistically significantly raised association in this study was for exposure to chemical fertilizers in forestry (OR = 8.93; 95% CI 1.73-42.13), but this observation was based on only six exposed subjects. Results did not change when we restricted analyses to morphologically verified cases and excluded proxy interviews as well as cancer controls. We did not observe effect modification by sex or eye color. CONCLUSIONS: Risk estimates for pesticide exposures and occupational activities in agriculture and forestry were not increased and did not indicate a hormonal mechanism due to these exposures.	Cancer Causes & Control	23	1	141-51	Self-reported exposure			Case-control	Type of pesticide	cancer	doctor-diagnosed	AHIC	AHIC
1150	T. Carreon, M. A. Butler, A. M. Ruder, M. A. Waters, K. E. Davis King, G. M. Calvert, P. A. Schulte, B. Connally, E. M. Ward, W. T. Sanderson, E. F. Heineman, J. S. Mandel, R. F. Morton, D. J. Reding, K. D. Rosenman, G. Talaska and G. Brain Cancer Collaborative Study	Gliomas and farm pesticide exposure in women: the Upper Midwest Health Study	2005	An excess incidence of brain cancer in male farmers has been noted in several studies, but few studies have focused on women. The National Institute for Occupational Safety and Health Upper Midwest Health Study evaluated effects of rural exposures for 341 female glioma cases and 528 controls, all adult (18-80 years of age) nonmetropolitan residents of Iowa, Michigan, Minnesota, and Wisconsin. On average, controls lived longer on farms than did cases. After adjusting for age, age group, education, and farm residence, no association with glioma was observed for exposure to arsenicals, benzoic acids, carbamates, chloroacetanilides, dinitroanilines, inorganics, organochlorines, organophosphates, phenoxys, triazines, or urea-based or estrogenic pesticides. An increased risk of glioma was observed for carbamate herbicides but was not statistically significant (odds ratio = 3.0; 95% confidence interval, 0.9-9.5). No association was observed between glioma and exposure to 12 widely used specific pesticides, after adjustment for age, age group, education, and any other pesticide exposure. These results were not affected after exclusion of proxy respondents (43% of cases, 2% of controls). Women were less likely than men to have applied pesticides, but more likely to have laundered pesticide-contaminated clothes. Storing pesticides in the house was associated with a statistically non-significant increased risk. Results show that exposure to pesticides was not associated with an increased risk of intracranial gliomas in women. Other farm-related factors could be etiologic factors and will be discussed in future reports.	Environmental Health Perspectives	113	5	546-51	Self-reported exposure	Expert case-by-case assessment		Case-control	Specific active ingredient	cancer	doctor-diagnosed	USA	hic

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1151	T. D. Howard, F. C. Hsu, H. Chen, S. A. Quandt, J. W. Talton, P. Summers and T. A. Arcury	Changes in DNA methylation over the growing season differ between North Carolina farmworkers and non-farmworkers	2016	PURPOSE: The occupational risk to farmworkers, particularly chronic exposure to pesticides, is an acknowledged environmental and work-related health problem. Epigenetics has recently been shown to contribute to a number of complex diseases and traits, including measures of cognitive function and preclinical neurodegenerative disease. We sought to determine whether changes in DNA methylation existed between farmworker and non-farmworker populations and to identify the genes most likely involved in those changes. METHODS: Eighty-three farmworkers and 60 non-farmworkers were selected from PACE4, a community-based, participatory research project comparing occupational exposures between immigrant Latino farmworker and non-farmworker manual workers. Measurements of DNA methylation were performed with the Infinium HumanMethylation450 BeadChip, at the beginning and end of the 2012 growing season. Bonferroni adjustment was used to identify significant findings (p = 1.03 x 10(-7), based on 485,000 tested methylation sites), although less stringent criteria (i.e., p <= 1 x 10(-6)) were used to identify sites of interest. Expression quantitative trait locus (eQTL) databases were used to help identify the most likely functional genes for each associated methylation site. RESULTS: Methylation at 36 CpG sites, located in or near 72 genes, differed between the two groups (p <= 1 x 10(-6)). The difference between the two groups was generally due to an increase in methylation in the farmworkers and a slight decrease in methylation in the non-farmworkers. Enrichment was observed in several biological pathways, including those involved in the immune response, as well as growth hormone signaling, role of BRCA1 in DNA damage response, p70S6K signaling, and PI3K signaling in B lymphocytes. CONCLUSIONS: We identified considerable changes in DNA methylation at 36 CpG sites over the growing season that differed between farmworkers and non-farmworkers. Dominant pathways included immune-related (HLA) processes, as well as a number of diverse biological systems. Further studies are necessary to determine which exposures or behaviors are responsible for the observed changes, and whether these changes eventually lead to disease-related phenotypes in this population.	International Archives of Occupational & Environmental Health	89	7	1103-10	Job title			Cohort (prospective)	Job title	genetic (biomarkers)	medical test result	USA	hic
1152	T. D. Howard, F. C. Hsu, J. G. Grzywacz, H. Chen, S. A. Quandt, Q. M. Vallejos, L. E. Whalley, W. Cui, S. Padilla and T. A. Arcury	Evaluation of candidate genes for cholinesterase activity in farmworkers exposed to organophosphorus pesticides: association of single nucleotide polymorphisms in BCHE	2010	BACKGROUND: Organophosphate pesticides act as cholinesterase inhibitors. For those with agricultural exposure to these chemicals, risk of potential exposure-related health effects may be modified by genetic variability in cholinesterase metabolism. Cholinesterase activity is a useful, indirect measurement of pesticide exposure, especially in high-risk individuals such as farmworkers. To understand fully the links between pesticide exposure and potential human disease, analyses must be able to consider genetic variability in pesticide metabolism. OBJECTIVES: We studied participants in the Community Participatory Approach to Measuring Farmworker Pesticide Exposure (PACE3) study to determine whether cholinesterase levels are associated with single-nucleotide polymorphisms (SNPs) involved in pesticide metabolism. METHODS: Cholinesterase levels were measured from blood samples taken from 287 PACE3 participants at up to four time points during the 2007 growing season. We performed association tests of cholinesterase levels and 256 SNPs in 30 candidate genes potentially involved in pesticide metabolism. A false discovery rate (FDR) p-value was used to account for multiple testing. RESULTS: Thirty-five SNPs were associated (unadjusted p < 0.05) based on at least one of the genetic models tested (general, additive, dominant, and recessive). The strongest evidence of association with cholinesterase levels was observed with two SNPs, rs2668207 and rs2048493, in the butyrylcholinesterase (BCHE) gene (FDR adjusted p = 0.15 for both; unadjusted p = 0.00098 and 0.00068, respectively). In participants with at least one minor allele, cholinesterase levels were lower by 4.3-9.5% at all time points, consistent with an effect that is independent of pesticide exposure. CONCLUSIONS: Common genetic variation in the BCHE gene may contribute to subtle changes in cholinesterase levels.	Environmental Health Perspectives	118	10	1395-9	Biomonitoring (blood)			Cohort (prospective)	Chemical class	genetic (biomarkers)	medical test result	USA	hic
1153	T. D. K. LeVan, W. P.; Lee, H. P.; Koh, D.; Yu, M. C.; London, S. J.	Vapor, dust, and smoke exposure in relation to adult-onset asthma and chronic respiratory symptoms: the Singapore Chinese Health Study	2006	Occupational factors contribute to a significant fraction of respiratory disease and symptoms. The authors evaluated the role of occupational exposures in asthma, chronic bronchitis, and respiratory symptoms in the Singapore Chinese Health Study, a population-based cohort of adults aged 45-74 years at enrollment in 1993-1998. Information on occupations and occupational exposures was collected at enrollment for 52,325 subjects for whom respiratory outcomes were obtained via follow-up interviews in 1999-2004. Exposure to dusts from cotton, wood, metal, minerals, and/or asbestos was associated with nonchronic cough and/or phlegm (odds ratio (OR) = 1.19, 95% confidence interval (CI): 1.08, 1.30), chronic bronchitis (OR = 1.26, 95% CI: 1.01, 1.57), and adult-onset asthma (OR = 1.14, 95% CI: 1.00, 1.30). Cotton dust was the major contributor to respiratory symptoms. Vapor exposure from chemical solvents, dyes, cooling oils, paints, wood preservatives, and/or pesticides was associated with nonchronic cough or phlegm (OR = 1.14, 95% CI: 1.03, 1.27), chronic dry cough (OR = 1.55, 95% CI: 1.19, 2.01), and adult-onset asthma (OR = 1.34, 95% CI: 1.15, 1.56). Chemical solvents, cooling oils, and pesticides were the major contributors to respiratory symptoms. These data support the role of occupational exposures in the etiology of respiratory illness in a population-based cohort in Singapore with a low prevalence of atopic illness.	American Journal of Epidemiology	163	12	1118-28	Self-reported exposure			Cohort (prospective)	Pesticides in general	respiratory	self-reported	Malaysia	umic
1154	T. Dassanayake, I. B. Gawarammana, V. Weerasinghe, P. S. Dissanayake, S. Pragaash, A. Dawson and N. Senanayake	Auditory event-related potential changes in chronic occupational exposure to organophosphate pesticides	2009	OBJECTIVE: To determine whether chronic occupational exposure to organophosphates (OP) pesticides leads to cognitive impairment using event-related potentials (ERPs). METHODS: ERPs of 38 vegetable farmers applying OP pesticides and 35 controls were recorded using an auditory oddball paradigm. The N1, P2, N2 and P300 ERP components and the number of counting errors were compared between the groups. RESULTS: The farmers made significantly more counting errors than controls in the oddball task. The mixed model ANOVA of component latencies revealed a significant componentxgroup interaction, suggesting farmers had a greater delay in later ERP components. Intergroup comparisons of individual components showed significant delays in N2 and P300 latencies. Subsequent ANCOVA showed significant P300 delay even after adjusting for the latency of the preceding component, N2. Intergroup differences of P300 amplitudes were not significant, although there was limited evidence of a difference in scalp topography. CONCLUSION: Our findings indicate that chronic low-level occupational exposure to OP pesticides is associated with progressively increasing delay in successive ERP components, particularly P300. SIGNIFICANCE: Chronic exposure to OP pesticides may delay the neurophysiological processes underlying early stages of selective attention and late stages of sensory information processing that include stimulus evaluation and updating of working memory.	Clinical Neurophysiology	120	9	1693-8	Self-reported exposure			Cross-sectional	Chemical class	mental disorders	medical test result	NA	NA

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1155	T. E. Arbuckle, D. A. Savitz, L. S. Mery and K. M. Curtis	Exposure to phenoxy herbicides and the risk of spontaneous abortion	1999	The Ontario Farm Family Health Study was designed to assess retrospectively the potential adverse effects of exposure to pesticides on pregnancy. Information on the health and life style of approximately 2,000 farm couples, as well as a history of use of pesticides on the farm, was collected by questionnaire. This analysis focuses on pre- and postconception exposure to phenoxy herbicides and the risk of spontaneous abortion using the complete (to date) pregnancy history for each woman. Preconception exposure (from 3 months before conception to the month of conception) was weakly associated with the risk of spontaneous abortion at <20 weeks' gestation [adjusted odds ratio (OR) = 1.1; 95% confidence interval (CI) = 0.6-1.9]. When the analyses were restricted to spontaneous abortions of <12 weeks, the risk was more than doubled (adjusted OR = 2.5; 95% CI = 1.0-6.4), but the results were sensitive to the cutpoint used. If the husband did not normally wear protective equipment during application, the crude OR for early spontaneous abortions was 5.0 (95% CI = 0.7-36.2). Exposure to phenoxy herbicides during the first trimester was generally not associated with increased risk of spontaneous abortion. The results suggest a possible role of preconception (possibly paternal) exposures to phenoxy herbicides in the risk of early spontaneous abortions.	Epidemiology	10	6	752-60	Self-reported exposure			Cross-sectional	Chemical class	reproductive	self-reported	USA	hic
1156	T. E. Arbuckle, Z. Lin and L. S. Mery	An exploratory analysis of the effect of pesticide exposure on the risk of spontaneous abortion in an Ontario farm population	2001	The toxicity of pesticides on human reproduction is largely unknown--particularly how mixtures of pesticide products might affect fetal toxicity. The Ontario Farm Family Health Study collected data by questionnaire on the identity and timing of pesticide use on the farm, lifestyle factors, and a complete reproductive history from the farm operator and eligible couples living on the farm. A total of 2,110 women provided information on 3,936 pregnancies, including 395 spontaneous abortions. To explore critical windows of exposure and target sites for toxicity, we examined exposures separately for preconception (3 months before and up to month of conception) and postconception (first trimester) windows and for early (< 12 weeks) and late (12-19 weeks) spontaneous abortions. We observed moderate increases in risk of early abortions for preconception exposures to phenoxy acetic acid herbicides [odds ratio (OR) = 1.5; 95% confidence interval (CI), 1.1-2.1], triazines (OR = 1.4; 95% CI, 1.0-2.0), and any herbicide (OR = 1.4; 95% CI, 1.1-1.9). For late abortions, preconception exposure to glyphosate (OR = 1.7; 95% CI, 1.0-2.9), thiocarbamates (OR = 1.8; 95% CI, 1.1-3.0), and the miscellaneous class of pesticides (OR = 1.5; 95% CI, 1.0-2.4) was associated with elevated risks. Postconception exposures were generally associated with late spontaneous abortions. Older maternal age (> 34 years of age) was the strongest risk factor for spontaneous abortions, and we observed several interactions between pesticides in the older age group using Classification and Regression Tree analysis. This study shows that timing of exposure and restricting analyses to more homogeneous endpoints are important in characterizing the reproductive toxicity of pesticides.	Environmental Health Perspectives	109	8	851-7	Self-reported exposure			Cohort (prospective)	Chemical class	reproductive	self-reported	USA	hic
1157	T. E. Meyer, A. L. Coker, M. Sanderson and E. Symanski	A case-control study of farming and prostate cancer in African-American and Caucasian men	2007	OBJECTIVE: To determine the risk of prostate cancer associated with farming by duration, recency and specific activities among African-Americans and Caucasians. METHODS: This population-based case-control study had information on farming-related activities for 405 incident prostate cancer cases and 392 controls matched for age, race and region in South Carolina, USA, from 1999 to 2001. Cases with histologically confirmed, primary invasive prostate cancer who were aged between 65 and 79 years were ascertained through the South Carolina Central Cancer Registry. Appropriately matched controls were identified from the Health Care Financing Administration Medicare Beneficiary File. Data were collected using computer-assisted telephone interviewing, and adjusted odds ratios (aOR) were estimated using unconditional logistic regression. RESULTS: Farming was associated with increased risk of prostate cancer in Caucasians (aOR 1.8; 95% confidence interval (CI) 1.3 to 2.7) but not in African-Americans (aOR 1.0; 95% CI 0.6 to 1.6). Regarding specific farming activities, farmers who mixed or applied pesticides had a higher risk of prostate cancer (aOR 1.6; 95% CI 1.2 to 2.2). Increased risk of prostate cancer was observed only for those farming <5 years. CONCLUSIONS: Increased risk of prostate cancer for farmers in this study may be attributable to pesticide exposure. Racial differences in the association between farming and prostate cancer may be explained by different farming activities or different gene-environment interactions by race.	Occupational & Environmental Medicine	64	3	155-60	Self-reported job history			Case-control	Job title	cancer	doctor-diagnosed	USA	hic
1158	T. E. Taha and R. H. Gray	Agricultural pesticide exposure and perinatal mortality in central Sudan	1993	Hospital- and community-based studies were conducted in central Sudan to investigate the association between pesticide exposure and perinatal mortality. The cases were 197 stillbirths in the hospital and 36 perinatal deaths in the community; the controls were 812 liveborn, normal-birth-weight infants in the hospital, and 1505 liveborn infants who survived for the first 7 days after birth in the community. The odds ratio (OR) of perinatal death associated with pesticide exposure was estimated using multiple logistic regression. There was a consistent and significant association between pesticide exposure and perinatal mortality in the hospital (adjusted OR = 1.9; 95% confidence interval (CI): 1.3-2.8) and the community populations (adjusted OR = 2.7; 95% CI: 1.1-6.4). The OR was significantly higher among women engaged in farming (3.6; 95% CI: 1.6-8.0), but not among women in nonfarming occupations (1.6; 95% CI: 0.8-3.3). The estimated attributable risks of perinatal death owing to pesticide exposure were 22.6% for hospital stillbirths and 15.7% for community perinatal deaths; but among women engaged in farming in the hospital population the attributable risks were substantially higher (34.5%).	Bulletin of the World Health Organization	71	3	317-21	Self-reported exposure			Case-control	Pesticides in general	offspring	doctor-diagnosed	Sudan	lmic
1159	T. Kauppinen, T. Partanen, R. Degerth and A. Ojajarvi	Pancreatic cancer and occupational exposures	1995	We conducted a nationwide case-control study in Finland to identify occupational risk factors for pancreatic cancer. We constructed the occupational exposure histories for 595 incident cases of primary exocrinic cancer of the pancreas and of 1,622 cancer controls, using three different methods. We found elevated odds ratios (OR) for ionizing radiation [OR = 4.3; 95% confidence interval (CI) = 1.6-11.4], nonchlorinated solvents (OR = 1.6-1.8), and pesticides (OR = 1.7; 95% CI = 0.8-3.4). Asbestos, chromates, cleaning agents, waxes, polishes, and most other exposures were not meaningfully associated with pancreatic cancer. Inorganic dust containing crystalline silica (OR = 2.0; 95% CI = 1.2-3.5), heat stress (OR = 2.2; 95% CI = 0.8-6.6), and rubber chemicals including acrylonitrile (OR = 2.1; 95% CI = 0.9-4.7) emerged as previously unsuspected risk factors. Occupational exposure probably has a small role in the etiology of pancreatic cancer in the present-day industrialized or postindustrial work environment.	Epidemiology	6	5	498-502	Job exposure matrix			Case-control	Pesticides in general	cancer	doctor-diagnosed	Finland	hic

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1160	T. Koeman, Slottje; , Leo; , Huss; , Peters; Bausch, Goldbohm; Brandt Van, Der; , Kromhout; , Vermeulen	Occupational exposures and amytrophic lateral sclerosis mortality in a large prospective cohort	2013	Objectives This study aims to study multiple occupational exposures and their possible associations with Amyotrophic Lateral Sclerosis (ALS) mortality within the Netherlands Cohort Study (NLCS). Methods For this case-cohort analysis, 120,852 persons aged 55 to 69 years at time of enrollment in 1986 were followed up (17.3 yrs) for ALS mortality through linkage with Statistics Netherlands. Information on occupational history and potential confounders such as sex, age, smoking, alcohol use, BMI, physical activity and educational level were collected at baseline through a self-administered questionnaire. Occupations were coded using the International Standard Classification of Occupations (ISCO-88). Occupational exposures were assigned through several job-exposure matrices (JEMs): ALOHA-JEM (solvents, pesticides), DOM-JEM (diesel exhaust, metals), an extremely low frequency magnetic fields (ELF-MF)-JEM and an electrical shock-JEM. Assigned exposure levels were ordinal (background or no exposure, low exposure, high exposure). Exposure measures included 'ever exposure' (ever had a job with high or low exposure) and cumulative exposure. Associations between occupational exposures and ALS mortality were analysed separately for men and women, using Cox-regression. Hazard ratios (HR) and 95% confidence intervals (CI) were estimated using attained age as underlying time scale. Results 79 cases of ALS were identified in men and 62 in women. In men, ever a job with ELF-MF exposure versus background showed an association with ALS-mortality (ever low HR: 1.51 (95% CI 0.93 - 2.45); ever high HR: 1.95 (95% CI 0.92 - 4.16), and an exposure-response relationship in cumulative exposure (HR third tertile of exposed: 1.87 (95% CI 1.04 - 3.33). Exposure to solvents also showed some significant associations, but no clear exposure-response relationship. Including exposure to electrical shocks or chlorinated solvents into the model only marginally changed the association between ELF-MF and ALS mortality. Conclusions Of the occupational exposures analysed in this study, only occupational ELF-MF exposure showed a consistent association with ALS mortality.	Occupational and Environmental Medicine	70	NA	NA	Job exposure matrix			Cohort (prospective)	Type of pesticide	mortality (all cause)	doctor-diagnosed	Netherlands	hic
1161	T. Leet, J. Acquavella, C. Lynch, M. Anne, N. S. Weiss, T. Vaughan and H. Checkoway	Cancer incidence among alachlor manufacturing workers	1996	A historical cohort study was conducted to evaluate cancer incidence among chemical workers with occupational and environmental exposure to alachlor, the active ingredient in a family of pre-emergent acetanilide herbicides. The study followed 943 workers with at least 1 year of cumulative employment at the Monsanto plant in Muscatine, Iowa, from startup of the alachlor manufacturing process in March 1968 through December 1990. Approximately 96% of all workers were successfully traced to determine their last known residence and cancer status. Eighteen workers were diagnosed with cancer during the follow-up period, based on pathology information from the statewide cancer registry maintained by the State Health Registry of Iowa. The standardized incidence ratio for all cancers was 1.5 (95% CI 0.9-2.4) for all workers exposed to alachlor, which was due primarily to elevated rates for colorectal cancer and chronic myeloid leukemia. Workers with 5 or more years in estimated high alachlor exposure jobs had elevated rates of colorectal cancer (3 cases, SIR = 5.2, 95% CI 1.1-15.1). Interpretation of the study results is limited by the small size of the study population, minimal length of follow-up, and current information concerning alachlor metabolism in primates and humans. Nonetheless, the findings suggest the need for continued evaluation of this and other alachlor-exposed cohorts.	American Journal of Industrial Medicine	30	3	300-6	Environmental air monitoring	Expert case-by-case assessment		Cohort (retrospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
1162	T. Lifeng, W. Shoulin, J. Junmin, S. Xuezhao, L. Yannan, W. Qianli and C. Longsheng	Effects of fenvalerate exposure on semen quality among occupational workers	2006	PURPOSE: The purpose of the study was to observe the effects of fenvalerate exposure on the semen quality of occupational workers. MATERIALS AND METHODS: Thirty-two male workers who were exposed to fenvalerate and 46 male administrators in the office in the same pesticide factory were selected as the exposure group and internal control group, respectively, and 22 male administrators in a center for disease control served as the external control group. In order to evaluate the exposure levels, the concentration of fenvalerate, toluene and xylene in the ambient air of the work place in these three groups were monitored simultaneously for 3 consecutive days. Moreover, the amount of fenvalerate in individual sampling and dermal contamination were evaluated in the exposure group and external control group. After the semen was collected according to the standard method, the workers' semen qualities were analyzed. RESULTS: Concentration of fenvalerate in the exposure areas was 21.55 x 10(-4) mg/m(3). The fenvalerate concentration in individual samplings in the exposure areas was 0.11 mg/m(3). The dermal contamination for workers in the fenvalerate exposure area was 0.05 mg/m(3). Fenvalerate was not detected in individual samplings collected in external areas. Sperm motion parameters through routine semen analysis in the exposure group were decreased significantly, and the abnormality rate of viscidity and coagulation was increased significantly as compared with the internal and the external control groups ($p < .05$ or $p < .01$). Furthermore, sperm progression and beat cross frequency (BCF) (4.20 +/- 1.68 Hz) in the exposure group were also significantly lower than those in the external control group by computer-assisted sperm motility analysis (CASA) ($p < .05$). CONCLUSION: Occupational exposure to fenvalerate could affect the semen quality of the workers, but the conclusion warrants further complete investigation due to various limitations of the study.	Contraception	73	1	33756	Environmental air monitoring			Cohort (prospective)	Specific active ingredient	reproductive	medical test result	NA	NA
1163	T. M. Farahat, G. M. Abdelrasoul, M. M. Amr, M. M. Shebl, F. M. Farahat and W. K. Anger	Neurobehavioural effects among workers occupationally exposed to organophosphorous pesticides	2003	AIMS: To identify neurobehavioural deficits among workers exposed to organophosphorous (OP) pesticides in their occupation. METHODS: This study was conducted during the period when pesticides were applied to cotton crops in the fields in Menoufiya Governorate, Egypt. Fifty two occupationally exposed male workers were compared to 50 unexposed male controls who were similar in age, socioeconomic class, and years of education (> or =12 years). All participants completed a questionnaire (assessing personal, occupational, and medical histories), general and neurological clinical examination, neurobehavioural test battery (including tests for verbal abstraction, problem solving, attention, memory, and visuomotor speed), personality assessment, and serological analysis for serum acetylcholinesterase. RESULTS: After correcting for confounders of age and education, the exposed participants exhibited significantly lower performance than controls on six neurobehavioural tests (Similarities, Digit Symbol, Trailmaking part A and B, Letter Cancellation, Digit Span, and Benton Visual Retention). A longer duration of work with pesticides was associated with lower performance on most neurobehavioural tests after adjusting for multiple comparisons. Although serum acetylcholinesterase was significantly lower in the exposed than the control participants, it was not significantly correlated with either neurobehavioural performance or neurological abnormalities. CONCLUSIONS: Occupational exposure to OP pesticides was associated with deficits in a wider array of neurobehavioural functions than previously reported, perhaps because of higher exposure in this population. Moderate chronic OP exposure may not only affect visuomotor speed as reported previously, but also verbal abstraction, attention, and memory.	Occupational & Environmental Medicine	60	4	279-86	Biomonitoring (blood)			Cross-sectional	Chemical class	neurological	medical test result	Egypt	lmic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1164	T. M. Saldana, O. Basso, D. D. Baird, J. A. Hoppin, C. R. Weinberg, A. Blair, M. C. Alavanja and D. P. Sandler	Pesticide exposure and hypertensive disorders during pregnancy	2009	BACKGROUND: Hypertensive disorders of pregnancy, including pregnancy-induced hypertension (PIH) and preeclampsia (PE), complicate 2-8% of pregnancies. Few studies have examined environmental risk factors in relation to these conditions. OBJECTIVES: Our goal was to examine whether pesticide exposure during pregnancy was associated with hypertensive disorders of pregnancy. METHODS: We analyzed self-reported data from 11,274 wives of farmers enrolled in the Agricultural Health Study (AHS) between 1993 and 1997. Using logistic regression models, we estimated the adjusted odds ratios (AORs) for PIH and PE associated with pesticide-related activities during the first trimester of pregnancy. RESULTS: First-trimester residential and agricultural activities with potential exposure to pesticides were associated with both PIH [residential AOR = 1.27; 95% confidence interval (CI), 1.02-1.60; agricultural AOR = 1.60; 95% CI, 1.05-2.45] and PE (residential AOR = 1.32; 95% CI, 1.02-1.70; agricultural AOR = 2.07; 95% CI, 1.34-3.21). CONCLUSIONS: Exposure to pesticides during pregnancy may increase the risk of hypertensive disorders of pregnancy. Laboratory research may provide insights into relationships between pesticide exposure and hypertensive diseases of pregnancy.	Environmental Health Perspectives	117	9	1393-6	Self-reported exposure			Cross-sectional	Pesticides in general	circulatory	self-reported	USA	hic
1165	T. M. Saldana, O. Basso, J. A. Hoppin, D. D. Baird, C. Knott, A. Blair, M. C. Alavanja and D. P. Sandler	Pesticide exposure and self-reported gestational diabetes mellitus in the Agricultural Health Study	2007	OBJECTIVE: To examine the association between pesticide use during pregnancy and gestational diabetes mellitus (GDM) among wives of licensed pesticide applicators. RESEARCH DESIGN AND METHODS: Using data from the Agricultural Health Study (AHS), we estimated the association between self-reported pesticide-related activities during the first trimester of the most recent pregnancy and GDM among 11,273 women whose pregnancy occurred within 25 years of enrollment. RESULTS: A total of 506 (4.5%) women reported having had GDM. Women who reported agricultural pesticide exposure (mixing or applying pesticides to crops or repairing pesticide application equipment) during pregnancy were more likely to report GDM (odds ratio [OR] 2.2 [95% CI 1.5-3.3]). We saw no association between residential pesticide exposure (applying pesticides in the home and garden during pregnancy) and GDM (1.0 [0.8-1.3]). Among women who reported agricultural exposure during pregnancy, risk of GDM was associated with ever-use of four herbicides (2,4,5-T; 2,4,5-TP; atrazine; or butylate) and three insecticides (diazinon, phorate, or carbofuran). CONCLUSIONS: These findings suggest that activities involving exposure to agricultural pesticides during the first trimester of pregnancy may increase the risk of GDM.	Diabetes Care	30	3	529-34	Self-reported exposure			Cross-sectional	Specific active ingredient	endocrine/nutritional/metabolical	self-reported	USA	hic
1166	T. M. Schnorr, C. C. Lawson, E. A. Whelan, D. A. Dankovic, J. A. Deddens, L. A. Piacitelli, J. Reefhuis, M. H. Sweeney, L. B. Connally and M. A. Fingerhut	Spontaneous abortion, sex ratio, and paternal occupational exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin	2001	There is conflicting research regarding an association between fetal death and paternal exposure to Agent Orange, a phenoxy herbicide widely used in Vietnam that was contaminated with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Men who worked in the U.S. factories that produced Agent Orange were exposed to TCDD at levels hundreds of times higher than TCDD levels in the general population. Wives of TCDD-exposed chemical workers and wives of nonexposed neighborhood referents were interviewed to determine reproductive history. Paternal serum TCDD level at time of conception was estimated for each pregnancy using serum samples taken in 1987. Estimated TCDD levels of workers during or after exposure were high (median, 254 ppt; range, 3-16,340 ppt) compared to referent levels (median, 6 ppt; range, 2-19 ppt). No association between paternal TCDD level at the time of conception and spontaneous abortion was observed among pregnancies fathered by workers with TCDD levels of < 20 ppt [odds ratio (OR) = 0.77; 95% confidence interval (CI), 0.48-1.22], 20 to < 255 ppt (OR = 0.81; 95% CI, 0.40-1.63), 255 to < 1,120, (OR = 0.69; 95% CI, 0.30-1.58), and >or= 1,120 ppt (OR = 0.95; 95% CI, 0.42-2.17) compared to pregnancies fathered by referents. The sex ratio [males/(males + females)] of offspring also did not differ by TCDD exposure (0.53 and 0.54 among workers and referents, respectively). We did not find an association between paternal serum TCDD level and spontaneous abortion or sex ratio of offspring in this population. The estimated TCDD levels in this exposed worker population were much higher than in other studies, providing additional evidence that paternal TCDD exposure does not increase the risk of spontaneous abortion at levels above those observed in the general population. The study could not evaluate the effect of father's childhood or prenatal TCDD exposure on subsequent sex ratio.	Environmental Health Perspectives	109	11	1127-32	Self-reported job history	Biomonitoring (blood)		Cross-sectional	Pesticides in general	reproductive	medical test result	USA	hic
1167	T. N. Wafa, K.; Amel, N.; Ikbal, C.; Insaf, T.; Asma, K.; Hedi, M. A.; Mohamed, H.	Oxidative stress, hematological and biochemical alterations in farmers exposed to pesticides	2013	In this study, a cohort of farmers from the Mateur region in the North of Tunisia, were interviewed and examined for the biochemical effects of pesticides. We studied their haematological profile, lipid parameters, serum markers of nephrotoxicity and hepatotoxicity. We also evaluated the activities of Butyrylcholinesterase (BChE), Acetylcholinesterase (AChE) and thiolactonase-paroxonase (PON). Moreover, lipid peroxidation and activities of antioxidant enzymes superoxide dismutase (SOD) and catalase (CAT) were determined. The duration of pesticide use and the farmers' age were considered in the analysis. Our results revealed significant differences in some haematological parameters, in liver and kidney functions, in the lipidic status of the pesticide-exposed group. We also reported an increase in the index of incidence of cardiovascular risk in farmer populations. A significant decrease in AChE, BChE and PON levels was found among farmers. Lipid peroxidation, however, increased. The activities of SOD and CAT were remarkably elevated in farmer populations. There was a significant relation between changes in biological markers, the duration of pesticide use and the farmers' age. This study indicates that a long-term exposure to pesticides may play an important role in the development of vascular diseases via metabolic disorders of lipoproteins, lipid peroxidation and oxidative stress, inhibition of BChE and decrease in thiolactonase-PON levels.	Journal of Environmental Science & Health - Part B: Pesticides, Food Contaminants, & Agricultural Wastes	48	12	1058-69	Biomonitoring (blood)			Cohort (prospective)	Chemical class	genetic (biomarkers)	medical test result	Tunisia	lmic
1168	T. Nurminen, K. Rantala, K. Kurppa and P. C. Holmberg	Agricultural work during pregnancy and selected structural malformations in Finland	1995	We studied the relation between birth defects and maternal agricultural work in a nationwide time- and area-matched case-referent series of 1,306 pairs of infants (581 orofacial clefts, 365 central nervous system defects, 360 skeletal defects) obtained through the Finnish Register of Congenital Malformations. We supplemented the Register data, including the mothers' latest and previous pregnancies, diseases, consumption of drugs and alcohol, smoking habits, and the like, with detailed interviews on the mothers' work conditions. When all of the birth defects were pooled and agricultural work was compared with nonagricultural work in the first trimester of pregnancy, the adjusted odds ratio was 1.4 [95% confidence interval (CI) = 0.9-2.0]. For orofacial clefts, the corresponding odds ratio was 1.9 (95% CI = 1.1-3.5). An industrial hygienist's blinded assessment indicated that seven mothers of infants with orofacial clefts and three reference mothers had been exposed to pesticides in agricultural work; the adjusted odds ratio for work with pesticide exposure, when compared with unexposed agricultural work, was 1.9 (95% CI = 0.4-8.3). Exposure to solvents did not explain the observed association.	Epidemiology	6	1	23-30	Expert case-by-case assessment	Self-reported job history		NA	Pesticides in general	offspring	doctor-diagnosed	Finland	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1169	T. P. Kauppinen, T. J. Partanen, S. G. Hernberg, J. I. Nickels, R. A. Luukkonen, T. R. Hakulinen and E. I. Pukkala	Chemical exposures and respiratory cancer among Finnish woodworkers	1993	A case-control study of respiratory cancer, nested within a cohort of male woodworkers, was updated in Finland. The update extended the initial follow up of 3805 workers from 19 plants to 7307 workers from 35 plants. Each case of respiratory cancer (n = 136) diagnosed between 1957 and 1982 within the cohort was matched by year of birth with three controls (n = 408) from the cohort. Chemical exposures were assessed for the cases and the controls by a plant and period specific job exposure matrix. An excess of respiratory cancer was associated with phenol. Concomitant exposures to several other agents occurred as well, however, and no exposure-response relation for phenol was seen. An excess risk and an increasing exposure-response relation were found for engine exhaust from petrol and diesel driven factory trucks. The excess risk associated with pesticides was lower than in our previous study, an indication of qualitative and quantitative differences in exposure between the initial and augmented cohorts. Slightly increased risks were found for terpenes and mould spores, which may be due to chance although the contribution of occupational exposure cannot be ruled out. Exposure to wood dust, mainly from pine, spruce and birch, at a level of about 1 mg/m3, was not associated with lung cancer, upper respiratory cancer, or adenocarcinoma of the lung.	British Journal of Industrial Medicine	50	2	143-8	Job exposure matrix			Case-control	Pesticides in general	cancer	doctor-diagnosed	Finland	hic
1170	T. Parron, A. F. Hernandez and E. Villanueva	Increased risk of suicide with exposure to pesticides in an intensive agricultural area. A 12-year retrospective study	1996	Several reports have suggested that exposure to agricultural pesticides (mainly chronic exposure to organophosphates) produces depression, and depression is a major risk factor for suicide. A retrospective epidemiological study of 251 suicide cases was undertaken to explore the possible relationship between the high suicide rates in an intensive agricultural area, and a specific group of population at risk, namely farmers with chronic exposure to pesticides, who are at risk to develop mood disorders (mainly depression). Our data show that the suicide rate in that area is significantly higher than the suicide rates from other geographic areas with very similar socioeconomic and demographic features. In addition, the mortality from suicide in this population (farmers) does differ significantly from that of the rest of the population.	Forensic Science International	79	1	53-63	Job title			Cohort (retrospective)	Job title	other	doctor-diagnosed	NA	NA
1171	T. Parron, A. F. Hernandez, A. Pla and E. Villanueva	Clinical and biochemical changes in greenhouse sprayers chronically exposed to pesticides	1996	1 This study was conducted with the aim of evaluating the impact on health produced by the use of different types of pesticides in greenhouses. It is based on the need to practice and develop biological monitoring techniques to assess exposure and predict health risk in workers occupationally exposed to pesticides. 2 Two groups of greenhouse workers with either high or low exposure to a combination of pesticides was taken in Almeria, a Spanish province where cultures under plastic are very extended. 3 One hundred and five sprayers were interviewed to collect information about symptoms and signs related to past exposures. Each pesticide sprayer was examined by a physician, and a blood sample was drawn for plasma and red blood cell cholinesterases, complete blood count, and liver and renal function tests. 4 Exposure of workers to a combination of pesticides resulted in 37% of the workers showing toxic signs and symptoms. The main toxic effect observed were a high incidence of spontaneous abortion, depression, and certain neurologic disorders like headache, tremor and paraesthesia. 5 The major analytical change was a decrease of the mean corpuscular haemoglobin concentration in 38% of the cases. However, no significant decrease in both serum and erythrocyte cholinesterase activities was observed. 6 The sprayers were not usually aware of the potential hazards of pesticides and did not try their best to maintain personal hygiene.	Human & Experimental Toxicology	15	12	957-63	Job title			Cross-sectional	Job title	endocrine/nutritional/metabolical	self-reported	Spain	hic
1172	T. R. Tonozzi and L. A. Layne	Hired crop worker injuries on farms in the United States: A comparison of two survey periods from the National Agricultural Workers Survey	2016	BACKGROUND: Hired crop workers in the United States are at high risk of occupational injury. Targeted surveillance is important for effective occupational safety efforts. METHODS: The National Agricultural Workers Survey was utilized to collect injury data during the years 1999, 2002-2004 (period I) and 2008-2010 (period II). RESULTS: The overall injury rate declined between the two periods from 4.3 to 2.9/100 per full-time week-based equivalents (FTEWB). Injury rates remained high during both periods for those with greater than 20 years farm experience (3.6 and 3.8/100 FTEWB) and pesticide handling work (4.9 and 5.0/100 FTEWB). Overexertion, contact with objects and equipment, and falls from height were common during both periods. Older workers comprised a greater proportion of injury cases in period II. CONCLUSION: Overexertion that leads to sprains/strains, dangerous ladder use, and pesticide use should be targeted as important risk exposures on the farm.	American Journal of Industrial Medicine	59	5	408-23	Self-reported exposure			Cohort (prospective)	Pesticides in general	other	other	USA	hic
1173	T. S. Koeman, L. J.; van den Brandt, P. A.; Slottje, P.; Huss, A.; Peters, S.; Kromhout, H.; Vermeulen, R.	Occupational exposures and risk of dementia-related mortality in the prospective Netherlands Cohort Study	2015	BACKGROUND: Occupational exposures may be associated with non-vascular dementia. METHODS: We analyzed the effects of occupational exposures to solvents, pesticides, metals, extremely low frequency magnetic fields (ELF-MF), electrical shocks, and diesel motor exhaust on non-vascular dementia related mortality in the Netherlands Cohort Study (NLCS). Exposures were assigned using job-exposure matrices. After 17.3 years of follow-up, 682 male and 870 female cases were available. Analyses were performed using Cox regression. RESULTS: Occupational exposure to metals, chlorinated solvents and ELF-MF showed positive associations with non-vascular dementia among men, which seemed driven by metals (hazard ratio ever high vs. background exposure: 1.35 [0.98-1.86]). Pesticide exposure showed statistically significant, inverse associations with non-vascular dementia among men. We found no associations for shocks, aromatic solvents, and diesel motor exhaust. CONCLUSIONS: Consistent positive associations were found between occupational exposure to metals and non-vascular dementia. The finding on pesticides is not supported in the overall literature.	American Journal of Industrial Medicine	58	6	625-35	Job exposure matrix			Cohort (prospective)	Type of pesticide	mortality (all cause)	doctor-diagnosed	Netherlands	hic
1174	T. S. Koeman, P.; Schouten, L. J.; Peters, S.; Huss, A.; Veldink, J. H.; Kromhout, H.; van den Brandt, P. A.; Vermeulen, R.	Occupational exposure and amyotrophic lateral sclerosis in a prospective cohort	2017	OBJECTIVE: To prospectively study suspected occupational risk factors for amyotrophic lateral sclerosis (ALS). METHODS: For this case-cohort analysis within the prospective Netherlands Cohort Study, 58279 men and 62573 women aged 55-69 years at enrolment in 1986 were followed up for 17.3 years on ALS mortality. Information on occupational history and potential confounders were collected at baseline through a self-administered questionnaire and entered for a random subcohort (2092 men and 2074 women) and ALS deaths (76 men and 60 women). Occupational exposure to solvents, pesticides, metals, extremely low frequency magnetic fields (ELF-MFs) and electrical shocks was estimated by means of job exposure matrices (JEMs). Associations between ever/never occupationally exposed and cumulative exposure and ALS mortality were analysed by gender using Cox regression. RESULTS: Occupational exposure to ELF-MF showed a possible association with ALS mortality among men: HR for ever holding a job with high exposure versus background 2.19 (95% (CI): 1.02 to 4.73) and HR for the highest tertile of cumulative exposure versus background 1.93 (95% CI 1.05 to 3.55). INTERPRETATION: These results strengthen the evidence suggesting a positive association between ELF-MF exposure and ALS. We did not replicate earlier positive findings for other occupational exposures.	Occupational & Environmental Medicine	74	8	578-585	Job exposure matrix			Cohort (prospective)	Type of pesticide	mortality (all cause)	doctor-diagnosed	Netherlands	hic

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1175	T. Sorahan	Multiple myeloma and glyphosate use: A re-analysis of US Agricultural Health Study data	2012	A follow-up study of 57,311 US pesticide applicators enrolled in the US Agricultural Health Study (AHS) identified 32 cases of multiple myeloma (De Roos et al., 2005). Analyses in relation to ever-use of glyphosate produced disparate findings. Risks were unexceptional (RR = 1.1) when all study subjects were included, with adjustment for age only. However a non-significant elevated risk (RR = 2.6) was reported after adjustment formanyvariables and when subjects with missing data for any of these variables were excluded (22 cases remaining). Such differences are unusual and it seemed important to understand how they came about and which result should be given more importance. A Poisson regression analysis similar to that employed by the original researchers was used, except that subjects with missing data were not excluded. Instead 'not known' categories were used for each variable (e.g. lifetime smoking now had four possible values: never, no more than 12 pack-years, more than 12 pack-years, not known). With analysis of the full dataset, adjustment for age only produced a relative risk of 1.1 (95% CI 0.5-2.4) for ever use of glyphosate. Additional adjustment for education, smoking, alcohol use, family history of cancer and use of ten other pesticides had little effect (RR = 1.2, 95% CI 0.5 to 2.9). The exclusion of subjects with missing data for aetiologically irrelevant variables is not to be recommended, and currently, there is no good evidence in the AHS for a link between multiple myeloma and ever use of glyphosate.	Toxicology Letters	211	NA	S127	Algorithm/model	Self-reported exposure		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
1176	T. V. S. Chaves, M. T. Islam, M. O. de Moraes, M. de Alencar, D. C. V. Gomes, R. M. de Carvalho, S. W. Maluf, F. P. de Moura do Amaral, M. Paz, G. S. Cerqueira, H. M. L. Rolim, E. S. J. M. de Castro, A. A. de Carvalho Melo-Cavalcante and M. E. A. de Moraes	Occupational and life-style factors-acquired mutagenicity in agric-workers of northeastern Brazil	2017	Pesticides are a complex mixture of chemicals used to protect crops from a number of pests and diseases. They have been considered as potential mutagenic agents. This study aims at evaluation of the mutagenic effect of pesticide exposure to agricultural workers through chromosomal aberrations (CA) and micronucleus (MN) assay in peripheral blood lymphocytes and oral mucosal cells, respectively. The exposed group was consisted with 97 farmers, while the control (un-exposed) group consisted of 55. The results showed a significant ($p < 0.05$) increase in frequency of CA and MN in the exposed group. Both CA and MN profiles were linked to a significant ($p < 0.05$) co-relation with the confounding factors such as smoking habits, alcohol, vegetables, tea/coffee, vitamins, and sweetener consumptions. More cytogenetic events were denoted in smoking and alcohol consumption as well as non-personal protective equipment (non-PPE) and low/no vegetables user farmers. In conclusion, a deficiency of dietary and medicaments-derived antioxidants, while consumption of alcohol and tobacco, as well as effects of radiation, heavy metal poisoning (especially from sweeteners), and non-PPE using habits, may contribute cytogenetic damage to the workers.	Environmental Science & Pollution Research	24	18	15454-15461	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Brazil	umic
1177	T. Zheng, S. H. Zahm, K. P. Cantor, D. D. Weisenburger, Y. Zhang and A. Blair	Agricultural exposure to carbamate pesticides and risk of non-Hodgkin lymphoma	2001	Recent epidemiological studies have suggested an increased risk of non-Hodgkin lymphoma (NHL) from carbamate insecticide use among farmers. To further explore the possible relationships, we conducted a pooled analysis of three population-based case-control studies conducted in four midwestern states in the United States. A total of 985 white male subjects and 2895 control subjects were included in this analysis. Unconditional logistic regression was used to estimate the association and control for confounding. Compared with nonfarmers, farmers who had ever used carbamate pesticides had a 30% to 50% increased risk of NHL, whereas farmers without carbamate pesticide use showed no increased risk. Analyses for individual carbamate pesticides found a more consistent association with Sevin but not carbofuran, butylate, or S-ethyl dipropylthiocarbamate plus protectant. Among farmers using Sevin, the risk of NHL was limited to those who personally handled the product, those who first used the product for > or = 20 years before their disease diagnosis, and those who used the product for a longer period. These associations persisted after adjusting for other major classes of pesticides. These results suggest an increased risk of NHL associated with carbamate pesticide use, particularly Sevin. Further investigation of the association is warranted.	Journal of Occupational & Environmental Medicine	43	7	641-9	Self-reported exposure			Case-control	Chemical class	cancer	doctor-diagnosed	USA	hic
1178	U. K. P. Misra, M.; Pandey, C. M.	A study of cognitive functions and event related potentials following organophosphate exposure	1994	To study the cognitive changes following chronic occupational exposure to organophosphate (OP) pesticides, a clinical and neurophysiological study was performed on 31 workers engaged in spraying fenthion, an OP pesticide. The mean age of the workers was 32.1 years (range 19-55) and mean duration of exposure 10.5 years (range 1-14). The workers reported mild transient symptoms after spraying. There was no clinical evidence suggestive of excessive cholinergic activity. Clinical psychometry revealed significant changes in Benton visual retention test, memory quotient, and Alexander's Passalong Test. Serum AChE level was 27% less in the exposed group compared to the controls. P3 of event related potentials were elicited in 28 subjects, P3 latency though was prolonged in one subject only but the group difference was significant. The amplitude of P3 however did not show significant difference. The results suggest subtle subclinical effect of chronic fenthion exposure on the cognitive functions and event related potentials.	Electromyography & Clinical Neurophysiology	34	4	197-203	Biomonitoring (blood)			Cohort (prospective)	Chemical class	mental disorders	self-reported	NA	NA
1179	U. K. Priyadharshini, R. Latha, U. Kavitha and N. Nirmala	Effects of organophosphorus pesticides on cardiorespiratory parameters among the farmers	2017	Introduction: Indiscriminate use and improper handling of synthetic pesticides in agriculture have resulted in serious problems such as asthma, wheeze and chronic bronchitis among the farmers. Though number of studies have been done on pesticide exposure and its effect on cardiorespiratory parameters in Northern India, only few studies were done in Southern India, thus this study was chosen. Aim: To find the cardiorespiratory changes in farm workers exposed to organophosphorus pesticides. Materials and Methods: Peak Expiratory Flow Rate (PEFR), blood pressure, pulse rate were measured among 35 farm workers of Palayam and Naduveerpattu village of Cuddalore district and 35 age, sex, BMI matched controls were taken from urban area and the same parameters were measured in both groups from 10 am-12 am in the morning. History of use of personal protective equipments like face mask, eye mask, special clothes, shoes, hat, history of respiratory symptoms and hygienic work practices was also obtained from the farmers. Chi-square test was used to analyse the qualitative data. All values were expressed as Mean<U+00AC><U+00B1>SD. Students unpaired t-test was used to compare PEFR between two groups and to compare the duration of exposure and PEFR using GRAPH PAD PRISM. The $p<0.05$ was considered to be statistically significant. Results: There was a significant decrease in PEFR among the farmers ($p<0.001$) compared to the controls. On comparing the duration of exposure of pesticide and the PEFR values by unpaired Students t-test, there was a significant difference with p-value of 0.03. Blood Pressure did not show any significant difference between the two groups. But the pulse rate was significantly decreased among the farmers ($p<0.001$) which could be due to their regular physical activity. About 71% of the farmers used personal protective equipments. Conclusion: Thus, chronic exposure to organophosphorus pesticides has an impact on PEFR among the farmers.	Journal of Clinical and Diagnostic Research	11	9	CC01-CC04	Self-reported exposure			Cross-sectional	Chemical class	circulatory	medical test result	India	lmic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1180	U. Undeger and N. Basaran	Effects of pesticide exposure on serum immunoglobulin and complement levels	2001	Serum immunoglobulins (IgG, IgA and IgM), C3 and C4 complement protein levels were examined in the male workers of the municipality who routinely applied pesticides for at least one year, and compared to healthy male controls in order to determine whether immune alterations were evident in the pesticide-exposed workers. Pyrethroids were the most commonly used pesticides for the last 3 years. Serum immunoglobulins and complement levels were measured by turbidimetry. Serum IgG, IgA, IgM and C3 complement levels were found to be unchanged when compared to controls whereas a significant decrease was observed in serum C4 complement levels of the workers.	Immunopharmacology & Immunotoxicology	23	3	437-43	Job title			Cross-sectional	Chemical class	hematological	medical test result	Turkey	umic
1181	U. Undeger and N. Basaran	Assessment of DNA damage in workers occupationally exposed to pesticide mixtures by the alkaline comet assay	2002	The potential genetic hazard of pesticides to human beings is of great concern in occupational and environmental settings because of the widespread use of these chemicals for domestic and industrial applications. Various studies have revealed a significantly elevated risk for particular tumours in humans exposed to some pesticides. Results from the biological monitoring or cytogenetic methods for the detection of health risks to pesticides have given both positive and negative results of mutagenicity. In this study DNA damage in peripheral lymphocytes of 33 pesticide-exposed workers employed in the municipality of Ankara (Turkey) for at least 1 year was examined by alkaline single-cell gel electrophoresis, the 'comet' technique. Results were compared with those from 33 controls of comparable age, sex and smoking habits, which were not occupationally exposed to pesticides. Work characteristics of the exposed workers and the use of personnel protective measures were also investigated. The DNA damage observed in lymphocytes of the workers was significantly higher than that in the controls (P<0.001). The observed DNA damage was found to be significantly lower (P<0.001) in workers applying some of the necessary individual safety protections during their work. Cigarette smoking was not related to increases in DNA damage; also, no significant association was found between the duration of occupational exposure to pesticides and the degree of DNA damage.	Archives of Toxicology	76	7	430-6	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Turkey	umic
1182	V. Andre, P. Lebailly, D. Pottier, E. Deslandes, M. De Meo, M. Henry-Amar and P. Gauduchon	Urine mutagenicity of farmers occupationally exposed during a 1-day use of chlorothalonil and insecticides	2003	OBJECTIVES: A study was conducted to evaluate the genotoxic impregnation consecutive to a 1-day open-field spraying of pesticides. METHODS: From 14 farmers (five smokers and nine non-smokers), three urine samples were collected at the end of the spraying season: the morning (S1) of the day of spraying, the evening (S2) and the morning (S3) of the following day. A fourth sample (S0) was obtained before the pesticide-handling period. Mutagenicity of urine extracts was evaluated with the Ames test, using strains TA97a, TA98, TA100 and TA102, with and without S9 mix. RESULTS: The ratio of induced vs spontaneous revertants (induction ratio) was > or =2 in five farmers (including three smokers), with only one strain responding in each. Applying the SALM software proposed by Kim and Margolin in combination with the ANOVA-Dunnett test on crude data (number of revertants), urine extracts were found to be mutagenic on at least one Salmonella strain in 57% and 96% of non-smokers and smokers, respectively. The proportion of mutagenic responses tended to increase from S1 to S3 (not statistically significant) in non-smokers only. Finally, there were no relationships between the relative changes in the number of revertants (adjusted for urine concentration) and any exposure parameters available: area sprayed, number of tanks prepared and time free of exposure to any pesticide. CONCLUSIONS: The lack of significant relationships between urine mutagenicity and exposure data argues against a direct role of the pesticides sprayed, on this impregnation. This result should be considered with caution since the number of farmers involved may limit the significance of the study.	International Archives of Occupational & Environmental Health	76	1	55-62	Biomonitoring (urine)			Cohort (prospective)	Chemical class	cancer	doctor-diagnosed	France	hic
1183	V. Chrysostome, F. Tison, F. Yekhlef, C. Sourgen, I. Baldi and J. F. Dartigues	Epidemiology of multiple system atrophy: a prevalence and pilot risk factor study in Aquitaine, France	2004	We investigated the prevalence of multiple system atrophy (MSA) in Gironde, France, through a network of 120 public and private specialists and assessed the relationship between some environmental factors and MSA in a case-control study involving 50 MSA patients, 50 Parkinson's disease (PD) patients and 50 healthy controls. The occupational exposure to pesticides was evaluated through a job-exposure matrix. On prevalence day (November 1, 1998), the crude prevalence of MSA in Gironde was 1.94/100,000 inhabitants. We found no significant relationship between occupational exposure to pesticides and MSA. PD patients were significantly less frequently ever-smokers than controls and the same tendency was observed for MSA patients. We also described the clinical features that heralded the disease among this nonselected population.	Neuroepidemiology	23	4	201-8	Job exposure matrix			Case-control	Pesticides in general	neurological	doctor-diagnosed	France	hic
1184	V. Daniel, W. Huber, K. Bauer, C. Suesal, C. Conradt and G. Opelz	Associations of blood levels of PCB, HCHS, and HCB with numbers of lymphocyte subpopulations, in vitro lymphocyte response, plasma cytokine levels, and immunoglobulin autoantibodies	2001	Pentachlorophenol (PCP), hexachlorocyclohexane-[alpha], -beta, and -[gamma] (HCH-[alpha], -beta, and -[gamma]), polychlorinated biphenyls (PCBs), and hexachlorobenzene (HCB) are widely distributed industrial chemicals. They are suspected to induce immunologic impairments in exposed individuals. We examined dose-response relationships of blood levels of these chemicals with cellular (numbers of lymphocyte subpopulations, in vitro lymphocyte response) or humoral (plasma cytokine levels, immunoglobulin autoantibodies) immunologic dysfunctions. We studied 146 patients who had been occupationally exposed primarily to PCBs for more than 6 months. Lymphocyte subpopulations, in vitro responses to mitogens and allogeneic stimulator cells, plasma neopterin, cytokines, soluble cytokine receptors, soluble adhesion molecules, anti-Ig autoantibodies, and liver transaminases were determined. Blood levels of the different compounds were strongly correlated with one another. There were only weak dose-response relationships between blood levels of PCBs with cellular immune parameters, and of HCHs and HCB with humoral immune parameters. An exception was the statistically significant negative association of HCB with interferon-[gamma] (IFN-[gamma]), indicating that HCB has a significant impact on Th1 lymphocytes. Patients with HCB blood levels above the mean of 1,109 ng/L more often had undetectable IFN-[gamma] blood levels than patients below the mean. Patients with increased PCB 138 (> 710 ng/L) had more frequently undetectable interleukin-4 blood levels than patients with PCB 138 below the mean, and patients with increased PCB 101 (> 31 ng/L) more often had low DR+ cell counts in the blood (< 190/microL) than patients with PCB 101 below the mean. To assess possible cumulative effects, we compared patients who had blood levels of all compounds below background with patients who had blood levels of all compounds above background. Patients with low or absent blood levels of the compounds studied had higher IFN-[gamma] plasma levels, providing some evidence for a cumulative effect of several weakly active compounds. In conclusion, exposure to PCBs, HCB, or HCHs is associated with weak immunologic abnormalities. These results contrast with those obtained in earlier studies of blood levels of PCP, which showed a strong dose-dependent relationship with immunologic impairments. Our data suggest that long-term exposure of patients to HCB suppresses IFN-[gamma] production.	Environmental Health Perspectives	109	2	173-8	Biomonitoring (blood)			Cohort (prospective)	Specific active ingredient	immunological	medical test result	Germany	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1185	V. F. Garry, B. Burroughs, R. Tarone and J. S. Kesner	Herbicides and adjuvants: an evolving view	1999	The present report examines the in vitro genotoxicity (micronucleus assay) of herbicides and adjuvants and reports on an in vivo human study on potential endocrine effects of pesticides, including herbicides. Adjuvants are used in conjunction with 2,4-dichlorophenoxy acetic acid (2,4-D) and other herbicides. Earlier pesticide applier survey results (n = 709) show that 59% of the applicators used adjuvants, and the majority of this group used paraffinic oils and/or surfactant mixtures. As a beginning effort to explore the role of adjuvants and herbicides in hormonally based reproductive effects, a prospective, controlled study was performed to analyze blood specimens from three different exposure groups (applicators using herbicides only; applicators using both herbicides and insecticides; and applicators using fumigants in addition to herbicides and insecticides; and a control group composed of other agricultural workers including organic farmers). The applicators and controls were age- and smoking-matched. Study subjects (n = 78) were tested before, during, and after completion of pesticide application season for the effects of pesticide products on hormone levels in the bloodstream. Of the applicator exposure groups examined, only the herbicide group showed significant endocrinologic differences from controls. Free testosterone levels were significantly elevated in post-season measurements (p = 0.032), and follicle-stimulating hormone (FSH) was significantly decreased at the height of the season (p = 0.016) and in the post-season (p = 0.010) as compared to controls. These endocrinologic findings are discussed in terms of their possible relationship to potential endocrine effects of herbicides, herbicide contaminants, and adjuvants. In vitro genotoxicity examination compared four different commercially available surfactant mixtures with 12 different commercial herbicide products, including six different chlorophenoxy herbicides. Only one herbicide yielded a significant dose-response curve. All four adjuvants showed positive dose-response effects. These preliminary data suggest that adjuvants are not inert but are toxicologically active components added to herbicide mixtures. Whether adjuvant toxicant effects are additive or are independent of herbicide effects is poorly understood.	Toxicology & Industrial Health	15	1	159-67	Self-reported exposure			Cohort (prospective)	Specific active ingredient	genetic (biomarkers)	medical test result	USA	hic
1186	V. F. Garry, D. Schreinemachers, M. E. Harkins and J. Griffith	Pesticide appliers, biocides, and birth defects in rural Minnesota	1996	Earlier studies by our group suggested the possibility that offspring of pesticide appliers might have increased risks of birth anomalies. To evaluate this hypothesis, 935 births to 34,772 state-licensed, private pesticide appliers in Minnesota occurring between 1989 and 1992 were linked to the Minnesota state birth registry containing 210,723 live births in this timeframe. The birth defect rate for all birth anomalies was significantly increased in children born to private appliers. Specific birth defect categories, circulatory/respiratory, urogenital, and musculoskeletal/integumental, showed significant increases. For the general population and for appliers, the birth anomaly rate differed by corp-growing region. Western Minnesota, a major wheat, sugar beet, and potato growing region, showed the highest rate of birth anomalies per/1000 live births: 30.0 for private appliers versus 26.9 for the general population of the same region. The lowest rates, 23.7/1000 for private appliers versus 18.3/1000 for the general population, occurred in noncorp regions. The highest frequency of use of chlorophenoxy herbicides and fungicides also occurred in western Minnesota. Births in the general population of western Minnesota showed a significant increase in birth anomalies in the same three birth anomaly categories as appliers and for central nervous system anomalies. This increase was most pronounced for infants conceived in the spring. The seasonal effect did not occur in other regions. The male/female sex ratio for the four birth anomaly categories of interest in areas of high phenoxy herbicide/fungicide use is 2.8 for appliers versus 1.5 for the general population of the same region (p = 0.05). In minimal use regions, this ratio is 2.1 for appliers versus 1.7 for the general population. The pattern of excess frequency of birth anomalies by pesticide use, season, and alteration of sex ratio suggests exposure-related effects in appliers and the general population of the crop-growing region of western Minnesota.	Environmental Health Perspectives	104	4	394-9	Job title			Cohort (prospective)	Job title	offspring	doctor-diagnosed	USA	hic
1187	V. F. Garry, J. T. Kelly, J. M. Sprafka, S. Edwards and J. Griffith	Survey of health and use characterization of pesticide appliers in Minnesota	1994	We surveyed 1,000 randomly selected state-licensed pesticide appliers to improve our understanding of pesticide use and its potential health effects. Participants were stratified by pesticide class (herbicides, insecticides, fungicides, fumigants) to determine potential differences in health characteristics among different pesticide groups. A subset of 60 applicators, divided by pesticide class used, were studied for exposure-related cholinesterase (ChE) depression. ChE depression in excess of 20% was most frequent in fumigant applicators who did enclosed-space application, in addition to other pesticide application procedures (p < .05). Survey data demonstrated that the prevalence of all common chronic diseases considered together was significantly increased (p = .015) in fumigant appliers, compared with all other pesticide use groups. The frequency of chronic lung disease was also significantly increased in the fumigant applier group (p = .027). Curiously, two cases of a rare hematopoietic neoplasm--hairy cell leukemia--were identified in our study group (annual incidence 0.67/100,000 in Minnesota). Whether there is an association between this unique tumor and agricultural work is uncertain, and further study is needed in this regard.	Archives of Environmental Health	49	5	337-43	Self-reported exposure			Cross-sectional	Type of pesticide	NA	self-reported	USA	hic
1188	V. F. Garry, R. E. Tarone, L. Long, J. Griffith, J. T. Kelly and B. Burroughs	Pesticide appliers with mixed pesticide exposure: G-banded analysis and possible relationship to non-Hodgkin's lymphoma	1996	To further investigate the possible relationships between agricultural pesticide exposure and the increased risk of non-Hodgkin's Lymphoma among farm workers in the north central United States, we performed G-banded chromosome analyses of peripheral blood from workers classified according to primary types of pesticide exposure: herbicides (n = 20), insecticides (n = 18), fnmigants (n = 23), and occupationally unexposed controls (n = 33). Significantly increased rearrangement frequencies were demonstrated in fumigant and insecticide appliers compared to control subjects. At certain chromosome bands there were significant excesses of breaks observed in pesticide appliers, but no breaks were observed in controls. Some of these bands contained genes with potential implications for cancer risk, including oncogenes and genes involved in tumor suppression and apoptosis. Of particular interest with regard to lymphoma risk were the excess rearrangements and breaks involving hand 14q32 in fumigant appliers and the excess breaks involving band 18q21 in herbicide appliers; translocations linking 14q32 and 18q21 are the most common rearrangements observed in non- Hodgkin's lymphoma patients. The potential pathobiological relevance of these cytogenetic events warrants additional investigation at the molecular level.	Cancer Epidemiology Biomarkers and Prevention	5	1	43420	Registers			Cross-sectional	Job title	cancer	doctor-diagnosed	USA	hic

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1189	V. F. Garry, S. E. Holland, L. L. Erickson and B. L. Burroughs	Male reproductive hormones and thyroid function in pesticide applicators in the Red River Valley of Minnesota	2003	In the present effort, 144 pesticide applicators and 49 urban control subjects who reported no chronic disease were studied. Applicators provided records of the season's pesticides used by product, volumes, dates, and methods of application. Blood specimens for examination of hormone levels were obtained in summer and fall. In the herbicide-only applicator group, significant increases in testosterone levels in fall compared to summer and also elevated levels of follicle-stimulating hormone (FSH) and luteinizing hormone (LH) in the fall were noted. With respect to fungicide use, in an earlier cross-sectional epidemiologic study, data demonstrated that historic fungicide use was associated with a significant alteration of the sex ratio of children borne to applicators. As before, among current study subjects it was noted that historic fungicide use was associated with increased numbers of girls being born. Lower mean total testosterone concentrations by quartile were also correlated with increased numbers of live-born female infants. A downward summer to fall seasonal shift in thyroid-stimulating hormone (TSH) concentrations occurred among applicators but not among controls. Farmers who had aerial application of fungicides to their land in the current season showed a significant shift in TSH values (from 1.75 to 1.11 mU/L). Subclinical hypothyroidism was noted in 5/144 applicators (TSH values >4.5 mU/L), but not in urban control subjects. Based on current and past studies, it was concluded that, in addition to pesticide exposure, individual susceptibility and perhaps economic factors may play a supporting role in the reported results.	Journal of Toxicology & Environmental Health Part A	66	11	965-86	Self-reported exposure			Cross-sectional	Type of pesticide	reproductive	medical test result	USA	hic
1190	V. F. Kahl, D. Simon, M. Salvador, S. Branco Cdos, J. F. Dias, F. R. da Silva, C. T. de Souza and J. da Silva	Telomere measurement in individuals occupationally exposed to pesticide mixtures in tobacco fields	2016	Occupational exposure to pesticides in tobacco fields causes genetic damage in farmers. The aim of this study was to analyze tobacco farmers chronically exposed to low doses of pesticides and nicotine (present in the tobacco leaves) in relation to absolute telomere length (aTL), and explore the influence of lifestyle characteristics, oxidative stress, and inorganic element levels. DNA was isolated from peripheral blood samples from agricultural workers and non-exposed individuals, and aTL was measured by quantitative real time polymerase chain reaction (qPCR) analysis. Oxidative stress (thiobarbituric acid reactive substances [TBARS], which measures oxidative damage to lipids; and toxic equivalent antioxidant capacity [TEAC], which measures total equivalent antioxidant capacity) was evaluated in serum, and inorganic element content was analyzed in whole blood through particle-induced X-ray emission technique. It was found that exposure to pesticides and tobacco smoking had significant effects on aTL. Individuals occupationally exposed to complex mixtures of pesticides in tobacco fields and individuals who smoked had decreased aTL compared with the non-exposed group. TBARS and TEAC were significantly elevated in the exposed group. There were no significant differences in inorganic elements. There was no evidence of an influence of age, gender, consumption of alcoholic beverages, or intake of fruits and vegetables on aTL within the groups. In addition, years of work in the tobacco field in the exposed group did not influence any of the variables analyzed. Although further studies were needed, these results suggested differences in telomere maintenance in tobacco farmers compared with the control group, indicating that telomere length may be a good biomarker of occupational exposure.	Environmental & Molecular Mutagenesis	57	1	74-84	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Brazil	umic
1191	V. Garaj-Vrhovac and D. Zeljezic	Evaluation of DNA damage in workers occupationally exposed to pesticides using single-cell gel electrophoresis (SCGE) assay. Pesticide genotoxicity revealed by comet assay	2000	The comet assay, also called the single-cell gel electrophoresis (SCGE) assay, is a rapid and sensitive method for the detection of DNA damage (strand breaks and alkali-labile sites) in individual cells. The assay is based on the embedding of cells in agarose, their lysis in alkaline buffer and finally subjection to an electric current. In the present study, alkaline SCGE was used to evaluate the extent of primary DNA damage and DNA repair in peripheral blood lymphocytes of workers employed in pesticide production. After the period of high pesticide exposure, lymphocytes of the occupationally exposed workers manifested increased tail length and tail moment compared to the control group. After the workers spent 6 months out of the pesticide exposure zone, both endpoints were still above that of the control but significantly decreased as compared to the results of the first analysis.	Mutation Research	469	2	279-85	Job title			Cohort (prospective)	Job title	genetic (biomarkers)	medical test result	NA	NA
1192	V. Garaj-Vrhovac and D. Zeljezic	Assessment of genome damage in a population of Croatian workers employed in pesticide production by chromosomal aberration analysis, micronucleus assay and Comet assay	2002	The widespread use of pesticides suggests that the evaluation of their genotoxicity should be extended using the different assays available. In the present study we used two standard cytogenetic methods (chromosomal aberration analysis and micronucleus assay) and the Comet assay as a relatively new and powerful technique. The study included 10 workers occupationally exposed to a complex mixture of pesticides (atrazine, alachlor, cyanazine, 2,4-dichlorophenoxyacetic acid, malathion) during their production and 20 control subjects with no history of exposure to any physical or chemical agents. For the chromosomal aberration analysis, whole blood was cultivated for 48 h, whereas for the micronucleus assay, whole blood was cultivated for 72 h. For the comet assay whole blood was embedded in agarose on a microscope slide, lysed with detergent, denaturated and subjected to alkaline electrophoresis. Damage to DNA was evaluated by measuring tail length and calculating the tail moment. A significantly increased number of chromatid and chromosome breaks, as well as the presence of dicentric chromosomes and chromatid exchanges in exposed subjects compared with control subjects ($P < 0.05$), was found. There was also a statistically significant difference in frequency and distribution of micronuclei between the two groups examined. In the exposed subjects the Comet assay showed a statistically significant ($P < 0.001$) increase in DNA migration. Results suggest that long-term occupational exposure to pesticides could cause genome damage in somatic cells and therefore may represent a potential hazard to human health.	Journal of Applied Toxicology	22	4	249-55	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Croatia	hic
1193	V. How, Z. Hashim, P. Ismail, D. Omar, S. M. Said and S. B. Tamrin	Characterization of risk factors for DNA damage among paddy farm worker exposed to mixtures of organophosphates	2015	This is a cross-sectional study conducted among paddy farmers to characterize potential risk factors that influence levels of DNA damage from exposure to mixtures of organophosphates. Comet assay was used to determine the level of DNA damage by measuring the comet tail length from the exfoliated buccal mucosa. The result suggests that farmers who chronically exposure to a mixture of organophosphates has at least 2-fold significant increase of DNA damage as compared with control group. Factor analysis and linear regression both suggest that DNA damage reported by farmers may influence individual, occupational, and residential factors and are reported as significant predictor factors, whereas this effect is mainly caused by individual factors among the control group. The findings of the present study suggest that either farmer or control group bear certain extent of genotoxic burden contributed by different risk factors.	Archives of Environmental & Occupational Health	70	2	102-9	Self-reported job history			Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	Malaysia	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1194	V. K. Bhatnagar, A. B. Karnik, A. M. Suthar, S. S. Zaidi, R. Kashyap, M. P. Shah, P. K. Kulkarni and H. N. Saiyed	Biological indices in formulators exposed to a combination of pesticides	2002	NA	Bulletin of Environmental Contamination & Toxicology	68	1	43334	Self-reported job history			Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	India	lmic
1195	V. Loyant, A. Jaffre, J. Breton, I. Baldi, A. Vital, F. Chapon, S. Dutoit, Y. Lecluse, H. Loiseau, P. Lebailly and P. Gauduchon	Screening of TP53 mutations by DHPLC and sequencing in brain tumours from patients with an occupational exposure to pesticides or organic solvents	2005	The aetiology of brain tumours remains unclear. Occupational exposures to pesticides and organic solvents are suspected risk factors. The case-control study CEREPHY (221 cases, 442 controls) carried in the Departement de la Gironde in France revealed a significantly increased risk of brain tumours for subjects most exposed to pesticides. In some cancers, TP53 mutations could reflect exposure to specific carcinogens. These mutations are present in approximately 30% of astrocytic brain tumours. In a pilot study, we explored the hypothesis that pesticide or solvent exposure could raise the frequency of TP53 mutations in brain tumour cells. We investigated TP53 mutations in exons 2-11 by denaturing high performance liquid chromatography (DHPLC) and sequencing, and p53 accumulation by immunohistochemistry in brain tumour of the 30 patients from CEREPHY study with a history of occupational exposure to pesticides (n = 21) and/or organic solvents (n = 14) for whom tumoral tissue was available. Included cases concerned 27% of CEREPHY cases exposed to pesticides and, based on the cumulative index of occupational exposure, they were more exposed to pesticides. There were 12 gliomas, 6 meningiomas, 7 neurinomas, 2 central nervous system lymphomas and 3 tumours of other histological types. We detected TP53 mutations in three tumours, which is similar to the expected number (3.3) calculated from 46 published studies referenced in the IARC TP53 mutations database, taking into account histological types. Considering TP53 mutations previously detected in the laboratory by DHPLC and the frequency of TP53 polymorphisms detected in this sample (similar to published data), the TP53 mutations rate is probably not underestimated. These preliminary results, even if it was on a limited number of tumours, are not in favour of the role of pesticide or organic solvent exposure in the occurrence of TP53 mutations in brain tumours.	Mutagenesis	20	5	365-73	Self-reported job history	Expert case-by-case assessment		Case-control	Job title	cancer	doctor-diagnosed	France	hic
1196	V. M. Hanssen, A. W. Nigatu, Z. K. Zeleke, B. E. Moen and M. Bratveit	High Prevalence of Respiratory and Dermal Symptoms Among Ethiopian Flower Farm Workers	2015	The flower industry is among the most important export industries in Ethiopia, employing more than 50,000 workers. The working conditions and health status among workers in Ethiopian flower industry are not documented. A questionnaire-based interview was conducted among 213 flower industry workers from 3 flower farms and 60 control workers from supermarkets from February to March 2012. A walk-through survey was also performed on the 3 flower farms. Interviewed flower farm workers have high prevalences of respiratory and dermal symptoms, which are rarely reported among controls. Female workers inside the greenhouses on the 3 flower farms have significantly more respiratory and dermal symptoms than workers outside the greenhouse, also when adjusting for age and education. Limited access to personal protection equipment (PPE) and unsafe pesticide routines are documented. This study indicates that working in these flower greenhouses might be associated with adverse health effects.	Archives of Environmental & Occupational Health	70	4	204-13	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	Ethiopia	lic
1197	V. M. R. Harrison, S.	Anxiety and depression following cumulative low-level exposure to organophosphate pesticides	2016	Previous research suggests that individuals with a prior history of pesticide poisoning are at increased risk of psychiatric disorder (Freire and Koifman, 2013), but findings regarding the impact of cumulative low-level exposure are inconsistent. The aim of the current study was to investigate whether sheep farmers with a history of low-level exposure to organophosphate pesticides (1) report a higher level of psychological distress on subjective symptom questionnaires, compared to unexposed controls (2) also meet internationally agreed diagnostic criteria for a psychiatric disorder more often than unexposed controls. 127sheep farmers were evaluated and compared to 78 unexposed controls, matched in terms of gender, education, level of intelligence, working status and area of residence. Both self-report measures and structured clinical interviews were used to assess mental health. The exposed cohort reported significantly higher rates of anxiety and depression when self-report questionnaires were used to evaluate mood, even when stressful life events, demographic and physical health factors were taken into account. However, when diagnostic interviews were used to assess mood, this pattern only held true for anxiety.	Environmental Research	151	NA	528-536	Self-reported exposure			NA	Chemical class	mental disorders	self-reported	UK	hic
1198	V. McGuire, W. T. Longstreth, Jr., L. M. Nelson, T. D. Koepsell, H. Checkoway, M. S. Morgan and G. van Belle	Occupational exposures and amyotrophic lateral sclerosis. A population-based case-control study	1997	This population-based case-control study was conducted in three countries in western Washington State to evaluate associations between workplace exposures and the risk of amyotrophic lateral sclerosis (ALS). Cases (n = 174) were all newly diagnosed with ALS by neurologists during 1990-1994, and controls (n = 348), who were matched according to age (+/-5 years) and sex, were identified via random-digit dialing or Medicare enrollment files. Four industrial hygienists blindly assessed detailed lifetime job histories for exposures to metals, solvents, and agricultural chemicals. Case-control comparisons were made for jobs held between 15 years of age and 10 years prior to the cases' dates of diagnosis. After adjustment for age and education, ever exposure to agricultural chemicals was associated with ALS (odds ratio (OR) = 2.0, 95% confidence interval (CI) 1.1-3.5); this association was observed separately in men (OR = 2.4, 95% CI 1.2-4.8) but not in women (OR = 0.9, 95% CI 0.2-3.8). Among men, the odds ratio for low exposure to agricultural chemicals (below the median level for exposed controls) relative to no exposure was 1.5 (95% CI 0.4-5.3), and for high exposure, it was 2.8 (95% CI 1.3-6.1) (p for trend = 0.03). Similar analyses based on the panel's assessment of exposures to metals and solvents showed no associations. These findings suggest an association between ALS and agricultural chemicals in men.	American Journal of Epidemiology	145	12	1076-88	Expert case-by-case assessment	Self-reported job history		Case-control	Pesticides in general	neurological	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1199	V. Ndlovu, M. A. A. Dalvie and M. F. Jeebhay	Asthma associated with pesticide exposure among women in the rural Western Cape of South Africa	2013	Background: Pesticide exposure has been increasingly associated with adverse respiratory health effects in domestic and occupational settings. Few studies have investigated asthma associated with pesticides among women and farm workers in developing countries. South Africa is one of the largest users of pesticides on the African continent. The aim of the study was to investigate the association between pesticide exposure (primarily organophosphates and carbamates) and respiratory allergy and asthma. Methods: A cross-sectional study of 211 women comprising those working and living on farms (farm dwellers, n = 121) and those residing in neighbouring farm areas (town dwellers, n = 90) was conducted using abbreviated ECRHS questionnaires, Phadiatop, specific IgE to mite allergens (HDM, storage mite, spidermite) (Phadia, ImmunoCAP) and FENO as per ATS/ERS criteria (2005). Outcomes included doctor diagnosed asthma (DA), current asthma (CA and attack in previous year), ocular nasal symptoms (ONS) and an asthma symptom score (ASS) (based on four symptoms in the previous year including wheeze with breathlessness, woken up with chest tightness, attack of shortness of breath at rest and woken by attack of coughing). Exposure variables included self-reported exposure to pesticides (household and occupational) and biomarkers as proxy for exposure as measured by whole blood cholinesterase (ChE). Results: The median age was 37 years (interquartile range: 28-45 years). At least 9% had low ChE (below laboratory reference standard) of whom 78% were farm dwellers. The prevalence of DA, CA and ONS was 11%, 6% and 24% respectively. Adjusted models (age, smoking, years of schooling, atopy) demonstrated that ONS was associated with immediate re-entry in the pesticide sprayed field (RR = 2.97; CI: 0.93-9.50). ASS was also associated with farm dweller status (RR = 2.25; CI: 1.45- 3.48) and low ChE (RR = 1.93; CI: 1.09- 3.44). Subjects with a low ChE had a 5-fold increased odds of high FeNO (>50 ppb) (CI: 0.80-28.00; P = 0.08) suggestive of probable allergic asthma. Conclusion: Pesticide exposure among women farm workers is associated with increased risk of ocular nasal symptoms and asthma. This study was limited by a cross sectional study design, small sample size and lack of information on specific pesticides used. These associations need further exploration in a larger longitudinal study.	Allergy: European Journal of Allergy and Clinical Immunology	68	NA	100	Self-reported exposure			Cross-sectional	Pesticides in general	respiratory	self-reported	South Africa	umic
1200	V. P. Tuc, V. Wangsuphachart, P. Tasanapradit, W. Fungladda, P. Van Trong and N. T. Nhung	Impacts of pesticide use on semen characteristics among rice farmers in Kienxuong District, Thaibinh Province, Vietnam	2007	This case-control study assessed the effects of pesticide use on semen characteristics among rice farmers of Kienxuong District, Thaibinh Province, Vietnam. Semen samples of 1,036 rice farmers were obtained by manual masturbation and screened at Commune Health Stations. Of these, 156 abnormal semen samples were identified; 314 rice farmers with normal semen were recruited as controls. The semen characteristics (volume, sperm concentration, total sperm count, motility, vitality and morphology) of the cases were considerably poorer than the controls. Factors associated with abnormal semen after adjusting for age, smoking and alcohol drinking by logistic regression were: distance of less than 300 meters from household to rice fields and duration of work over 10 years as a farmer (adjusted OR = 3.16, 95% CI: 1.97-5.05 and adjusted OR = 3.98, 95% CI: 2.20-7.21, respectively). Rice farmers without personal protective equipment (PPE) when spraying pesticides and without pesticide training (adjusted OR = 3.05, CI: 1.92-4.85 and adjusted OR = 1.90, CI: 1.14-3.16, respectively) were also at risk for abnormal semen compared to controls. These findings showed the strength of association between pesticide use and abnormal semen characteristics among rice farmers in Kienxuong District, Thaibinh Province, Vietnam.	Southeast Asian Journal of Tropical Medicine & Public Health	38	3	569-75	Self-reported exposure			Case-control	Pesticides in general	reproductive	medical test result	Vietnam	lmic
1201	V. P.-G. Lope, B.; Aragones, N.; Lopez-Abente, G.; Gustavsson, P.; Plato, N.; Zock, J. P.; Pollan, M.	Occupation, exposure to chemicals, sensitizing agents, and risk of multiple myeloma in Sweden	2008	BACKGROUND: This study sought to identify occupations with high incidence of multiple myeloma and to investigate possible excess risk associated with occupational exposure to chemicals and sensitizing agents in Sweden. METHODS: A historical cohort of 2,992,166 workers was followed up (1971--1989) through record linkage with the National Cancer and Death Registries. For each job category, age and period standardized incidence ratios and age and period adjusted relative risks of multiple myeloma were calculated using Poisson models. Exposure to chemicals and to sensitizing agents was also assessed using two job-exposure matrices. Men and women were analyzed separately. RESULTS: During follow-up, 3,127 and 1,282 myelomas were diagnosed in men and women, respectively. In men, excess risk was detected among working proprietors, agricultural, horticultural and forestry enterprisers, bakers and pastry cooks, dental technicians, stone cutters/carvers, and prison/reformatory officials. In women, this excess was observed among attendants in psychiatric care, metal workers, bakers and pastry cooks, and paper/paperboard product workers. Workers, particularly bakers and pastry cooks, exposed to high molecular weight sensitizing agents registered an excess risk of over 40% across the sexes. Occasional, although intense, exposure to pesticides was also associated with risk of myeloma in our cohort. CONCLUSIONS: Our study supports a possible etiologic role for farming and use of pesticides in myeloma risk. The high incidence found in both female and male bakers and pastry cooks has not been described previously. Further research is required to assess the influence of high molecular weight sensitizing agents on risk of multiple myeloma.	Cancer Epidemiology, Biomarkers & Prevention	17	11	446874	Job exposure matrix			Cohort (retrospective)	Type of pesticide	cancer	doctor-diagnosed	Sweden	hic
1202	V. Padma, N. N. Anand, S. Pavithra, M. , K. and S. M. Javid	Lifetime exposure to agricultural pesticides and incicidence of diabetes among pesticide applicators	2016	Introduction and Aim: Diabetes mellitus is a disorder that has a multifactorial pathogenesis.Genetic component, as well as many environmental and lifestyle factors, play an important role in etiology of diabetes. Evidence suggests that environmental contaminants, including pesticides, might play an important role in the pathogenesis. Organophosphate insecticides disrupt glucose homeostasis in animal models and can lead to hyperglycemia. The aim of the study is to investigate the relation between lifetime exposure to agricultural pesticides and incidence of diabetes among pesticide applicators. Materials and Methods: This cross-sectional study was conducted in the village of Kumuli, Chengalpattu district with 50 pesticide applicators. The study was started in 20 11 January and followed up till 2016 January . Results: Among 50 pesticide applicators eight developed diabetes on follow-up. Incident diabetes was self reported in a five year follow- up interview. Lifetime exposure to pesticides and covariate information were reported by participants at enrollment. Applicators who had used organochlorine insecticides Aldrin, chlordane, heptachlor had increased a risk of diabetes. Conclusion: Long-Term exposure from handling certain pesticides, in particular, organochlorine and organophosphate insecticides, may be associated with increased risk of diabetes,.	Biomedicine (India)	36	4	43104	Self-reported exposure			Cross-sectional	Pesticides in general	endocrine/nutritional/metabolical	doctor-diagnosed	India	lmic

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1203	V. Rafnsson	Cancer incidence among farmers exposed to lindane while sheep dipping	2006	OBJECTIVES: The objective of this study was to determine whether site-specific cancer incidence among farmers exposed to the insecticide lindane (g-hexachlorocyclohexane) while dipping sheep differs from that of the general population in Iceland. METHODS: Cohorts of 7882 men and 429 women, who, according to records on sheep dipping, were sheep owners, were followed from 1962 to 2003 in the Cancer Registry for cancer incidence. The observed number of cancers was compared with expected values, calculated on the basis of person-years of risk and cancer incidence in the general population of Iceland. RESULTS: For men the standardized incidence ratio (SIR) for all cancer sites was 0.79, with a 95% confidence interval (95% CI) of 0.76-0.83. For both the men and the women a significantly increased risk for lip cancer was found, with SIR of 1.50 (95% CI 1.08-2.04) and 9.09 (95% CI 1.02-32.82), respectively. The SIR for several cancer sites were lower than unity for both the men and women. Examples were cancers of the colon, rectum, pancreas, stomach, lungs, kidney, bladder, and brain and nervous system. CONCLUSIONS: The decreased risk of most cancers among these sheep farmers agrees with findings reported previously among farmers from other countries, as well as in Iceland. Cancer of the lip was the only cancer type in significant excess among both genders, and the stomach cancer rates were near unity, but, in previous studies on Icelandic farmers, an increase had been found for stomach cancer. The site-specific cancer incidence for sheep-dipping farmers did not differ substantially from that of the general population.	Scandinavian Journal of Work, Environment & Health	32	3	185-9	Registers			Cohort (prospective)	Type of pesticide	cancer	doctor-diagnosed	Iceland	hic
1204	V. Rafnsson	Risk of non-Hodgkin's lymphoma and exposure to hexachlorocyclohexane, a nested case-control study	2006	Organochlorines have been linked with non-Hodgkin's lymphoma (NHL) in epidemiological studies. We elucidate the importance of hexachlorocyclohexane (HCH), an organochlorine insecticide, in the aetiology of NHL among individuals with dermal exposure to HCH. This is a case-control study nested in a cohort of sheep owners, collected from records on sheep dipping. The number of dipped sheep was used as surrogate for exposure. No other insecticide was used in sheep dip in Iceland during the study period. Cases (n=45) were identified by record linkage with the national cancer registry (through 1962-2003) and controls (n=221) were selected at random from the cohort. In logistic regression analysis the odds ratio for NHL was 3.86 (95% CI 1.59-8.53), adjusted for age, for individuals who had 100 sheep or more as compared to those who had less than 100 sheep. The results indicate that HCH may be linked to the development of NHL.	European Journal of Cancer	42	16	29707	Registers			Case-control	Chemical class	cancer	doctor-diagnosed	Iceland	hic
1205	V. Ramirez and P. Cuenca	[DNA damage in female workers exposed to pesticides in banana plantations at Limon, Costa Rica]	2002	Pesticide use in Costa Rica is very high and all year round. A high percentage of what is sprayed remains in the environment and in the living organisms around. This situation brings contamination and health problems to people in contact with them. The onset of adverse effects may be in the short or the long term, and symptoms vary widely, from headaches to cancer. Much research in this area has been devoted to acute or chronic effects, and not until recently to the genotoxic effect of pesticides. This study evaluated the genotoxic effect of pesticides used in banana packing activities, using the comet assay (single cell electrophoresis) as the biological marker in lymphocytes. This was a case-control double blind study of 30 exposed women from 15 banana farms and 28 women not occupationally exposed to pesticides from the same geographic area. Results show damage to single stranded DNA after working from 5 to 15 years (R2 = 0.12). In Costa Rica we do not have an historical record of the kind of pesticides used in banana farms, the period of time and for how long were they used. This prevented further analysis concerning dose, frequency of exposure and use of new or old kind of pesticides in the farms in relation to DNA damage. The comet assay is of value in the genetic monitoring of pesticide exposed populations.	Revista de Biologia Tropical	50	2	507-18	Job title			Case-control	Job title	genetic (biomarkers)	medical test result	Costa Rica	umic
1206	V. Rapisarda, C. Ledda, S. Matera, L. Fago, G. Arrabito, L. Falzone, A. Marconi, M. Libra and C. Loreto	Absence of t(14;18) chromosome translocation in agricultural workers after short-term exposure to pesticides	2017	Exposure to pesticides represents a potential health risk for the general population and for agricultural workers in particular. Some researchers observed that occupational exposure to pesticides is associated with risk of non-Hodgkin's lymphoma (NHL). The chromosomal translocation t(14;18)(q32;q21) is one of the most common chromosomal abnormalities in NHL. The aim of this study was to detect the effects of pesticides on t(14;18) chromosome translocation in agricultural workers after short-term exposure. Fifty-two workers occupationally exposed to pesticides (fungicides and insecticides) and 52 non-exposed were recruited. The farm workers were on average exposed to pesticides for ~3.7 h a day for 5 years. The frequency of BCL2-IGH t(14;18) translocation in workers occupationally exposed to pesticides was 10% (5 of 52) vs. 8% (4 of 52) in the control group. Overall, these data suggest that no significant association between occupational exposure to pesticides and an increased frequency of the chromosomal translocation BCL2-IGH t(14;18) in farmers was observed. However, further studies with a higher number of subjects exposed to pesticides are necessary to confirm this observation.	Molecular Medicine Reports	15	5	3379-3382	Self-reported exposure			Case-control	Type of pesticide	cancer	doctor-diagnosed	Italy	hic
1207	V. Z. Garaj-Vrhovac, D.	Cytogenetic monitoring of croatian population occupationally exposed to a complex mixture of pesticides	2001	This paper describes a longitudinal study of possible genetic damage in Croatian workers occupationally exposed to a complex mixture of pesticides. The methods of choice were chromosomal aberration analysis, sister chromatid exchange analysis (SCE), micronucleus assay and comet assay. In order to determine primary genotoxic effects in workers, blood samples were taken after the workers spent 8 months in the production of pesticides. During the production all subjects were simultaneously exposed to a complex mixture of pesticides containing atrazine, alachlor, cyanazine, 2,4-dichlorophenoxyacetic acid, and malathion. To detect DNA repair in lymphocytes of the same subjects the second series of blood samples was taken 8 months after the workers were removed from production. Regardless of the time sampling time the exposed workers showed an increased number of chromosomal aberrations, SCE frequency, micronucleus (MN) frequency, and values of comet assay parameters. After 8 months of non-exposure the workers showed a significantly decreased number of chromosomal aberrations, MN frequency, and DNA migration compared to the results of the first sampling, but it was still significantly higher than in controls. Furthermore, the SCE frequency in the exposed subjects did not drop after the 8 months of non-exposure, which indicates long-term exposure to a mixture of pesticides.	Toxicology	165	2	153-62	Job title			Cohort (prospective)	Job title	genetic (biomarkers)	medical test result	Croatia	hic

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1208	W. Ahrens, I. Langner, N. Schmei<U+221A><U+00FC>er, B. Mester and T. Behrens	Male germ-cell cancer in car manufacturing workers: Results of a nested case-control study	2013	Introduction: This case-control study nested in a cohort of car manufacturing workers investigated occupational and non-occupational factors to explain the excess incidence previously observed in this cohort. Particular attention was paid to pesticides in avocational farm work and to electromagnetic fields (EMF)/endocrine disrupting chemicals (EDC) within the industry. Methods and materials: Personal interviews of 205 cases and 1,091 controls matched by age (<U+00AC><U+00B1>2 years) covered medical and personal characteristics, dietary habits, occupational history and environmental factors. Specific job tasks were assessed by 37 job-specific-questionnaires. An expert panel developed a job-exposure-matrix (JEM) and assessed exposure for each individual with possible exposure according to the JEM. Odds ratios (ORs) and 95 % confidence intervals (CI) were calculated by conditional logistic regression. Results: The prevalence of farming and forestry working was below expectation (5.3 % in cases and 6.3 % in controls) and related exposure to pesticides, fertilisers, or disinfectants was not associated with GCC. Metal-cutting and non-cutting jobs yielded ORs of 1.87 (CI 1.31-2.67) and 1.24 (CI 0.68-2.28), respectively, amongst machine fitters, machine assemblers and precision instrument makers. Exposure to oil-based cutting fluids showed an excess risk of nonseminoma after more than 5,000 exposure-hours (OR = 4.72; CI 1.48-15.09). Ever-exposure to bisphenol A (OR = 1.39; CI 0.93-2.06), epoxy resins (OR = 1.41; CI 0.95-2.09) and the glycolether EGBE (OR = 1.3; CI 0.93-1.83) was associated nonsignificantly with GCT. An elevated risk due to dimethylformamide was indicated after 3.5 to 8.5 years (OR = 3.48; CI 0.98-12.34). EMF exposure showed no risk elevation. Discussion: Exposures in farming activities did not explain the excess risk in the cohort. Our data indicate a possible risk of GCC related to exposure to metal-cutting fluids. EGBE belongs to the agent exposures that warrant further attention in this regard. Exposure misclassification may disguise associations for this and other EDCs that showed moderately elevated risks.	European Journal of Epidemiology	28	1	S101	Self-reported job history	Job exposure matrix		Case-control	Pesticides in general	cancer	doctor-diagnosed	Germany	hic
1209	W. H. Wolfe, J. E. Michalek, J. C. Miner, A. J. Rahe, C. A. Moore, L. L. Needham and D. G. Patterson, Jr.	Paternal serum dioxin and reproductive outcomes among veterans of Operation Ranch Hand	1995	We studied whether paternal exposure to Agent Orange and its dioxin contaminant (2,3,7,8-tetrachlorodibenzo-p-dioxin) during the Vietnam War is related to adverse reproductive outcomes after service in Southeast Asia. The index cohort comprises conceptions and children of veterans of Operation Ranch Hand, the unit responsible for aerial spraying of herbicides in Vietnam from 1962 to 1971. The comparison cohort comprises conceptions and children of Air Force veterans who served in Southeast Asia during the same period but who were not involved with spraying herbicides. We found no meaningful elevation in risk for spontaneous abortion or stillbirth. In analyses of birth defects, we found elevations in risk in some organ system categories, which, after review of the clinical descriptions, were found to be not biologically meaningful. There was an increase in nervous system defects in Ranch Hand children with increased paternal dioxin, but it was based on sparse data. We found no indication of increased birth defect severity, delays in development, or hyperkinetic syndrome with paternal dioxin. These data provide little or no support for the theory that paternal exposure to Agent Orange and its dioxin contaminant is associated with adverse reproductive outcomes.	Epidemiology	6	1	17-22	Algorithm/model			Cohort (prospective)	Chemical class	reproductive	doctor-diagnosed	USA	hic
1210	W. Halperin, R. Vogt, M. H. Sweeney, G. Shopp, M. Fingerhut and M. Petersen	Immunological markers among workers exposed to 2,3,7,8-tetrachlorodibenzo-p-dioxin	1998	OBJECTIVES: To examine the association of immune cell number and function with occupational exposure to substances contaminated with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). METHODS: A cross sectional medical survey. The exposed participants were employed at two chemical plants between 1951 and 1972 in the manufacture of 2,4,5-trichlorophenate and its derivatives. The reference group consisted of people with no occupational exposure to phenoxy herbicides who lived within the communities of the workers. Data from a total of 259 workers and 243 unexposed referents were included in the analysis of immune function. Laboratory tests for immune status included enumeration of circulating leukocyte and lymphocyte populations, proliferative responses of circulating lymphocytes to mitogens and antigens, and serum concentrations of the major immunoglobulins and complement factor C3. RESULTS: The workers had substantial exposure to substances contaminated with TCDD, as indicated by a lipid adjusted mean serum TCDD concentration of 229 ppt compared with a mean of 6 ppt in the unexposed referents. Workers were divided into categories based on their serum TCDD concentration. For all categories except the lowest, with values of serum TCDD comparable with the unexposed referents, there were increased odds of having lower counts of CD26 cells (activated T cells) (odds ratio (OR) 1.0, 95% confidence interval (95% CI) 0.5 to 1.8 for TCDD < 20 ppt; OR 1.6, 95% CI 0.8 to 3.2 for TCDD 20-51 ppt; OR 2.7, 95% CI 1.4 to 5.1 for TCDD 52-125 ppt; OR 2.6, 95% CI 1.4 to 4.9 for TCDD 125-297 ppt; OR 2.4, 95% CI 1.3 to 4.6 for TCDD 298-3389 ppt). A less consistent finding was decreased spontaneous proliferation of cultured lymphocytes. However, increases were found in proliferation of lymphocytes in response to concanavalin and pokeweed in workers in the high TCDD category. Age, cigarette smoking, and alcohol were significant predictors of several immunological outcomes. CONCLUSIONS: Associations between serum TCDD concentration and both a decrease in circulating CD26 cells and decreased spontaneous background proliferation were the major findings of this study. These results are unlikely to be of clinical importance but may reflect limited evidence for an association between immunological changes in workers and high serum concentrations of TCDD, or chance findings resulting from the evaluation of multiple immunological variables.	Occupational & Environmental Medicine	55	11	742-9	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	immunological	medical test result	USA	hic
1211	W. Halperin, W. Kalow, M. H. Sweeney, B. K. Tang, M. Fingerhut, B. Timpkins and K. Wille	Induction of P-450 in workers exposed to dioxin	1995	OBJECTIVES: To examine the effects of occupational exposure to substances contaminated with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) on cytochrome P-4501A2 activity in a cross sectional medical survey. METHODS: The exposed workers had been employed at two chemical plants > 15 years earlier in the manufacture of 2,4, 5-trichlorophenol and its derivatives. The control group consisted of people with no occupational exposure to phenoxy herbicides and who lived within the communities of the exposed workers. A total of 58 workers and 125 unexposed controls participated in the analysis. Cytochrome P-450 activity was assessed with test that measures caffeine metabolites in the urine. A ratio of metabolites of caffeine (CMR) constituted a measure of P-4501A2 activity. RESULTS: Compared with the control group in multivariate logistic regression, raised non-significant associations were found for three of four categories of TCDD in exposed workers (TCDD < 20 pg/g, odds ratio (OR) 1.7, 95% confidence interval (95% CI) 0.6 to 5.0, TCDD 20-66, OR 0.3, 95% CI 0.0 to 1.7; TCDD 67-147, OR 2.3, 95% CI 0.6 to 8.8; TCDD > or = 148, OR 3.1, 95% CI 0.8 to 12.5). We found a strongly significant association of CMR and urinary cotinine, a measure of smoking, and urinary free ethanol. We found weak non-significant associations between P-4501A2 activity and increased serum TCDD among workers. CONCLUSIONS: The absence of an association between serum TCDD and cytochrome P-4501A2 may be due to the size of the study, insensitivity of the CMR to assess cytochrome P-4501A2 activity, or inadequate levels of exposure, although these were among the highest in human groups tested.	Occupational & Environmental Medicine	52	2	86-91	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	genetic (biomarkers)	medical test result	USA	hic

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1212	W. Hoffmann, C. Terschueren, H. Heimpel, A. Feller, W. Butte, O. Hostrup, D. Richardson and E. Greiser	Population-based research on occupational and environmental factors for leukemia and non-Hodgkin's lymphoma: the Northern Germany Leukemia and Lymphoma Study (NLL)	2008	BACKGROUND: The Northern Germany Leukemia and Lymphoma Study (NLL) is a population-based study designed to provide a quantitative basis for investigations into occupational and environmental risk factors for leukemia and lymphoma. METHODS: All incident cases of leukemia and lymphoma diagnosed between 1/1/1986 and 12/31/1998 in six counties in Northern Germany were actively ascertained. Controls were selected from population registries. Use of pesticides, sources of food supply, time spent at home and work, medical and family history were assessed via face-to-face interview. This self-reported information was used in conjunction with direct environmental measurements of pesticides in household dust and electromagnetic fields (EMFs). In addition, geographical information system (GIS) data were used to derive estimates of environmental exposure to pesticides, EMFs associated with transmission lines, and ionizing radiation from routine nuclear power reactor operations. Occupational exposure assessment was based on lifetime work history. For each job, information on branch of industry, company, job description, and duration of employment were ascertained. RESULTS: Fourteen hundred thirty cases and 3041 controls were recruited. Lifetime residential and workplace histories totaled 49,628 addresses. Occupational exposure to pesticides was reported by 15% of the male participants (women: 16%). Four percent of the men (women: 8%) were occupationally exposed to ionizing radiation for >or=1 year over their lifetime. Sixty four percent of the participants had lived in the vicinity (20 km) of a nuclear power plant in operation. CONCLUSIONS: The NLL illustrates the successful application of innovative methods to simultaneously assess occupational and environmental risk factors for leukemia and lymphoma including radiological hazards, pesticides, and EMFs.	American Journal of Industrial Medicine	51	4	246-57	Self-reported exposure			Case-control	Pesticides in general	cancer	doctor-diagnosed	Germany	hic
1213	W. J. B. Lee, A.; Hoppin, J. A.; Lubin, J. H.; Rusiecki, J. A.; Sandler, D. P.; Dosemeci, M.; Alavanja, M. C.	Cancer incidence among pesticide applicators exposed to chlorpyrifos in the Agricultural Health Study	2004	BACKGROUND: Chlorpyrifos is one of the most widely used insecticides in the United States. We evaluated the incidence of cancer among pesticide applicators exposed to chlorpyrifos in the Agricultural Health Study, a prospective cohort study of licensed pesticide applicators in Iowa and North Carolina. METHODS: A total of 54,383 pesticide applicators were included in this analysis. Detailed information on pesticide exposure and lifestyle factors was obtained from self-administered questionnaires completed at the time of enrollment (December 1993-December 1997). Poisson regression analysis was used to evaluate the association between chlorpyrifos exposure and cancer incidence after adjustment for potential confounders. All statistical tests were two-sided. RESULTS: A total of 2070 incident malignant neoplasms were diagnosed through 2001. The rate ratio for all cancers combined among chlorpyrifos-exposed applicators compared with nonexposed applicators was 0.97 (95% confidence interval = 0.87 to 1.08). For most cancers analyzed, there was no evidence of an exposure-response relationship. However, the incidence of lung cancer was statistically significantly associated with both chlorpyrifos lifetime exposure-days (P(trend) = .002) and chlorpyrifos intensity-weighted exposure-days (P(trend) = .036). After adjustment for other pesticide exposures and demographic factors, individuals in the highest quartile of chlorpyrifos lifetime exposure-days (>56 days) had a relative risk of lung cancer 2.18 (95% confidence interval = 1.31 to 3.64) times that of those with no chlorpyrifos exposure. CONCLUSION: Our findings suggest an association between chlorpyrifos use and incidence of lung cancer that deserves further evaluation.	Journal of the National Cancer Institute	96	23	1781-9	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
1214	W. J. H. Lee, J. A.; Blair, A.; Lubin, J. H.; Dosemeci, M.; Sandler, D. P.; Alavanja, M. C.	Cancer incidence among pesticide applicators exposed to alachlor in the Agricultural Health Study	2004	The authors evaluated the incidence of cancer among pesticide applicators with exposure to alachlor in the Agricultural Health Study, a prospective cohort study of licensed pesticide applicators in Iowa and North Carolina. A total of 49,980 pesticide applicators are included in this analysis; 26,510 applicators (53%) reported use of alachlor on the enrollment questionnaire. Detailed pesticide exposure and other information were obtained from a self-administered questionnaire completed at the time of enrollment (1993-1997). Poisson regression analysis was used to evaluate the exposure-response relations between alachlor and cancer incidence controlled for the effects of potential confounding factors. A total of 1,466 incident malignant neoplasms were diagnosed during the study period, 1993-2000. Among alachlor-exposed applicators, the authors found a significant increasing trend for incidence of all lymphohematopoietic cancers associated with lifetime exposure-days (p for trend = 0.02) and intensity-weighted exposure-days (p for trend = 0.03) to alachlor. The risks of leukemia (rate ratio = 2.83, 95% confidence interval: 0.74, 10.9) and multiple myeloma (rate ratio = 5.66, 95% confidence interval: 0.70, 45.7) were increased among applicators in the highest alachlor exposure category. Our findings suggest a possible association between alachlor application and incidence of lymphohematopoietic cancers among applicators in the Agricultural Health Study.	American Journal of Epidemiology	159	4	373-80	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
1215	W. J. Lee, A. Baccarelli, M. Tretiakova, S. Gorbanev, A. Lomtev, I. Klimkina, V. Tchibissov, O. Averkina and M. Dosemeci	Pesticide exposure and lung cancer mortality in Leningrad province in Russia	2006	This study was carried out to examine the association between pesticide exposure and lung cancer mortality. We conducted an autopsy based case-control study in Leningrad Province in Russia. A total of 540 lung cancer cases and 582 controls were identified among subjects who had died in the hospitals of the Leningrad province between 1993 and 1998. Using work history records, we assessed exposure to pesticide at the level of industry and job title. Unconditional logistic regression was used to calculate adjusted odds ratio for pesticide exposure and lung cancer mortality. There was no association between ever exposure to pesticide and lung cancer mortality overall (odds ratio=1.06, 95% confidence interval=0.82-1.36) and in both men (odds ratio=1.11, 95% confidence interval=0.84-1.46) and women (odds ratio=0.74, 95% confidence interval=0.37-1.46). We observed no statistically significant odds ratio by duration of pesticide exposure, intensity of pesticide exposure, and cumulative pesticide exposures with lung cancer mortality in both smokers and nonsmokers. Odds ratio also did not differ when the analysis was restricted to individuals who had exposure data with high confidence scores. Our findings suggest no associations between pesticide exposures and mortality of lung cancer in the population of the Leningrad province in Russia that deserves further evaluation.	Environment International	32	3	412-6	Job title			Case-control	Job title	mortality (all cause)	doctor-diagnosed	Russia	umic

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1216	W. J. Lee, D. P. Sandler, A. Blair, C. Samanic, A. J. Cross and M. C. Alavanja	Pesticide use and colorectal cancer risk in the Agricultural Health Study	2007	We investigated the relationship between agricultural pesticides and colorectal cancer incidence in the Agricultural Health Study. A total of 56,813 pesticide applicators with no prior history of colorectal cancer were included in this analysis. Detailed pesticide exposure and other information were obtained from self-administered questionnaires completed at the time of enrollment (1993-1997). Cancer incidence was determined through population-based cancer registries from enrollment through December 31, 2002. A total of 305 incident colorectal cancers (212 colon, 93 rectum) were diagnosed during the study period, 1993-2002. Although most of the 50 pesticides studied were not associated with colorectal cancer risk, chlorpyrifos use showed significant exposure response trend (p for trend = 0.008) for rectal cancer, rising to a 2.7-fold (95% confidence interval: 1.2-6.4) increased risk in the highest exposure category. Aldicarb was associated with a significantly increased risk of colon cancer (p for trend = 0.001), based on a small number of exposed cases, with the highest exposure category resulting in a 4.1-fold increased risk (95% confidence interval: 1.3-12.8). In contrast, dichlorophenoxyacetic acid showed a significant inverse association with colon cancer but the association was not monotonic. Our findings should be interpreted cautiously since the literature suggesting that pesticides are related to colorectal cancer is limited. Nonetheless the possibility of an association between exposure to certain pesticides and incidence of colorectal cancer among pesticide applicators deserves further evaluation.	International Journal of Cancer	121	2	339-46	Algorithm/model	Self-reported exposure		Cohort (prospective)	Specific active ingredient	cancer	doctor-diagnosed	USA	hic
1217	W. J. Lee, E. S. Cha, J. Park, Y. Ko, H. J. Kim and J. Kim	Incidence of acute occupational pesticide poisoning among male farmers in South Korea	2012	BACKGROUND: Pesticide poisoning from agricultural labor has been recognized as a major public health problem among farmers worldwide. The objective of this study was to examine the incidence of acute occupational pesticide poisoning among male farmers in South Korea. METHODS: A nationwide sampling survey of male farmers was conducted in South Korea. This survey used a stratified multistage probability sampling design and adopted the face-to-face interview method. A total of 1,958 male farmers were interviewed in order to estimate the incidence of acute occupational pesticide poisoning in rural areas in 2010. Based on a self-reported definition, the incidence rate in 2010 and the lifetime hospitalization rate due to acute occupational pesticide poisoning among male farmers were estimated. RESULTS: The incidence rate of acute occupational pesticide poisoning was 24.7 (95% CI 22.1-27.2) per 100 male farmers, which corresponds to 209,512 cases across South Korea in 2010. About 12% of the pesticide poisoning cases included either visiting a medical doctor or hospitalization. The lifetime rate of hospitalization due to occupational pesticide poisoning was 6.1 (95% CI 4.9-7.3) among male farmers. Poisoning occurred mainly when farmers were applying pesticides during summer. CONCLUSION: Our nationwide sampling survey demonstrated that acute occupational pesticide poisonings are highly prevalent among male South Korean farmers. Intensive intervention efforts to reduce occupational pesticide poisoning are urgently needed in South Korea.	American Journal of Industrial Medicine	55	9	799-807	Self-reported exposure			Cross-sectional	Pesticides in general	pesticide-related illness	self-reported	Korea	hic
1218	W. J. Lee, J. S. Colt, E. F. Heineman, R. McComb, D. D. Weisenburger, W. Lijinsky and M. H. Ward	Agricultural pesticide use and risk of glioma in Nebraska, United States	2005	BACKGROUND: To evaluate the risk of the adult glioma associated with farming and agricultural pesticide use, the authors conducted a population based case control study in eastern Nebraska. METHODS: Telephone interviews were conducted with men and women diagnosed with gliomas (n = 251) between 1988 and 1993 and controls (n = 498) randomly selected from the same geographical area. Unconditional logistic regression was used to calculate adjusted odds ratios (ORs) for farming and for use of individual and chemical classes of insecticides and herbicides, including pesticides classified as nitrosatable (able to form N-nitroso compounds upon reaction with nitrite). Non-farmers were used as the reference category for all analyses. RESULTS: Among men, ever living or working on a farm and duration of farming were associated with significantly increased risks of glioma (> or =55 years on a farm OR = 3.9, 95% CI 1.8 to 8.6); however, positive findings were limited to proxy respondents. Among women, there were no positive associations with farming activities among self or proxy respondents. Specific pesticide families and individual pesticides were associated with significantly increased risks among male farmers; however, most of the positive associations were limited to proxy respondents. For two herbicides and three insecticides, use was positively associated with risk among both self and proxy respondents. Based on a small number of exposed cases, ORs were significantly increased for the herbicides metribuzin (OR = 3.4, 95% CI 1.2 to 9.7) and paraquat (OR = 11.1, 95% CI 1.2 to 101), and for the insecticides bufencarb (OR = 18.9, 95% CI 1.9 to 187), chlorpyrifos (OR = 22.6, 95% CI 2.7 to 191), and coumaphos (OR = 5.9, 95% CI 1.1 to 32). CONCLUSION: The authors found significant associations between some specific agricultural pesticide exposures and the risk of glioma among male farmers but not among female farmers in Nebraska; however, most of the positive associations were limited to proxy respondents. These findings warrant further evaluation in prospective cohort studies where issues of recall bias are not a concern.	Occupational & Environmental Medicine	62	11	786-92	Self-reported exposure			Case-control	Type of pesticide	cancer	doctor-diagnosed	USA	hic
1219	W. J. Lee, M. C. Alavanja, J. A. Hoppin, J. A. Rusiecki, F. Kamel, A. Blair and D. P. Sandler	Mortality among pesticide applicators exposed to chlorpyrifos in the Agricultural Health Study	2007	BACKGROUND: Chlorpyrifos is one of the most widely used organophosphate insecticides in the United States. Although the toxicity of chlorpyrifos has been extensively studied in animals, the epidemiologic data are limited. OBJECTIVE: To evaluate whether agricultural chlorpyrifos exposure was associated with mortality, we examined deaths among pesticide applicators in the Agricultural Health Study, a prospective study of licensed pesticide applicators in Iowa and North Carolina. METHODS: A total of 55,071 pesticide applicators were included in this analysis. Detailed pesticide exposure data and other information were obtained from self-administered questionnaires completed at the time of enrollment (1993-1997). Lifetime chlorpyrifos use was divided into tertiles. Poisson regression analysis was used to evaluate the exposure-response relationships between chlorpyrifos use and causes of death after adjustment for potential confounders. RESULTS: A total of 1,851 deaths (588 among chlorpyrifos users) were observed during the study period, 1993-2001. The relative risk (RR) of death from all causes combined among applicators exposed to chlorpyrifos was slightly lower than that for nonexposed applicators (RR = 0.90; 95% confidence interval, 0.81-1.01). For most causes of death analyzed, there was no evidence of an exposure-response relationship. However, the relative risks for mortality from suicide and non-motor-vehicle accidents were increased 2-fold in the highest category of chlorpyrifos exposure days. CONCLUSIONS: Our findings of a possible association between chlorpyrifos use and external causes of death were based on small numbers. However, the findings may reflect a link between chlorpyrifos and depression or other neurobehavioral symptoms that deserves further evaluation.	Environmental Health Perspectives	115	4	528-34	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	mortality (all cause)	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1220	W. J. Lee, M. P. Purdue, P. Stewart, M. Schenk, A. J. De Roos, J. R. Cerhan, R. K. Severson, W. Cozen, P. Hartge and A. Blair	Asthma history, occupational exposure to pesticides and the risk of non-Hodgkin's lymphoma	2006	We previously reported that, although asthma did not increase the risk of non-Hodgkin's lymphoma (NHL), the risk from pesticide exposures was higher among asthmatics than that among nonasthmatics. To further evaluate this finding, we analyzed data from a population-based case-control study of NHL conducted in Iowa, Detroit, Los Angeles and Seattle. Cases (n = 668) diagnosed with NHL from 1998 to 2000 and controls (n = 543) randomly selected from the same geographical areas as that of the cases were included in this analysis. Odds ratios (OR) for the risk of NHL from potential occupational exposure to pesticides tended to be higher among asthmatics (OR = 1.7; 95% CI 0.3-9.1) when compared with that among nonasthmatics (OR = 0.9; 95% CI 0.6-1.5). The risks of NHL associated with pesticide exposure were also higher among asthmatics who had history of hospitalization (OR = 2.1; 95% CI 0.2-29.0) or daily medication for asthma (OR = infinite) than those among asthmatics who did not have such histories. Our results support the previous finding that the risk of NHL from pesticide exposure may be greater among asthmatics.	International Journal of Cancer	118	12	465472	Job exposure matrix			Case-control	Pesticides in general	cancer	doctor-diagnosed	USA	hic
1221	W. J. Lee, W. Lijinsky, E. F. Heineman, R. S. Markin, D. D. Weisenburger and M. H. Ward	Agricultural pesticide use and adenocarcinomas of the stomach and oesophagus	2004	AIMS: To evaluate the risk of the stomach and oesophageal adenocarcinomas associated with farming and agricultural pesticide use. METHODS: Population based case-control study in eastern Nebraska. Telephone interviews were conducted with men and women diagnosed with adenocarcinoma of the stomach (n = 170) or oesophagus (n = 137) between 1988 and 1993, and controls (n = 502) randomly selected from the same geographical area. Unconditional logistic regression was used to calculate adjusted odds ratios (ORs) for farming and for use of individual and chemical classes of insecticides and herbicides, including pesticides classified as nitrosatable (able to form N-nitroso compounds on reaction with nitrite). Non-farmers were used as the reference category for all analyses. RESULTS: Ever living or working on a farm, duration of farming, and size of the farm were not associated with stomach or oesophageal adenocarcinomas. There was no association for either cancer with ever-use of insecticides (stomach OR 0.9, 95% CI 0.6 to 1.4; oesophagus OR 0.7, 95% CI 0.4 to 1.1) or herbicides (stomach OR 0.9, 95% CI 0.5 to 1.4; oesophagus OR 0.7, 95% CI 0.4 to 1.2). Likewise, individual pesticides, including individual nitrosatable pesticides, were not significantly associated with risk. CONCLUSIONS: No significant associations were found between specific agricultural pesticide exposures and the risk of stomach or oesophageal adenocarcinomas among Nebraska farmers.	Occupational & Environmental Medicine	61	9	743-9	Self-reported exposure			Case-control	Type of pesticide	cancer	doctor-diagnosed	USA	hic
1222	W. J. Ntow, L. M. Tagoe, P. Drechsel, P. Kelderman, E. Nyarko and H. J. Gijzen	Occupational exposure to pesticides: blood cholinesterase activity in a farming community in Ghana	2009	A survey was undertaken to establish the extent of pesticide exposure in a farming community. Cholinesterase (ChE) activity in whole blood was used as a marker for assessing exposure to pesticides. Complete data were gathered for 63 farmers at Akumadan (exposed) and 58 control subjects at Tono, both prominent vegetable-farming communities in Ghana, by means of a questionnaire and blood cholinesterase analyses (acetylcholine assay). Although whole-blood ChE was significantly lower in the exposed than the control participants, it was not significantly correlated with either confounders of age, sex, body weight, and height or high-risks practices. The high-risks practices revealed during the survey included lack of use of personal protective clothing, short reentry intervals, and wrong direction of spraying of pesticides by hand or knapsack sprayer. About 97% of exposed participants had experienced symptoms attributable to pesticide exposure. The frequent symptoms were reported as weakness and headache. There is the need to review safety precautions in the use and application of pesticides in Ghana.	Archives of Environmental Contamination & Toxicology	56	3	623-30	Job title			Cross-sectional	Job title	NA	self-reported	Ghana	lmic
1223	W. Karmaus and N. Wolf	Reduced birthweight and length in the offspring of females exposed to PCDFs, PCP, and lindane	1995	The objective of this study was to investigate a broad range of adverse health outcomes and their potential association to wood preservative used in daycare centers. This article focuses on reproductive effects. A sample of 221 exposed teachers was provided by the employer's liability insurers. A comparison group (n = 189) insured by the same two organizations was recruited from nonexposed daycare centers. In a face-to-face interview, job history and reproductive history of 398 female teachers were ascertained. Data on exposure were provided, including measurements on concentration of pentachlorophenol (PCP) and lindane in wood panels, and of PCP, lindane, polychlorinated dibenzo-p-dioxins and dibenzofurans in indoor air. An exposure matrix based on individual job history, independent exposure information from each center, and reproductive history was set up with regard to the vulnerable time windows for each pregnancy. Using this approach, 49 exposed and 507 nonexposed pregnancies were identified, including 32 exposed and 386 nonexposed live births. For subgroup analyses the observations were restricted to independent pregnancies, excluding multiple and consecutive births. The data were analyzed with linear regression techniques, taking confounders into account. The crude median difference between exposed and nonexposed was 175 g in birthweight and 2 cm in length. Controlling for confounders, the results show a significantly reduced but weight (p = 0.04) and length (p = 0.02) in exposed pregnancies, even after restricting the data to independent pregnancies and pregnancies for which data could be validated from the mother's health cards. These differences were not explained by differences in gestational age indicating that a toxic effect, which could cause small-for date newborns, might have affected the fetus.	Environmental Health Perspectives	103	12	1120-5	Self-reported exposure	Job exposure matrix		NA	Pesticides in general	offspring	self-reported	Germany	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1224	W. Karmaus, S. Davis, C. Fussman and K. Brooks	Maternal concentration of dichlorodiphenyl dichloroethylene (DDE) and initiation and duration of breast feeding	2005	Dichlorodiphenyl dichloroethylene (DDE) has been shown to reduce the duration of breast feeding in two studies. In addition to duration, we examined whether DDE lowers the initiation of breast feeding. Between 1973 and 1991, the Michigan Department of Community Health conducted three surveys to assess polychlorinated biphenyls (PCBs) and DDE serum concentrations in Michigan anglers. Through telephone interviews with parents, we retrospectively ascertained information on breast feeding. Based on repeated maternal serum measurements between 1973 and 1991, we arrived at the level of exposure at the time of delivery by extrapolating PCB and DDE serum levels. One mother may have contributed more than one child; however, serum concentrations varied between children from the same mother. The maternal DDE and PCB serum concentrations were categorised as follows: 0 to <5 microg/L, 5 to <10 microg/L, >or=10 microg/L. Repeated measurement models and survival analyses were used to determine the relationship between DDE and PCBs and characteristics of breast feeding while controlling for cohort effects, maternal age at delivery, education, and smoking during pregnancy. We focused on 176 pregnancies of 91 mothers who had maternal exposure information and gave birth between 1969 and 1995. Initiation of breast feeding was lowered by 39.5% and duration shortened by 66.4% in children of mothers who smoked during pregnancy. In children of non-smoking mothers, the incidence ratio for breast-feeding initiation was 0.45 [95% CI 0.15, 0.94] and 0.42 [95% CI 0.10, 1.03] when maternal DDE concentrations were 5 to <10 microg/L and >or=10 microg/L respectively, compared with the lowest DDE exposure group. In these offspring (of non-smoking mothers), breast-feeding duration was shorter when DDE concentrations were higher: 13 weeks for >or=10 microg/L DDE, compared with 21.7 weeks for lower DDE. We did not detect any association between PCBs and breast feeding. In the absence of the distorting effects of maternal smoking, DDE exposure may decrease initiation and duration of breast feeding.	Paediatric and Perinatal Epidemiology	19	5	388-98	Algorithm/model			Cohort (prospective)	Specific active ingredient	reproductive	self-reported	USA	hic
1225	W. O. d. P. Willis, A.; Molgaard, C. A.; Walker, C.; MacKendrick, T.	Pregnancy outcome among women exposed to pesticides through work or residence in an agricultural area	1993	The study population consisted of women enrolled in a southern California community clinic perinatal program. All women entering the program between January 1987 and December 1989 were asked to participate, and a cohort of 535 women was included in the study. Primarily Hispanic, of low income and educational level, many had recently immigrated from Mexico. They were potentially exposed to pesticides and other agricultural chemicals occupationally and/or environmentally because agricultural production in San Diego County is among the highest in the state. Study methods consisted of biologic assay of maternal blood samples for determination of cholinesterase activity and concurrent patient interviews to determine exposure history by self report. These assessments were conducted on each participant approximately once each trimester. Self-report and blood assay data were analyzed using chi 2, the Mantel-Haenszel extension of chi 2, and risk ratios to determine the association between pesticide exposure and spontaneous abortion, preterm birth, low birth weight and toxemia. No difference between exposed and unexposed women was noted for risk of preterm birth or toxemia. Subjects who experienced spontaneous abortion were all unexposed, and the rate of spontaneous abortion was 2.1%, less than generally expected. A greater incidence of low birth weight among unexposed women indicates that exposure may have had a "protective" effect.	Journal of Occupational Medicine	35	9	943-9	Biomonitoring (blood)			Cohort (prospective)	Chemical class	reproductive	self-reported	USA	hic
1226	W. P. Naksen, T.; Mangklabruks, A.; Chantara, S.; Thavornyutikarn, P.; Srinual, N.; Panuwet, P.; Ryan, P. B.; Riederer, A. M.; Barr, D. B.	Associations of maternal organophosphate pesticide exposure and PON1 activity with birth outcomes in SAWASDEE birth cohort, Thailand	2015	Prenatal organophosphate (OP) pesticide exposure has been reported to be associated with adverse birth outcomes and neurodevelopment. However, the mechanisms of toxicity of OP pesticides on human fetal development have not yet been elucidated. Our pilot study birth cohort, the Study of Asian Women and Offspring's Development and Environmental Exposures (SAWASDEE cohort) aimed to evaluate environmental chemical exposures and their relation to birth outcomes and infant neurodevelopment in 52 pregnant farmworkers in Fang district, Chiang Mai province, Thailand. A large array of data was collected multiple times during pregnancy including approximately monthly urine samples for evaluation of pesticide exposure, three blood samples for pesticide-related enzyme measurements and questionnaire data. This study investigated the changes in maternal acetylcholinesterase (AChE) and paraoxonase 1 (PON1) activities and their relation to urinary diakylphosphates (DAPs), class-related metabolites of OP pesticides, during pregnancy. Maternal AChE, butyrylcholinesterase (BChE) and PON1 activities were measured three times during pregnancy and urinary DAP concentrations were measured, on average, 8 times from enrollment during pregnancy until delivery. Among the individuals in the group with low maternal PON1 activity (n=23), newborn head circumference was negatively correlated with log10 maternal DEAP and DAP at enrollment (gestational age=12+/-3 weeks; beta=-1.0 cm, p=0.03 and beta=-1.8 cm, p<0.01, respectively) and at 32 weeks pregnancy (beta=-1.1cm, p=0.04 and beta=-2.6 cm, p=0.01, respectively). Furthermore, among these mothers, newborn birthweight was also negatively associated with log10 maternal DEAP and DAP at enrollment (beta=-219.7 g, p=0.05 and beta=-371.3g, p=0.02, respectively). Associations between maternal DAP levels and newborn outcomes were not observed in the group of participants with high maternal PON1 activity. Our results support previous findings from US birth cohort studies. This is the first study to report the associations between prenatal OP pesticide exposure and birth outcomes in Thailand.	Environmental Research	142	NA	288-96	Biomonitoring (urine)			Cohort (prospective)	Chemical class	offspring	medical test result	Thailand	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1227	W. Pickett, W. D. King, R. E. Lees, M. Bienefeld, H. I. Morrison and R. J. Brison	Suicide mortality and pesticide use among Canadian farmers	1998	BACKGROUND: An exploratory, case-control study was used to investigate a new hypothesis about suicide among farm operators. This hypothesis suggested a biologically plausible link between exposures to certain pesticides and the occurrence of suicide among farm operators. These analyses were based on data from the Canadian Farm Operator Cohort. METHODS: Canadian male farm operators who committed suicide between 1971-1987 (n = 1,457) were compared with a frequency matched (by age and province) sample of control farm operators (n = 11,656) who were alive at the time of death of individual cases. Comparisons focused on past exposures to pesticides reported to the 1971 Canada Census of Agriculture. RESULTS: Multivariate logistic regression analyses indicated no associations between suicide and (1) acres sprayed with herbicides, (2) acres sprayed with insecticides, and (3) the costs of agricultural chemicals purchased; after controlling for important covariates. There was, however, a suggestive increase in risk for suicide associated with herbicide and insecticide spraying among a subgroup of farm operators who were most likely to be directly exposed to pesticides: OR = 1.71 (95% CI = 1.08-2.71) for 1-48 vs. 0 acres sprayed. Additional risk factors that were identified included seasonal vs. year-round farm work (OR = 1.68; 95% CI = 1.15-2.46); and high levels of paid labor on the farm (e.g., OR = 1.61; 95% CI = 1.24-2.10, for > 13 vs. 0 weeks per year). Factors that were protective included marriage (odds ratio (OR) = 0.69; 95% confidence interval (CI) = 0.58-0.81), having more than one person resident in the farm house (e.g., two vs. one person; OR = 0.62; 95% CI = 0.42-0.92); and higher levels of education (e.g., postsecondary vs. primary; OR = 0.40; 95% CI = 0.17-0.96). CONCLUSIONS: This study does not provide strong support for the main hypothesis under study, that exposure to pesticides is an important risk factor for suicide among farmers. Although secondary to the main hypothesis, a number of other risk factors for suicide were suggested. These have implications for the future study and targeting of suicide prevention programs in rural Canada.	American Journal of Industrial Medicine	34	4	364-72	Registers			Case-control	Job title	mortality (all cause)	doctor-diagnosed	Canada	hic
1228	W. S. Goldner, D. P. Sandler, F. Yu, V. Shostrom, J. A. Hoppin, F. Kamel and T. D. LeVan	Hypothyroidism and pesticide use among male private pesticide applicators in the agricultural health study	2013	OBJECTIVE: Evaluate the association between thyroid disease and use of insecticides, herbicides, and fumigants/fungicides in male applicators in the Agricultural Health Study. METHODS: We examined the association between use of 50 specific pesticides and self-reported hypothyroidism, hyperthyroidism, and "other" thyroid disease among 22,246 male pesticide applicators. RESULTS: There was increased odds of hypothyroidism with ever use of the herbicides 2,4-D (2,4-dichlorophenoxyacetic acid), 2,4,5-T (2,4,5-trichlorophenoxyacetic acid), 2,4,5-TP (2,4,5-trichlorophenoxy-propionic acid), alachlor, dicamba, and petroleum oil. Hypothyroidism was also associated with ever use of eight insecticides: organochlorines chlordane, dichlorodiphenyltrichloroethane (DDT), heptachlor, lindane, and toxaphene; organophosphates diazinon and malathion; and the carbamate carbofuran. Exposure-response analysis showed increasing odds with increasing level of exposure for the herbicides alachlor and 2,4-D and the insecticides aldrin, chlordane, DDT, lindane, and parathion. CONCLUSION: There is an association between hypothyroidism and specific herbicides and insecticides in male applicators, similar to previous results for spouses.	Journal of Occupational & Environmental Medicine	55	10	1171-8	Self-reported exposure	Algorithm/model		Cohort (prospective)	Specific active ingredient	endocrine/nutritional/metabolical	medical test result	USA	hic
1229	W. Venegas, I. Zapata, E. Carbonell and R. Marcos	Micronuclei analysis in lymphocytes of pesticide sprayers from Concepcion, Chile	1998	To estimate the genetic risk associated with pesticide exposure in a defined population, the frequency of micronuclei (MN) in peripheral blood lymphocytes from a group of 22 pesticide sprayers from Concepcion, Chile, occupationally exposed to pesticide mixtures was evaluated. After scoring 1,000 binucleated cells for each donor, no significant increases were observed either for the total number of MN or for binucleated cells with MN, when compared with a concurrent control population. In addition, when the effects of different confounding factors such as age, smoking, and drinking habits were considered, no significant effect was observed. Our conclusion is that, in this specific group of workers and under the particular conditions of exposure to pesticides, when evaluated by the micronucleus assay, no genetic risk was detected.	Teratogenesis, Carcinogenesis, & Mutagenesis	18	3	123-9	Registers			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Chile	hic
1230	W. W. Au, C. H. Sierra-Torres, N. Cajas-Salazar, B. K. Shipp and M. S. Legator	Cytogenetic effects from exposure to mixed pesticides and the influence from genetic susceptibility	1999	Exposure to pesticides remains a major environmental health problem. Health risk from such exposure needs to be more precisely understood. We conducted three different cytogenetic assays to elucidate the biological effects of exposure to mixed pesticides in 20 Costa Rica farmers (all nonsmokers) compared with 20 matched controls. The farmers were also exposed to dibromochloropropane during the early employment years, and most of them experienced sterility/fertility problems. Our data show that the farmers had consistently higher frequencies of chromosome aberrations, as determined by the standard chromosome aberration assay, and significantly abnormal DNA repair responses ($p < 0.05$), as determined by the challenge assay, but no statistically significant differences in the tandem-probe fluorescence in situ hybridization (FISH) assay ($p > 0.05$). Genotype analysis indicates that farmers with certain "unfavorable" versions of polymorphic metabolizing genes (cytochrome P4502E1, the glutathione S-transferases mu and theta, and the paraoxonase genes) had significantly more biological effects, as determined by all three cytogenetic assays, than both the farmers with the "favorable" alleles and the matched controls. A unique observation is that, in individuals who had inherited any of the mentioned "unfavorable" alleles, farmers were consistently underrepresented. In conclusion, the Costa Rican farmers were exposed to genotoxic agents, most likely pesticides, which expressed the induction of biological and adverse health effects. The farmers who had inherited "unfavorable" metabolizing alleles were more susceptible to genotoxic effects than those with "favorable" alleles. Our genotype data suggest that the well-recognized "healthy worker effect" may be influenced by unrecognized occupational selection pressure against genetically susceptible individuals.	Environmental Health Perspectives	107	6	501-5	Self-reported exposure			Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Costa Rica	umic
1231	W. Y. Wong, G. A. Zielhuis, C. M. Thomas, H. M. Merkus and R. P. Steegers-Theunissen	New evidence of the influence of exogenous and endogenous factors on sperm count in man	2003	OBJECTIVE: To examine the association between individual exposures due to occupation, environment and lifestyle on sperm count, we conducted a case-control study among 92 fertile and 73 sub-fertile Caucasian males. STUDY DESIGN: Data from questionnaires were analysed using simple univariate and multivariate logistic regression models. RESULTS: At risk for oligozoospermia are men exposed to pesticides (odds ratio (OR) 8.4; 95% confidence interval (CI) 1.3-52.1), welding (OR 2.8; CI 0.9-8.7), antibiotic use (OR 15.4; CI 1.4-163), a history of mumps (OR 2.9; CI 1.3-6.7), gastrointestinal complaints (OR 6.2; CI 1.4-26.8), decreased intake of fruits (OR 2.3; CI 1.0-5.1), vegetables (OR 1.9; CI 0.7-5.0), or with female fertility disorders in their families (OR 8.4; CI 1.7-41.9). Unlike other studies, no associations were observed between oligozoospermia and exposure to paint or heat. CONCLUSION: This study suggests new risk factors oligozoospermia in man and confirms previously reported results from others.	European Journal of Obstetrics, Gynecology, & Reproductive Biology	110	1	49-54	Self-reported exposure			Case-control	Pesticides in general	reproductive	medical test result	Netherlands	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1232	X. Duan, Y. Yang, S. Wang, X. Feng, T. Wang, P. Wang, S. Liu, L. Li, G. Li, W. Yao, L. Cui and W. Wang	Cross-sectional associations between genetic polymorphisms in metabolic enzymes and longer leukocyte telomere length induced by omethoate	2017	Purpose: This study aimed to explore the effects of genetic polymorphisms in metabolic enzymes on relative telomere length changes and explore the mechanism of canceration induced by omethoate. Materials and Methods: 180 long-term omethoate-exposed workers and 115 healthy controls were recruited. Real-time PCR method was applied to determine the relative telomere length in peripheral blood leukocytes DNA, and Six polymorphic loci of GSTT1(+/-), GSTM1(+/-), GSTP1 rs1695, CYP2E1 rs6413432, CYP2E1 rs3813867 and PON2 rs12026 were detected by polymerase chain reaction and restriction fragment length polymorphism method; Multiple linear regression was conducted to explore the effects of omethoate exposure and genetic polymorphisms on the telomere length. Results: The relative telomere lengths in the control group (0.94 [0.76, 1.32]) were significantly shorter than that in the exposure group (1.50 [1.11, 2.57]) (Z = 7.910, P < 0.001). Univariate analysis showed that the relative telomere lengths of the GSTM1-deletion individuals were significantly longer than that of the non - deletion genotype in the control group (Z = 2.911, P = 0.004), and the relative telomere lengths of GSTP1 rs1695 polymorphism locus (GG+AG) genotype individuals were longer than that of AA genotype in the exposure group. The difference was statistically significant (Z = 2.262, P = 0.024). Multivariate analysis found that pesticide-exposure (b = 0.524, P < 0.001) and GSTM1 polymorphism (b = -0.136, P = 0.029) had an impact on telomere length. Conclusions: The relative telomere lengths of omethoate-exposure workers were longer than that in the control population. Also GSTM1 genetic polymorphism may influence the changes of the telomere length induced by omethoate. Copyright: Duan et al.	Oncotarget	8	46	80638-80644	EAM not reported			Cross-sectional	Specific active ingredient	genetic (biomarkers)	medical test result	China	umic
1233	X. Duan, Y. Yang, S. Wang, X. Feng, T. Wang, P. Wang, S. Liu, L. Li, W. Yao, L. Cui and W. Wang	Changes in the expression of genes involved in cell cycle regulation and the relative telomere length in the process of canceration induced by omethoate	2017	Organophosphorous pesticides (OPs), with high efficiency, broad-spectrum and low residue, are widely used in China. Omethoate is a broad category of organophosphorous pesticides and is more domestically utilized which has chronic toxic effect on human health caused by long-term, low-dose exposure to Ops, recently its potential genotoxicity has attracted wide attention which can cause chromosomal DNA damage. Thus, the aim of this study is screen susceptible biomarkers and explore the mechanism of canceration induced by omethoate. 180 long-term organophosphorus pesticide-exposed workers and 115 healthy controls were recruited. Quantitative polymerase chain reaction method was applied to determine the relative telomere length in peripheral lymphocyte DNA as well as p53 and p21 gene expression levels. Genetic polymorphisms were determined by the polymerase chain reaction-restriction fragment length polymorphism method. Multiple linear regression was conducted to explore the effects of exposure, expression levels, and polymorphisms in genes on the telomere length. The results showed the relative telomere lengths in the exposure group were significantly longer than that in the control group. The messenger RNA expression levels of p53 and p21 in exposure group were significantly lower than that in the control group; telomere lengths of the CA genotype individuals of p21 rs1801270 polymorphism locus were significantly longer than that of the CC genotype in the control group that were estimated using the Bonferroni method; and bivariate correlation analysis showed that the messenger RNA expression level of gene p53 was negatively correlated with telomere length, and the messenger RNA expression level of gene p21 was positively correlated with telomere length. Multivariate analysis found that p53 messenger RNA and p21 messenger RNA had an impact on telomere length. These results demonstrated that the messenger RNA expression levels of p53 and p21 may have a relationship with the changes in telomere length induced by omethoate and provided strong evidence for the mechanism of canceration induced by poison.	Tumour Biology	39	7	NA	EAM not reported			Cohort (prospective)	Specific active ingredient	genetic (biomarkers)	medical test result	China	umic
1234	X. Huang, C. Zhang, R. Hu, Y. Li, Y. Yin, Z. Chen, J. Cai and F. Cui	Association between occupational exposures to pesticides with heterogeneous chemical structures and farmer health in China.	2016	This study analyzed the associations of farmers' exposure to organophosphates (OPs), organosulfurs (OSs), organonitrogens (ONs) and pyrethroids (PYRs) with parameters of the blood complete counts (CBC), a blood chemistry panel (BCP) and the conventional nerve conduction studies among 224 farmers in China in 2012. Two health examinations and a series of follow-up field surveys were conducted. Multiple linear regression analyses were used to evaluate the associations. The results show considerable associations between multiple groups of pesticides and several CBC parameters, but it was not enough to provide evidence of hematological disorders. The short- and medium-term OPs exposures were mainly associated with liver damage and peripheral nerve impairment, respectively, while OSs exposure might induce liver damage and renal dysfunction. The neurotoxicity of ONs was second only to OPs in addition to its potential liver damage and the induced alterations in glucose. In comparison, the estimated results show that PYRs would be the least toxic in terms of the low-dose application. In conclusion, occupational exposures to pesticides with heterogeneous chemical structures are associated with farmer health in different patterns, and the association between a specific group of pesticides and farmer health also differs between the short- and medium-term exposures.	Scientific Reports	6	NA	25190	Self-reported exposure			Cohort (prospective)	Specific active ingredient	hematological	medical test result	China	umic
1235	X. L. Sun, T. Kido, S. Honma, E. Koh, R. Okamoto, H. D. Manh, S. Maruzeni, M. Nishijo, H. Nakagawa, T. Nakano, T. Takasuga, D. D. Nhu, N. N. Hung and L. K. Son	The relationship between dioxins exposure and risk of prostate cancer with steroid hormone and age in Vietnamese men	2017	Although Vietnam's massive herbicide exposure in 1960s and 1970s was clearly injurious to health, not all causal relationships have been clarified. We therefore explored associations among dioxins, steroid hormones, age and prostate cancer risk in men. We compared serum levels of dioxin, steroid hormones and prostate specific antigen (PSA) in men aged 56<U+201A><U+00C4><U+00EC>81<U+00AC><U+2020>years from herbicide-exposed hotspots (n<U+00AC><U+2020>=<U+00AC><U+2020>50) with those from non-sprayed regions (n<U+00AC><U+2020>=<U+00AC><U+2020>48). Mean serum levels of dioxin congeners in the hotspot group were 1.5<U+201A><U+00C4><U+00EC>11.3 times higher than the non-sprayed group depending on specific compound. Levels of testosterone, estradiol and 3<U+0152><U+2264>-hydroxysteroid dehydrogenase (3<U+0152><U+2264>-HSD) activity in the hotspot group were also significantly higher than in non-sprayed group. Estradiol levels were significantly related to levels of several specific dioxin derivatives in both group. Significant positive correlations were also found between DHT and 1234678-HpCDD or 1234678-HpCDF; and between 3<U+0152><U+2264>-HSD activity and 123678-HxCDD, 123478-HxCDF, 123678-HxCDF, or HxCB#169. After adjusting for age, body mass index, and tobacco use, multiple linear regressions showed levels of dihydrotestosterone (DHT), estradiol, testosterone and 3<U+0152><U+2264>-HSD activity were not associated with dioxins in the two groups; however, levels of DHT, testosterone and 3<U+0152><U+2264>-HSD activity increased significantly with age in the hotspot group. The hotspot and non-sprayed groups did not significantly differ in PSA levels. But six of the hotspot subjects had PSA levels ><U+00AC><U+2020>3<U+00AC><U+2020>ng/mL, 3 of whom were suspected to have prostate cancer (PC) after digital rectal examination. Our findings suggest that dioxin exposure can lead to increased levels of several sex steroid hormones with age. The correlation of dioxin with steroid hormone levels and prostate cancer risk should be studied further.	Science of the Total Environment	595	NA	842-848	Biomonitoring (blood)			Cross-sectional	Specific active ingredient	cancer	doctor-diagnosed	Vietnam	lmic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1236	X. Liu, B. L. Zhu, Y. H. Ban and M. Chen	Impacts of occupational contact with termite-control drug on human immune function	2004	Background: Many chemical poisons existing in our daily life and environment have immunotoxicity in certain dose including termite-control drug, chlordane, and pesticides containing arsenic. Whether occupational contact with this type of chemical poisons would induce injuries of the immune system of the operators? Objective: To investigate the impacts of occupational contact with termite-control drug on the immune functions of the operators. Design: A case-control trial. Settings: Original Department of Occupational Diseases, Toxic and Chemical Laboratory, Jiangsu Hospital of Prevention and Treatment for Occupational Disease. Participants: The study was performed in the original Department of Occupational Diseases, Toxic and Chemical Laboratory, Jiangsu Hospital of Prevention and Treatment for Occupational Disease from January 2002 and December 2003. Contact groups were termite-control group, arsenic-producing group and chlordane-producing group. A total of 216 subjects were selected from the staff who were termite controllers of some termite-control institute, workers produce arsenic drug and chlordane of some pesticide factory. Another 64 healthy subjects who had no occupational contacts were selected as the control group. Inclusive criteria: 1 subjects in the contact groups involved in were more than 2 years of service; 2 subjects in the control group were healthy volunteers had no contact with toxic and harmful substances, other conditions of the control group were similar to that of contact groups. Exclusive criteria: 1 subjects were in accordance with the inclusive criteria but had less than 2 years of exposure; 2 subjects had no contacts with toxic and harmful substances but other diseases. Interventions: ICS apparatus for immune chemistry system made by Beckman Company(USA) and PEG-ultraviolet quantitative method were used for the assay of serum IgA, IgG, IgM, C3, C4, CRP and CIC of operators. The impacts of the length of services, smoking, drinking and the poison concentration in vivo on immune level were analyzed as well. Main outcome measures: Serum levels of IgG, IgA, IgM, C3, C4, CRP and CIC. Results: Occupational contacts of termite-control drug significantly reduced serum IgG, IgA and IgM levels(t = 2.16 to 2.35, P < 0.05); However, there were no significant differences in IgG, IgA and IgM levels between subjects with different lengths of services. Smoking and drinking could aggravate the impacts of termite-control drugs, Arsenic and Chlordane, on human immune response, which significantly reduced serum IgG, IgA and IgM (t = 1.76 to 5.68, P < 0.05 to 0.01). Levels of immune globulin in vivo were negatively correlated with serum contents of chlordane and uric content of arsenic(r = - 0.5123 to - 0.2314, P < 0.05 to 0.01). Conclusion: Occupational contacts with termite-control drug can significantly reduce the	Chinese Journal of Clinical Rehabilitation	8	36	8408-8410	Job title			Case-control	Job title	immunological	medical test result	China	umic
1237	X. Sun, T. Kido, R. Okamoto, H. D. Manh, N. V. Hoang, M. Nakano, E. Koh, S. Maruzeni, M. Nishijo, H. Nakagawa, H. Suzuki, S. Honma, D. D. Nhu, N. N. Hung and K. Son le	The relationship between Agent Orange and prostate specific antigen: a comparison of a hotspot and a non-sprayed area in Vietnam	2013	OBJECTIVES: The aim of this study was to explore the impact of Agent Orange exposure for prostate cancer with a comparison of the prostate specific antigen (PSA) levels between a hotspot and a non-sprayed area.	NA	NA	NA	NA	Registers			Cohort (prospective)	Chemical class	cancer	doctor-diagnosed	USA	hic
1238	X. Xu, T. Niu, D. C. Christiani, S. T. Weiss, Y. Zhou, C. Chen, J. Yang, Z. Fang, Z. Jiang, W. Liang and F. Zhang	Environmental and occupational determinants of blood pressure in rural communities in China	1997	PURPOSE: To identify and characterize major environmental and occupational determinants of blood pressure in rural communities in China. METHODS: In 1993 we conducted a large cross-sectional, community-based study of 20,216 residents aged 15 years or older, from the Yijing area of Anhui Province (8022 men, 12,194 women), one of whom were receiving treatment for hypertension. The mean systolic blood pressure was 116.7 +/- 19.5 mmHg for men and 113.2 +/- 19.4 mmHg for women. RESULTS: The mean diastolic blood pressure was 72.4 +/- 12.1 mmHg for men and 70.4 +/- 11.6 mmHg for women. Age and body mass index were the two most important determinants of blood pressure in this population. With controls for age and body mass index, height and weight remained significant predictors of blood pressure. Multiple linear regression analysis indicated that alcohol consumption, self-reported exposure to noise, drinking of tap water and pond water, occupational exposure to dust/fumes/gases, rice consumption, inferior housing, household crowdedness, and being unmarried were related to increased blood pressure levels. Vegetable intake, frequent consumption of meat at meals, high level of physical activity, exposure to straw-combustion smoke, and pesticide use were negatively associated with blood pressure. CONCLUSIONS: Our study demonstrated that a broad array of demographic, ergonomic, nutritional, and environmental factors are critical determinants of blood pressure in this rural Chinese population.	Annals of Epidemiology	7	2	95-106	Self-reported exposure			Cross-sectional	Pesticides in general	circulatory	medical test result	China	umic
1239	X. Zhang, H. Sui, H. Li, J. Zheng, F. Wang, B. Li and Y. Zhang	Paraoxonase activity and genetic polymorphisms in northern Han Chinese workers exposed to organophosphate pesticides	2014	Paraoxonase (PON1) is one of the major players in the detoxification of organophosphates (OPs). This study presents our investigation into the effect of OPs on serum PON1 activity and the distribution of common PON1 polymorphisms in Han Chinese workers with repeated high exposure to OP pesticides, and the factors modulating PON1 activity. In all, 400 participants, including 180 workers exposed to OP pesticides occupationally, and 220 controls were investigated. Serum PON1 and cholinesterase (ChE) activity were measured, and genotyping was done using polymerase chain reaction-restriction fragment length polymorphism. The association between PON1 activity and PON1 polymorphisms, and the influencing factors of PON1 activity, were analyzed. The results revealed that repeated OP exposures significantly decreased serum PON1 and ChE activity (P< 0.05), although the exposed workers did not complain of health problems. Higher L and R allele frequencies for the L55M and Q192R polymorphisms of PON1 were observed. PON1 polymorphisms (especially the Q192R polymorphism) and pesticide exposures significantly affected serum PON1 activity in the study population. Therefore, the results of this investigation indicate PON1 polymorphisms and pesticide exposures may be important risk predictors for OP poisoning in the Han Chinese population, who display very high frequencies of the M allele and R allele for PON1 polymorphisms at the positions 55 and 192, respectively.	Experimental Biology & Medicine	239	2	232-9	Self-reported exposure			Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	China	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1240	X. Zhang, M. Wu, H. Yao, Y. Yang, M. Cui, Z. Tu, L. Stallones and H. Xiang	Pesticide poisoning and neurobehavioral function among farm workers in Jiangsu, People's Republic of China	2016	Pesticides remain an integral part of agricultural activities worldwide. Although there have been a number of studies over the last two decades concerning the adverse effects of pesticide poisoning and chronic long term exposures on neurobehavioral function, the impact of recent pesticide poisoning and long term pesticide exposure on neurobehavioral function in Chinese farm workers has not been reported. China is the largest user of pesticides worldwide and figures suggest 53,300-123,000 Chinese people are poisoned every year. A case control study was conducted to examine the impact of recent pesticide poisoning on neurobehavioral function and the relationship between years worked in agriculture and lower performance on neurobehavioral tests. A total of 121 farm workers who self-reported recent pesticide poisonings within the previous 12 months (case group) and 80 farm workers who reported no pesticide poisoning in the previous 12 months (control group) were recruited from three areas of Jiangsu Province, China. The World Health Organization (WHO) recommended neurobehavioral core test battery (NCTB) was used to assess neurobehavioral functioning among cases and controls. Student's t tests and two-way covariance analysis (ANCOVA) were used to test for significant differences in the neurobehavioral test results between the groups. Scores on the Profile of Mood States (POMS) in the recently poisoned group were significantly higher for anger-hostility, depression-dejection, tension-anxiety and lower for vigor-activity compared to controls ($p < .05$). Digit span, digit symbol, Benton visual retention and pursuit aiming scores were all significantly lower among the recently poisoned group compared to the controls ($p < .05$). Two-way ANCOVA indicated significantly lower performance in correct pursuit aiming and higher error pursuit aiming amongst the recently poisoned group and those who had worked for more than 30 years in agriculture ($p < .05$). These findings provide important preliminary epidemiological evidence regarding the association between occupational pesticide exposure and neurobehavioral functioning in Chinese farm workers.	Cortex	74	NA	396-404	Self-reported exposure			Case-control	Pesticides in general	neurological	medical test result	China	umic
1241	X. Zhang, W. Zhao, R. Jing, K. Wheeler, G. A. Smith, L. Stallones and H. Xiang	Work-related pesticide poisoning among farmers in two villages of Southern China: a cross-sectional survey	2011	BACKGROUND: Pesticide poisoning is an important health problem among Chinese farm workers, but there is a paucity of pesticide poisoning data from China. Using the WHO standard case definition of a possible acute pesticide poisoning, we investigated the prevalence and risk factors of acute work-related pesticide poisoning among farmers in Southern China. METHODS: A stratified sample of 910 pesticide applicators from two villages in southern China participated in face-to-face interviews. Respondents who self-reported having two or more of a list of sixty-six symptoms within 24 hours after pesticide application were categorized as having suffered acute pesticide poisoning. The association between the composite behavioral risk score and pesticide poisoning were assessed in a multivariate logistic model. RESULTS: A total of 80 (8.8%) pesticide applicators reported an acute work-related pesticide poisoning. The most frequent symptoms among applicators were dermal (11.6%) and nervous system (10.7%) symptoms. Poisoning was more common among women, farmers in poor areas, and applicators without safety training (all $p < 0.001$). After controlling for gender, age, education, geographic area and the behavioral risk score, farmers without safety training had an adjusted odds ratio of 3.22 (95% CI: 1.86-5.60). The likelihood of acute pesticide poisoning was also significantly associated with number of exposure risk behaviors. A significant "dose-response" relationship between composite behavioral risk scores calculated from 9 pesticides exposure risk behaviors and the log odds of pesticide poisoning prevalence was seen among these Chinese farmers ($R2 = 0.9246$). CONCLUSIONS: This study found that 8.8% of Chinese pesticide applicators suffered acute pesticide poisoning and suggests that pesticide safety training, safe application methods, and precautionary behavioral measures could be effective in reducing the risk of pesticide poisoning.	BMC Public Health	11	NA	429	Self-reported exposure			Cross-sectional	Pesticides in general	NA	self-reported	China	umic
1242	Y. A. Mekonnen, T.	Effects of pesticide applications on respiratory health of Ethiopian farm workers	2002	The effects of pesticide use on the respiratory health of agricultural farm workers were studied in 203 farm workers and 131 controls. The farm workers were sprayers, supervisors, technicians, and pest assessors. Pulmonary function was found to be remarkably poor among the non-smoker supervisors, followed by the non-smoker sprayers, as compared with that of the non-smoker controls. The means (SD) of FVC and FEV1 for supervisors and sprayers were 2.88 (0.41), 3.05(0.50) and 2.74(0.38), 2.89(0.54), respectively, $p < 0.05$. The non-smoker technicians had the most respiratory symptoms, with wheezing and breathlessness being the most frequent (35.7% in 14 technicians). Farm workers with various job experiences are subject to reduction of pulmonary function and frequent complaints of respiratory symptoms that could possibly lead to chronic respiratory health problems.	International Journal of Occupational & Environmental Health	8	1	35-40	Job title			Cross-sectional	Job title	respiratory	medical test result	Ethiopia	lic
1243	Y. Campos, V. Dos Santos Pinto da Silva, M. Sarpa Campos de Mello and U. Barros Otero	Exposure to pesticides and mental disorders in a rural population of Southern Brazil	2016	INTRODUCTION: Exposure to pesticides has been associated with mental disorders, especially in occupationally exposed populations, such as farmers. This effect has been attributed to the neurotoxic and endocrine-disrupting activity of pesticides, as suggested by experimental studies. OBJECTIVE: To determine the prevalence of common mental disorders and self-reported depression, and analyze their association with the exposure to pesticides in a rural population resident in the municipality of Dom Feliciano, Rio Grande do Sul, where tobacco farming is the main economic activity. METHODOLOGY: A cross-sectional study evaluating the prevalence of common mental disorders and self-reported depression in a sample of 869 adult individuals resident in Dom Feliciano, between October 2011 and March 2012 was performed. The evaluation of common mental disorders was performed using the Self-Reporting Questionnaire (SRQ-20), setting a cutoff point of 8 for both genders. A standardized questionnaire was used to obtain information on self-reported depression upon prior diagnosis by a health professional, and self-reported exposure to pesticide. In order to evaluate the association between exposure to pesticides and mental disorders, a non-conditional multivariate logistic regression analysis was performed. RESULTS: The prevalence of common mental disorders and self-reported depression in the sample population were 23% and 21%, respectively. Among individuals who reported depression, an increase of 73% was observed in the odds of pesticide exposure at an age equal to or less than 15 years. There was a positive association between self-reported pesticide poisoning and common mental disorders (OR=2.63; 95% CI, 1.62-4.25) as well as self-reported depression (OR=2.62; 95% CI, 1.63-4.21). Individuals who reported depression had a greater odds of exposure to pyrethroids (OR=1.80; 95% CI, 1.01-3.21) and aliphatic alcohol (OR=1.99; 95% CI, 1.04-3.83). An SRQ-20>=8 was associated with an approximately seven times higher odds of exposure to aliphatic alcohol (95% CI, 1.73-27.53). Self-reported depression positively correlated with a greater period of exposure to dinitroaniline (OR=2.20; 95% CI, 1.03-4.70) and sulphonylurea (OR=4.95; 95% CI, 1.06-23.04). CONCLUSION: The results suggest that exposure to pesticides could be related mental disorders. However, other common risk factors in tobacco farming, the main local economic activity, cannot be excluded.	Neurotoxicology	56	NA	43297	Self-reported exposure			Cross-sectional	Pesticides in general	mental disorders	self-reported	Brazil	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1244	Y. Carbajal-Lopez, S. Gomez-Arroyo, R. Villalobos-Pietrini, M. E. Calderon-Segura and A. Martinez-Arroyo	Biomonitoring of agricultural workers exposed to pesticide mixtures in Guerrero state, Mexico, with comet assay and micronucleus test	2016	The aim of this study was to evaluate the genotoxic effect of pesticides in exfoliated buccal cells of workers occupationally exposed in Guerrero, Mexico, using the comet assay and the micronucleus test. The study compared 111 agricultural workers in three rural communities (Arcelia 62, Ajuchitlan 13, and Tlapehuala 36), with 60 non-exposed individuals. All the participants were males. The presence of DNA damage was investigated in the exfoliated buccal cells of study participants with the comet assay and the micronucleus (MN) test; comet tail length was evaluated in 100 nuclei and 3000 epithelial cells of each individual, respectively; other nuclear anomalies such as nuclear buds, karyolysis, karyorrhexis, and binucleate cells were also evaluated. Study results revealed that the tail migration of DNA and the frequency of MN increased significantly in the exposed group, which also showed nuclear anomalies associated with cytotoxic or genotoxic effect. No positive correlation was noted between exposure time and tail length and micronuclei frequencies. No significant effect on genetic damage was observed as a result of age, smoking, and alcohol consumption. The MN and comet assay in exfoliated buccal cells are useful and minimally invasive methods for monitoring genetic damage in individuals exposed to pesticides. This study provided valuable data for establishing the possible risk to human health associated with pesticide exposure.	Environmental Science & Pollution Research	23	3	2513-20	Job title			Cross-sectional	Job title	genetic (biomarkers)	medical test result	Mexico	umic
1245	Y. Hao, S. Tian, X. Jiao, N. Mi, B. Zhang, T. Song, L. An, X. Zheng and D. Zhuang	Association of Parental Environmental Exposures and Supplementation Intake with Risk of Nonsyndromic Orofacial Clefts: A Case-Control Study in Heilongjiang Province, China	2015	The aim of present study was to check the possible association of potential parental environmental exposures and maternal supplementation intake with the risk of nonsyndromic orofacial clefting (NSOC). A retrospective study comprised 499 cases and 480 controls was conducted in Heilongjiang Province. Chi-square analysis and unconditional multiple logistic regression were used in the study. The results showed that maternal history of fever and the common cold without fever (ORCL/P = 3.11 and 5.56, 95%CI: 1.67-5.82 and 2.96-10.47, ORCPO = 3.31 and 8.23, 95%CI: 1.58-6.94 and 4.08-16.95), paternal smoking and alcohol consumption (ORCL/P = 2.15 and 5.04, 95%CI: 1.37-3.38 and 3.00-8.46, ORCPO = 1.82 and 4.40, 95%CI: 1.06-3.13 and 2.50-7.74), maternal exposure to organic solvents, heavy metals, or pesticides (ORCL/P = 6.07, 5.67 and 5.97, 95%CI: 1.49-24.76, 1.34-24.09 and 2.10-16.98, ORCPO = 10.65, 7.28 and 3.48, 95%CI: 2.54-44.67, 1.41-37.63 and 1.06-11.46) and multivitamin use during the preconception period (ORCL/P = 0.06, 95%CI: 0.02-0.23, ORCPO = 0.06, 95%CI: 0.01-0.30) were associated with cleft lip or without cleft palate (CL/P) and cleft palate only (CPO). Maternal history of skin disease and negative life events (ORCL/P = 12.07 and 1.67, 95%CI: 1.81-80.05 and 1.95-2.67) were associated with CL/P. Some potential parental hazardous exposures during the periconception period and maternal use of multivitamins during the preconception period were associated with risk of NSOC.	Nutrients	7	9	7172-84	Self-reported job history			Case-control	Pesticides in general	offspring	doctor-diagnosed	China	umic
1246	Y. J. Liu, P. L. Huang, Y. F. Chang, Y. H. Chen, Y. H. Chiou, Z. L. Xu and R. H. Wong	GSTP1 genetic polymorphism is associated with a higher risk of DNA damage in pesticide-exposed fruit growers	2006	Pesticide exposure is associated with various neoplastic diseases and congenital malformations. Animal studies also indicated that pesticides may be metabolized by cytochrome P450 3A5 (CYP3A5) enzymes, paraoxonases (PON1 and PON2), or glutathione S-transferases (GSTM1, GSTT1, and GSTP1). However, little is known about the genotoxicity of pesticides in people with various genetic polymorphisms of human CYP3A5, PON1, PON2, GSTM1, GSTT1, and GSTP1. Thus, this study was designed to investigate whether various metabolic genotypes are more susceptible to DNA damage in pesticide-exposed fruit growers. Using the Comet assay, the extent of DNA damage was evaluated in the peripheral blood of 91 fruit growers who experienced pesticide exposure and 106 unexposed controls. Questionnaires were administered to obtain demographic data, cigarette smoking habits, medical, and occupational histories. The genotypes for CYP3A5, PON1, PON2, GSTM1, GSTT1, and GSTP1 genes were identified by PCR. The results showed that subjects experiencing high or low pesticide exposure had a significantly greater DNA tail moment (DAN damage) than did controls. The multiple regression model also revealed that age ($P < 0.01$), high pesticide exposure ($P < 0.01$), low pesticide-exposure ($P < 0.01$), and CYP3A5 ($P = 0.04$) and GSTP1 ($P = 0.02$) genotypes were significantly associated with an increased DNA tail moment. Further analysis of environmental and genetic interactions revealed a significant interaction for GSTP1 genotypes to influence DNA tail moment for the high pesticide exposure group. These results suggest that individuals with susceptible metabolic GSTP1 genotypes may experience an increased risk of DNA damage elicited by pesticide exposure.	Cancer Epidemiology, Biomarkers & Prevention	15	4	659-66	Algorithm/model	Self-reported job history		Cross-sectional	Pesticides in general	genetic (biomarkers)	medical test result	Taiwan	hic
1247	Y. K. Cypel, H.	Mortality patterns of Army Chemical Corps veterans who were occupationally exposed to herbicides in Vietnam	2010	PURPOSE: This research examined the risk of disease-related mortality of the Army Chemical Corps (ACC) veterans who handled/sprayed herbicides in Vietnam in comparison with their non-Vietnam veteran peers or U.S. men. METHODS: Vital status was determined through December 31, 2005. All-cause mortality and cause-specific mortality were compared for individuals who served in Vietnam (n = 2872) versus those who did not (n = 2737). Similar analyses were completed on a subset of the original Vietnam cohort that consisted of individuals who either reported spraying herbicide (n = 662) or not (n = 811). The observed deaths for each of the two base cohorts were also compared with expected deaths for U.S. men. RESULTS: Statistically significant excess mortality was found for ACC Vietnam veterans for chronic obstructive pulmonary disease (adjusted relative risk [ARR], 4.82; 95% confidence interval [95% CI], 1.10-21.18). When examining patterns for veterans in the Vietnam veteran subset, we found nonsignificant elevated ARRs among herbicide sprayers for all-cause, respiratory system disease, and respiratory system cancer mortality. Compared with U.S. men, the Vietnam veteran cohort had significant excess mortality for all-causes (standardized mortality ratio [SMR], 1.13; 95% CI, 1.04-1.23), respiratory system cancer (SMR, 1.35; 95% CI, 1.03-1.73), nonmalignant respiratory system disease (SMR, 1.58; 95% CI, 1.08-2.23), and miscellaneous malignant cancers (SMR, 1.77; 95% CI, 1.03-2.84). CONCLUSIONS: The risk of mortality from respiratory disease (malignant or nonmalignant) was significantly greater for ACC Vietnam veterans in comparison with their non-Vietnam veteran peers and U.S. men. Herbicide exposure could be contributing to the patterns observed. Because of the unique nature of their military duties and study limitations, findings may not be generalizeable to Vietnam veterans as a whole.	Annals of Epidemiology	20	5	339-46	Job title			Cohort (prospective)	Type of pesticide	mortality (all cause)	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1248	Y. K. Shim, S. P. Mlynarek and E. van Wijngaarden	Parental exposure to pesticides and childhood brain cancer: U.S. Atlantic coast childhood brain cancer study	2009	BACKGROUND: The etiology of childhood brain cancer remains largely unknown. However, previous studies have yielded suggestive associations with parental pesticide use. OBJECTIVES: We aimed to evaluate parental exposure to pesticides at home and on the job in relation to the occurrence of brain cancer in children. METHODS: We included 526 one-to-one-matched case-control pairs. Brain cancer cases were diagnosed at < 10 years of age, and were identified from statewide cancer registries of four U.S. Atlantic Coast states. We selected controls by random digit dialing. We conducted computer-assisted telephone interviews with mothers. Using information on residential pesticide use and jobs held by fathers during the 2-year period before the child's birth, we assessed potential exposure to insecticides, herbicides, and fungicides. For each job, two raters independently classified the probability and intensity of exposure; 421 pairs were available for final analysis. We calculated odds ratios (ORs) and 95% confidence intervals (CIs) using conditional logistic regression, after adjustment for maternal education. RESULTS: A significant risk of astrocytoma was associated with exposures to herbicides from residential use (OR = 1.9; 95% CI, 1.2-3.0). Combining parental exposures to herbicides from both residential and occupational sources, the elevated risk remained significant (OR = 1.8; 95% CI, 1.1-3.1). We observed little association with primitive neuroectodermal tumors (PNET) for any of the pesticide classes or exposure sources considered. CONCLUSIONS: Our observation is consistent with a previous literature reporting suggestive associations between parental exposure to pesticides and risk of astrocytoma in offspring but not PNET. However, these findings should be viewed in light of limitations in exposure assessment and effective sample size.	Environmental Health Perspectives	117	6	1002-6	Self-reported exposure			Case-control	Pesticides in general	offspring	doctor-diagnosed	USA	hic
1249	Y. L. Guo, B. J. Wang, C. C. Lee and J. D. Wang	Prevalence of dermatoses and skin sensitisation associated with use of pesticides in fruit farmers of southern Taiwan	1996	OBJECTIVES: Agricultural workers are known to have occupational skin diseases. The prevalence and pattern of skin diseases are unknown in Taiwanese fruit farmers. The objective of this study is to determine the work exposure, prevalence of skin diseases, and sensitivity to common skin allergens and agricultural chemicals in fruit farmers of southern Taiwan. METHODS: 122 fruit farmers who regularly prepared and sprayed pesticides and a group of 63 printing press workers with no known exposure to pesticides were examined and patch tested with common skin allergens and agricultural chemicals. The farmers were also interviewed for their work habits, use of protective clothing, and exposure to pesticides. RESULTS: Most farmers reported regular use of hat, boots, and mask, but not gloves, raincoat, and goggles. This resulted in frequent skin contact with pesticides especially on the hands and face. About 30% of farmers had hand dermatitis, and more than two thirds had pigmentation and thickening on the hands. Fungal infection of the skin was noted in a quarter of subjects. By patch test, farmers and the printing press workers had a similar rate of sensitivity to common skin allergens. 40% of farmers were sensitive to agricultural chemical allergens, which was about twofold higher than that of the comparison group. Farmers were most frequently sensitive to Captofol, Folpet, and Captan which were associated with dermatitis on the volar aspects of the hands. CONCLUSIONS: Fruit farmers in southern Taiwan had a high prevalence of skin diseases related to use of pesticides, and appropriate protective measures and work practices should be taken to prevent such problems.	Occupational & Environmental Medicine	53	6	427-31	Self-reported exposure			Cross-sectional	Pesticides in general	dermatological	doctor-diagnosed	Taiwan	hic
1250	Y. Li, C. Zhang, Y. Yin, F. Cui, J. Cai, Z. Chen, Y. Jin, M. G. Robson, M. Li, Y. Ren, X. Huang and R. Hu	Neurological effects of pesticide use among farmers in China	2014	The intensive use of pesticides has attracted great attention from the Chinese government. However, current regulations have had limited influence on their safe use. Although the acute neurologic effects of pesticides have been well documented, little is known about their cumulative effects. Knowledge of the impact of pesticides on health may convince farmers to minimize their use. We conducted a cross-sectional study in three provinces of China to evaluate the relationship between pesticide exposure and neurological dysfunction. Crop farmers were divided into two groups depending on their level of pesticide exposure. A total of 236 participants were assessed by questionnaire and neurological examination for symptoms and signs of neuropathy. Characteristics of neurologic dysfunction following cumulative low-level exposure were assessed with logistic regression analysis. Farmers exposed to high-level pesticide use had greater risk of developing sensations of numbness or prickling (odds ratio (OR) 2.62, 95% confidence interval (CI): 1.08-6.36). After adjusting for recent exposure, the risk of numbness or prickling symptoms (OR 2.55, 95% CI: 1.04-6.25) remained statistically significant. Loss of muscle strength and decreased deep tendon reflexes had OR > 2, however, this did not reach statistical significance. These findings suggest that overuse of pesticides increased risk of neurologic dysfunction among farmers, with somatosensory small fibers most likely affected. Measures that are more efficient should be taken to curb excessive use of pesticides.	International Journal of Environmental Research & Public Health [Electronic Resource]	11	4	3995-4006	Self-reported exposure			NA	Pesticides in general	neurological	medical test result	China	umic
1251	Y. Mao, J. Hu, A. M. Ugnat and K. White	Non-Hodgkin's lymphoma and occupational exposure to chemicals in Canada. Canadian Cancer Registries Epidemiology Research Group	2000	BACKGROUND: The incidence of non-Hodgkin's lymphoma (NHL) has been increasing in Canada. This study assessed the effect of occupational exposure to specific chemicals on the risk of NHL. PATIENTS AND METHODS: Mailed questionnaires were used to obtain data on 1469 newly diagnosed, histologically confirmed NHL cases and 5073 population controls between 1994 and 1997 in eight Canadian provinces. Data was collected on socioeconomic status, life-style, diet, occupation, and years of exposure to any of 17 chemicals. Odds ratios (OR) and 95% confidence intervals (95% CI) were derived by logistic regression. RESULTS: The study found an increased risk of NHL among males exposed to benzidine, mineral, cutting, or lubricating oil, pesticides, and herbicides. Compared with non-exposure to each specific chemical, the adjusted ORs were 1.9 (95% CI: 1.1-3.4) for benzidine, 1.3 (95% CI: 1.0-1.5) for mineral, cutting, or lubricating oil, 1.3 (95% CI: 1.0-1.6) for herbicides, and 1.3 (95% CI: 1.0-1.6) for pesticides. Excess risk of NHL among females was associated with exposure to pesticides and wood dust. ORs increased with increasing exposure in years to benzidine and herbicides for males and with increasing exposure years to wood dust for females. These trends were statistically significant (P < 0.05). CONCLUSIONS: The findings in this study suggest that occupational exposure to specific chemicals plays an important role in the development of NHL in Canada.	Annals of Oncology	11	NA	69-73	Self-reported exposure			Case-control	Type of pesticide	cancer	doctor-diagnosed	Canada	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1252	Y. N. Issa, K.; Sallm<U+221A>< U+00A9>n, M.; Bjertness, E.; Kristensen, P.	Time to pregnancy and exposure to pesticides among couples of two agricultural villages in hebron district, occupied palestinian territory: A prospective study	2011	Objectives There is some evidence suggesting that exposure to pesticide in men is associated with reduced fertility. We examined effects of pesticide exposure on couple fecundability (probability of conceiving in a cycle) among Palestinian couples by using a time to pregnancy (TTP) approach. Methods Participants were 331 newly married couples in Beit U'mmar and Halhoul villages, 2005-2008. All had a wish to have children. We followed all couples prospectively from marriage until pregnancy or at a maximum of 12 months by using a monthly questionnaire on TTP and occupational pesticide exposure. Exposure was assessed each month, and cyclespecifi c exposure indicators were constructed for husband and wife. We estimated exposure effects on fecundability with discrete proportional hazards regression. Results Overall mean fecundability was 0.18 (95% CI 0.16 to 0.20). The 124 male farmers were exposed to pesticides in 428 cycles; fecundability 0.14 (0.11 to 0.18) and not exposed in 157 cycles; fecundability 0.32 (0.24 to 0.40). Non-farming couples (N=207, 1061 cycles) had a mean fecundability of 0.17 (0.15 to 0.19). For male exposure and female farming, the adjusted fecundability ratios (FR) were 0.87 (0.60 to 1.28), respectively 0.59 (0.31 to 1.10) as compared to non-farming couples. With the unexposed farmers as referents, the adjusted FRs for male exposure and female farming were 0.43 (0.30 to 0.62) and 0.46 (0.24 to 0.85). Conclusions Male exposure to pesticides and female farming were associated with reduced fecundability. Pesticide use in Palestinian agriculture could have adverse effects on male and/or female fertility, which warrants preventive efforts in order to reduce exposure.	Occupational and Environmental Medicine	68	NA	A6	Self-reported exposure			Cohort (prospective)	Pesticides in general	reproductive	self-reported	Palestine	lmic
1253	Y. R. Zhong, V.	Cancer incidence among Icelandic pesticide users	1996	BACKGROUND: This study was done to examine the cancer risk among pesticide users in Iceland. METHODS: We have followed a cohort of 2449 licensed pesticide users, students from a horticultural college, members of a pension fund for market gardeners, horticulturists and vegetable farmers up until the end of 1993 in the Icelandic Cancer Registry of cancer incidence. The observed number of cancers was compared with expected values calculated on the basis of cancer incidence for males and females in Iceland. RESULTS: The standardized incidence ratio (SIR) for all cancer sites was 0.80. Among females the increased incidence for cancer of lymphatic and haematopoietic tissue was significant (SIR = 5.56, 95% confidence interval (CI) 1.12-16.23). The incidence of rectal cancer was three times that expected (SIR = 2.94, 95% CI: 1.07-6.40), and this cancer was even more predominant among the licensed pesticides users (SIR = 4.63, 95% CI: 1.49-10.80). All cancers of the rectum were adenocarcinoma, however, one was adenocarcinoma in villous adenoma and one adenocarcinoma in tubulo-villous adenoma. CONCLUSION: The results provide some support for the suggestion that pesticide exposure may lead to cancer of the lymphatic and haematopoietic tissue in females. We suggest that some of the pesticides to which the licensed pesticide users were exposed may lead to rectal cancer.	International Journal of Epidemiology	25	6	1117-24	Job title			Cohort (prospective)	Job title	cancer	doctor-diagnosed	Iceland	hic
1254	Y. Rodvall, A. Ahlbom, B. Spannare and G. Nise	Glioma and occupational exposure in Sweden, a case-control study	1996	OBJECTIVES: The aim of the study was to analyse whether any job titles, industrial codes, and certain occupational exposures were associated with an increased risk of glioma. METHODS: A population based case-control study of incident primary brain tumours in adults was carried out in Uppsala, Sweden in the period 1987-90. The study included 192 cases of glioma and 192 matched controls. It also included cases with other tumours of the central nervous system with matched controls. Information from all 343 controls was used in this study. Information was collected by means of a questionnaire that was sent to all subjects. An occupational hygienist reviewed the questionnaires for self reported exposures to substances and assessed whether these reported exposures were plausible or not in the corresponding occupation. RESULTS: The kappa coefficient for those classified by the two methods ranged between 0.46 and 0.88, and they were almost the same for cases and controls. For men exposed to solvents a relative risk (RR) of 2.6 (95% CI 1.3 to 5.2) was found. For men exposed to pesticides the RR was 1.8 (95% CI 0.6 to 5.1), and for plastic materials the RR was 3.6 (95% CI 1.0 to 12.4). For men employed in forestry and logging the RR was 2.2 (95% CI 0.9 to 5.3) and in basic metal industries 2.0 (95% CI 1.0 to 4.0). CONCLUSION: An increased risk of glioma was associated with use of solvents, pesticides, and plastic materials but this should be interpreted with some caution.	Occupational & Environmental Medicine	53	8	526-32	Expert case-by-case assessment	Self-reported job history		Case-control	Pesticides in general	cancer	doctor-diagnosed	Sweden	hic
1255	Y. Rodvall, J. Dich and K. Wiklund	Cancer risk in offspring of male pesticide applicators in agriculture in Sweden	2003	AIMS: To explore cancer risk from date of birth until 1994 in children, born 1958 or later, of Swedish male pesticide applicators. METHODS: Records of male pesticide applicators licensed 1965-76 were linked to the Multigeneration Register. The records of their offspring were then linked to the Swedish Cancer Registry and the Cause of Death Register. RESULTS: In total 51 cases of cancer were observed, which is significantly lower than the expected 73.0 (standardised incidence ratio (SIR) 0.70, 95% CI 0.52 to 0.92). Tumours of the nervous system was most common, amounting to 20 cases, 39% of all cancer cases (SIR 1.01, 95% CI 0.62 to 1.56). A statistically significant reduced risk for leukaemia was found (SIR 0.43, 95% CI 0.19 to 0.86). For non-Hodgkin's lymphoma, three cases were observed and 4.8 expected (SIR 0.63, 95% CI 0.13 to 1.83). For Hodgkin's disease, five cases were observed versus 3.7 expected (SIR 1.36, 95% CI 0.44 to 3.17). Two cases of testicular cancer were observed and 1.7 expected (SIR 1.19, 95% CI 0.13 to 4.28). CONCLUSIONS: None of the a priori hypotheses of increased risk of tumours of the nervous system, kidney cancer, leukaemia, lymphoma, soft tissue sarcoma, and testicular cancer in children of male pesticide applicators could be confirmed.	Occupational & Environmental Medicine	60	10	798-801	Job title			Cohort (prospective)	Pesticides in general	cancer	doctor-diagnosed	Sweden	hic
1256	Y. S. Amoateng-Adjepong, N.; Delzell, E.; Cole, P.	Mortality among workers at a pesticide manufacturing plant	1995	This study evaluated the mortality experience of 2384 workers at a plant in Colorado that produced aldrin, azodrin, vapona, and other pesticides. Subjects were followed up for a median of 29 years, from 1952 through 1990. Comparisons of the cohort's mortality rates with those of the Colorado population indicated that observed and expected numbers of deaths were similar for all causes (465 observed/473 expected) and for all cancers (113/106). Standardized mortality ratios were elevated for hepatobiliary cancer (5/2.0; standardized mortality ratio, 249, 95% confidence interval, 81 to 581), due to an excess of biliary duct/gall bladder cancer, and for pneumonia (20/13; standardized mortality ratio, 150, 95% confidence interval, 92 to 232). These increases were limited to white men in hourly jobs but were not limited to any particular production unit and did not display duration-response trends. It is unlikely that these excesses are due to occupational exposures at the plant.	Journal of Occupational & Environmental Medicine	37	4	471-8	Job title			Cohort (prospective)	Job title	mortality (all cause)	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1257	Y. Sudjaroen	Biochemical and hematological status of pesticide sprayers in Samut Songkhram, Thailand	2015	Background: There are few epidemiological studies regarding the effects of pesticides on enzymes related to liver function or on the hematological and biochemical parameters in occupationally exposed individuals. Aims: The aim was to evaluate biochemical and hematological parameters in pesticide sprayers. Materials and Methods: Medical history, characteristics of pesticide use, and related symptoms were recorded, and blood samples were collected from farmers at Samut Songkhram, Thailand during the period November-December 2014. Samples were divided into the pesticide sprayer group (N = 30) and the organic farmer group (N = 41). The collected blood samples were prepared for the following purposes: 1) to determine cholinesterase (ChE) activity, blood glucose, liver function test, kidney function test, and lipid profiles, which were analyzed by the automatic analyzer cobas C501 (Roche Diagnostics, Switzerland) and 2) to evaluate hematological status using complete blood count (CBC), which was analyzed by Celltac E MEK-7222 (Nihon Kohden, Japan). Results and Discussion: The levels of ChE, blood glucose, aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP), bilirubin, total protein, albumin, blood urea nitrogen (BUN), and creatinine between the two groups were also not statistically different and were almost within the reference range. Lipid profiles, including levels of cholesterol, triglyceride, high-density lipoprotein cholesterol (HDL-C), and low-density lipoprotein cholesterol (LDL-C), were significantly different between the two groups at P = 0.035, P = 0.049, P = 0.032, and P = 0.043, respectively. Mean corpuscular hemoglobin concentration (MCHC) values of pesticide sprayers and organic farmers were lower than the reference range (30.6 <U+00AC><U+00B1> 1.9 g/dL and 29.9 <U+00AC><U+00B1> 1.7 g/dL) and were interpreted as anemia. Conclusions: Subchronic exposure to pesticides may alter the metabolism, which can cause hyperlipidemia and also anemia, as observed in this study.	Annals of Tropical Medicine and Public Health	8	5	186-190	Job title			Cross-sectional	Job title	biochemical	medical test result	Thailand	umic
1258	Y. Xia, Q. Bian, L. Xu, S. Cheng, L. Song, J. Liu, W. Wu, S. Wang and X. Wang	Genotoxic effects on human spermatozoa among pesticide factory workers exposed to fenvalerate	2004	Fenvalerate, a synthetic pyrethroid insecticide, is widely produced and used worldwide. To explore fenvalerate-induced genotoxic effects, particularly numerical chromosome aberration (CA), we firstly examined conventional semen parameters, the progression and motion parameters of the spermatozoa among 12 fenvalerate-exposed workers and 30 donors of the internal and external control groups. Then numerical CA of chromosome X, Y and 18 were investigated by multicolor fluorescence in situ hybridization (FISH). The results showed the significant differences in the percentage of sperm abnormality between fenvalerate-exposed group and the external control group (P = 0.024). In aneuploid parameters, the frequency (mean +/- S.D.) of sex chromosome disomy was 0.742 +/- 0.131% in fenvalerate-exposed group, which was significantly higher than those in the internal (0.563 +/- 0.135%) and external control group (0.386 +/- 0.140%) (P < 0.01), and the frequency of chromosome 18 disomy in fenvalerate-exposed group (0.326 +/- 0.069%) was significantly higher than those in the internal and external control groups (0.195 +/- 0.094% and 0.124 +/- 0.068%), respectively (P < 0.01). We also found the nullisomies of sex chromosomes and chromosome 18 were significantly higher than those in the external control group and two control groups, respectively (P < 0.01). The frequencies of aneuploidy and numerical CA we detected also showed significant differences between exposed group and control groups (P < 0.05 and/or P < 0.01). Moreover, we found the positive correlation not only between nullisomic frequencies of these chromosomes and numerical CA rate (r > 0.70, P < 0.01) but also between disomic frequency of sex chromosomes, aneuploidy rate and sperm abnormality in all donors (r = 0.530 and r = 0.536, P < 0.01). Our findings suggest that fenvalerate or its metabolites induced morphologic abnormality and genotoxic defects of spermatozoa among fenvalerate-exposed workers by causing numerical CA in spermatogenesis as a special and potential genotoxic agent.	Toxicology	203	1	49-60	Environmental air monitoring	Self-reported exposure		Cross-sectional	Specific active ingredient	genetic (biomarkers)	medical test result	China	umic
1259	Y. Xia, S. Cheng, Q. Bian, L. Xu, M. D. Collins, H. C. Chang, L. Song, J. Liu, S. Wang and X. Wang	Genotoxic effects on spermatozoa of carbaryl-exposed workers	2005	Carbaryl, one of the most important insecticides, is widely produced and used. To explore carbaryl-induced genotoxic effects of spermatozoa, particularly DNA damage and chromosome aberrations (CA), we first examined conventional semen parameters, the progression and motion parameters of the spermatozoa among 16 carbaryl-exposed workers and 30 internal and external control individuals. Sperm DNA damage represented as positive percentage of DNA fragmentation was detected by a modified terminal deoxy-nucleotidyl transferase-mediated dUTP-biotin nick end-labeling (TUNEL) assay. Then numerical CA of chromosome X, Y, and 18 were investigated by multicolor fluorescence in situ hybridization (FISH). The results showed significant differences in the percentage of sperm abnormality between carbaryl-exposed group and the external control group (p = 0.008). Mean (+/-SD) percentage of spermatozoa with fragmented DNA in carbaryl-exposed group (21.04 +/- 8.88%) was significantly higher than those in the internal (13.36 +/- 12.17%) and external control groups (13.92 +/- 7.15%), respectively (p = 0.035 and p = 0.030). Using FISH, we observed the frequency of sperm sex chromosome disomy was 0.661 +/- 0.238% in the exposed group, which was significantly higher than that in the external control group (0.386 +/- 0.140%) (p = 0.001), and the carbaryl-exposed group (0.276 +/- 0.126%) had an elevated chromosome 18 disomy compared with the internal (0.195 +/- 0.094%) and external control groups (0.124 +/- 0.068%), respectively (p < 0.05 and p < 0.01). In addition, carbaryl-exposed donors had significantly higher sperm nullisomic frequencies of sex chromosomes and chromosome 18 than the external controls (p < 0.01) but not the internal controls. In summary, the frequencies of aneuploidy and numerical CA showed significant differences between exposed group and control groups (p < 0.05 and/or p < 0.01). Moreover, positive correlations were found between sex chromosome disomy, aneuploidy rate, and morphologic abnormalities in spermatozoa of all donors (r = 0.564 and r = 0.555, p < 0.01). Our findings suggested that carbaryl might induce morphologic abnormalities and genotoxic defects of spermatozoa among exposed workers by causing DNA fragmentation and numerical CA in spermatogenesis as a potential genotoxicant. The evidence also indicated that the spermatotoxicity induced by carbaryl exposure might be related to adverse reproductive outcomes.	Toxicological Sciences	85	1	615-23	Environmental air monitoring			Cross-sectional	Specific active ingredient	genetic (biomarkers)	medical test result	China	umic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1260	Y. Y. Bernal-Hernandez, I. M. Medina-Diaz, B. S. Barron-Vivanco, M. I. Giron-Perez, B. Quintanilla-Vega, D. M. Paredes-Cuspedes, G. Lopez-Martinez and A. E. Rojas-Garcia	Paraoxonase 1 and its relationship with pesticide biomarkers in indigenous Mexican farmworkers	2014	OBJECTIVE: Biomarkers of pesticide toxicity and paraoxonase 1 (PON1) phenotype and genotypes were evaluated in indigenous Mexican farmworkers exposed mainly to organophosphate (OP) pesticides. METHODS: Acetylcholinesterase, butyrylcholinesterase, and PON1 activities--arylesterase and CMPAase activities--were evaluated spectrophotometrically. PON1 55 and 192 polymorphisms were determined by real-time polymerase chain reaction. Hematological parameters were evaluated using a cytometer. RESULTS: Butyrylcholinesterase and arylesterase activities were lower in farmworkers, who also showed lower levels of leukocytes but higher percentages of lymphocytes when compared with the nonexposed group. Our results showed a high frequency of OP, high hydrolysis-related PON1 alleles (LL/QR and LL/RR) in the study population. An association was observed between CMPAase activity and PON1Q192R polymorphism. CONCLUSIONS: Our results suggest that pesticide exposure modifies biochemical and hematological biomarkers in the study population, and that the phenotype of PON1 (CMPAase) is a sensible susceptibility biomarker of OP pesticide toxicity.	J Occup Environ Med	56	3	281-90	Job title			Cross-sectional	Chemical class	genetic (biomarkers)	medical test result	Mexico	umic
1261	Y. Yu, F. C. Su, B. C. Callaghan, S. A. Goutman, S. A. Batterman and E. L. Feldman	Environmental risk factors and amyotrophic lateral sclerosis (ALS): a case-control study of ALS in Michigan	2014	An interim report of a case-control study was conducted to explore the role of environmental factors in the development of amyotrophic lateral sclerosis (ALS). Sixty-six cases and 66 age- and gender-matched controls were recruited. Detailed information regarding residence history, occupational history, smoking, physical activity, and other factors was obtained using questionnaires. The association of ALS with potential risk factors, including smoking, physical activity and chemical exposure, was investigated using conditional logistic regression models. As compared to controls, a greater number of our randomly selected ALS patients reported exposure to fertilizers to treat private yards and gardens and occupational exposure to pesticides in the last 30 years than our randomly selected control cases. Smoking, occupational exposures to metals, dust/fibers/fumes/gas and radiation, and physical activity were not associated with ALS when comparing the randomly selected ALS patients to the control subjects. To further explore and confirm results, exposures over several time frames, including 0-10 and 10-30 years earlier, were considered, and analyses were stratified by age and gender. Pesticide and fertilizer exposure were both significantly associated with ALS in the randomly selected ALS patients. While study results need to be interpreted cautiously given the small sample size and the lack of direct exposure measures, these results suggest that environmental and particularly residential exposure factors warrant close attention in studies examining risk factors of ALS.	PLoS ONE [Electronic Resource]	9	6	e101186	Self-reported exposure			Case-control	Pesticides in general	neurological	doctor-diagnosed	USA	hic
1262	Y. Zhang, S. Han, D. Liang, X. Shi, F. Wang, W. Liu, L. Zhang, L. Chen, Y. Gu and Y. Tian	Prenatal exposure to organophosphate pesticides and neurobehavioral development of neonates: a birth cohort study in Shenyang, China	2014	BACKGROUND: A large amount of organophosphate pesticides (OPs) are used in agriculture in China every year, contributing to exposure of OPs through dietary consumption among the general population. However, the level of exposure to OPs in China is still uncertain. OBJECTIVE: To investigate the effect of the exposure to OPs on the neonatal neurodevelopment during pregnancy in Shenyang, China. METHODS: 249 pregnant women enrolled in the Central Hospital Affiliated to Shenyang Medical College from February 2011 to August 2012. A cohort of the mothers and their neonates participated in the study and information on each subject was obtained by questionnaire. Dialkyl phosphate (DAP) metabolites were detected in the urine of mothers during pregnancy to evaluate the exposure level to OPs. Neonate neurobehavioral developmental levels were assessed according to the standards of the Neonatal Behavioral Neurological Assessment (NBNA). Multiple linear regressions were utilized to analyze the association between pregnancy exposure to OPs and neonatal neurobehavioral development. RESULTS: The geometric means (GM) of urinary metabolites for dimethyl phosphate (DMP), dimethyl thiophosphate (DMTP), diethyl phosphate (DEP), and diethyl thiophosphate (DETP) in pregnant women were 18.03, 8.53, 7.14, and 5.64 micro g/L, respectively. Results from multiple linear regressions showed that prenatal OP exposure was one of the most important factors affecting NBNA scores. Prenatal total DAP concentrations were inversely associated with scores on the NBNA scales.?Additionally, a 10-fold increase in DAP concentrations was associated with a decrease of 1.78 regarding the Summary NBNA (95% CI, -2.12 to -1.45). And there was an estimated 2.11-point difference in summary NBNA scores between neonates in the highest quintile of prenatal OP exposure and the lowest quintile group. CONCLUSION: The high exposure of pregnant women to OPs in Shenyang, China was the predominant risk factor for neonatal neurobehavioral development.	PLoS ONE [Electronic Resource]	9	2	e88491	Self-reported exposure	Biomonitoring (urine)		Cohort (prospective)	Chemical class	offspring	medical test result	China	umic
1263	Z. Chen, P. A. Stewart, S. Davies, R. Giller, M. Krailo, M. Davis, L. Robison and X. O. Shu	Parental occupational exposure to pesticides and childhood germ-cell tumors	2005	In a recently completed US case-control study (Children's Oncology Group, 1993-2001) with 253 cases and 394 controls, the authors investigated the association between parental occupational exposure to pesticides and risk of childhood germ-cell tumors. Information on occupational pesticide exposure was collected using job-specific module questionnaires and assessed by an experienced industrial hygienist. Odds ratios for childhood germ-cell tumors associated with maternal exposures before pregnancy, during pregnancy, and after the birth of the index child were 1.0 (95% confidence interval (CI): 0.8, 1.4), 1.1 (95% CI: 0.7, 1.6), and 1.3 (95% CI: 0.9, 1.8), respectively. Paternal exposures before pregnancy, during pregnancy, and after the birth of the index child were not related to germ-cell tumors (odds ratios (ORs) were 0.9 (95% CI: 0.7, 1.2), 0.8 (95% CI: 0.5, 1.2), and 0.8 (95% CI: 0.5, 1.3), respectively). When both parents had ever been occupationally exposed to pesticides before the index pregnancy, the odds ratio was 0.8 (95% CI: 0.4, 1.3). Subgroup analyses showed a positive association between maternal exposure to herbicides during the postnatal period and risk of germ-cell tumors in girls (OR = 2.3, 95% CI: 1.0, 5.2) and an inverse association between paternal exposure to pesticides during the index pregnancy and germ-cell tumors in boys (OR = 0.2, 95% CI: 0.1, 1.0). This study did not provide strong evidence supporting a relation between parental pesticide exposure in the workplace and risk of germ-cell tumors among offspring.	American Journal of Epidemiology	162	9	858-67	Expert case-by-case assessment	Self-reported job history		Case-control	Pesticides in general	offspring	doctor-diagnosed	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1264	Z. J. Zhou, J. Zheng, Q. E. Wu and F. Xie	Carboxylic esterase and its associations with long-term effects of organophosphorus pesticides	2007	OBJECTIVE: To examine a) the effect of organophosphorus pesticide exposure on activity of carboxylic esterases, namely butyrylcholinesterase (BChE), carboxylesterase (CarbE) and paraoxonase (PonE); and b) the association of polymorphisms of BChE and PonE with individual genetic susceptibility to organophosphorus pesticide exposure. METHODS: A cross-sectional study was conducted in 75 workers exposed to organophosphorus pesticides and 100 non-exposed controls. The serum activity of these enzymes was measured. Variant forms of BCHE-K, PON-192, and PON-55 were detected. A symptom score was developed as a proxy measure of clinical outcomes. RESULTS: Activities of both BChE and CarbE were lower in exposed workers (27.3+/-21.65 nmolxh(-1)xmL(-1) and 235.6+/-104.03 nmolxmin(-1)xmL(-1)) than in non-exposed workers (78.313+/-30.354 nmolxh(-1)xmL(-1) and 362.681+/-194.997 nmolxmin(-1)xmL(-1)). The activity of PonE was not associated with exposure status. The AChE activity in the exposed workers with BCHE-K genotype UU (61 cases), genotype UK (12 cases) and genotype KK (2 cases) was 105.05, 84.42 and 79.00 mmolxh(-1)xmL(-1), respectively and the accumulative symptom scores were 3.74, 9.17, and 12.50 accordingly. The AChE activity in the exposed workers with PON-192 genotypeBB (37), genotype AB (27) and genotype AA (11) was 116.8, 91.2, and 72.3 mmolxh(-1)xmL(-1), respectively and the symptom scores were 2.00, 6.74, and 9.73 accordingly. The AChE activity in those with PON-55 genotype LL (70) and genotype LM (5) was 102.4 and 82.8 mmolxh(-1)xmL(-1) and the symptom scores were 4.53 and 9.20. The symptom score was the highest in individuals with abnormal homozygote for each of the three gene loci. CONCLUSIONS: Long-term exposure to organophosphorus pesticides can inhibit BChE and CarbE activity, but exerts no inhibitory effect on PonE activity. Different genotypes of BCHE-K, PON-192, and PON-55 may be related to the severity of adverse health effects of organophosphorus pesticide exposure. Implications of potentially higher susceptibility of workers with mutant homozygotes should be evaluated to reduce health risks.	Biomedical & Environmental Sciences	20	4	284-90	Biomonitoring (blood)			Cross-sectional	Chemical class	endocrine/nutritional/metabolical	medical test result	NA	NA
1265	Z. Liew, A. Wang, J. Bronstein and B. Ritz	Job exposure matrix (JEM)-derived estimates of lifetime occupational pesticide exposure and the risk of Parkinson's disease	2014	Studies that report an association between Parkinson's disease (PD) and occupational pesticide exposure often use self-reported exposure and none adjust for concomitant ambient pesticide exposure. For a population-based case-control study of PD conducted in California's heavily agricultural region, the authors developed a comprehensive job exposure matrix (JEM) to assess occupational exposure to pesticides. Relying on 357 incident cases and 750 population controls enrolled between 2001 and 2011, the authors estimated more than a 2-fold risk increase for PD among men classified as highly occupationally exposed. The authors also observed an exposure-response pattern and farming tasks with direct and intense pesticide exposures such as spraying and handling of pesticides resulted in greater risks than indirect bystander exposures. Results did not change after adjustment for ambient pesticide exposure. The authors provide further evidence that occupational pesticide exposure increases the risk of PD.	Archives of Environmental & Occupational Health	69	4	241-51	Job exposure matrix			Case-control	Pesticides in general	neurological	doctor-diagnosed	USA	hic
1266	Z. Maryam, A. Sajad, N. Maral, L. Zahra, P. Sima, A. Zeinab, M. Zahra, E. Fariba, H. Sezaneh and M. Davood	Relationship between exposure to pesticides and occurrence of acute leukemia in Iran	2015	BACKGROUND: One of the causes of acute leukemia can be exposure to certain chemicals such as pesticides. This study determined the relationship between exposure to pesticides and the occurrence of acute leukemia in Fars province, south of Iran. MATERIALS AND METHODS: Between April 2011 and April 2013 in a case-control study conducted in Nemazee Hospital in Shiraz, Southern Iran; 314 subjects diagnosed with acute leukemia (94 pediatric cases and 220 adults) were enrolled to determine any correlation between exposure to pesticides and the occurrence. Controls (n=314) were matched by sex and age. RESULTS: There was a history of exposure to pesticides among 85% of pediatric cases and 69% of their controls and 83% of adult cases and 75% of their controls while 87.5% of pediatric cases and 90% of adult cases reported exposure to intermediate and high doses of pesticides and among the controls, the exposure to low doses of pesticides was 70.5% and 65%, respectively. Exposure to indoor pesticides was seen among most of cases and controls. Being a farmer was at a significantly more increased risk of developing acute leukemia in comparison to other jobs, especially for their children. CONCLUSIONS: Exposure to pesticides was shown to be one of the most important causes of acute leukemia. It seems that there is a need to educate the people on public health importance of exposure to pesticides especially during school time to reduce the risk of malignancies during childhood.	Asian Pacific Journal of Cancer Prevention: Apjcp	16	1	239-44	Job title			Case-control	Pesticides in general	cancer	doctor-diagnosed	Iran	umic
1267	Z. Qureshi, D. Ramsey, J. R. Kramer, L. Whitehead and H. B. El-Serag	Occupational exposure and the risk of Barrett's esophagus: a case-control study	2013	BACKGROUND: Case-control studies in the United States and Europe have linked occupational exposure to volatile sulfur compounds, solvents, and pesticide to increased risk of esophageal adenocarcinoma. However, the association between occupational exposures and the risk of Barrett's esophagus (BE) is unclear given the absence of studies in this area. METHODS: This is a case-control study in patients undergoing endoscopy who were either referred directly or were eligible for screening colonoscopy and recruited from primary care clinics. All participants completed a survey on (1) self-reported occupational exposures to asbestos, metal dust, organic solvents, and pesticides, and (2) self reported longest held job and job-related activities. The latter were assigned by an industrial hygienist who was blinded to the case and control status into one of 99 standard occupational categories used by the US Department of Labor. Each occupational category was then assigned an expected level of exposure to the same four classes of agents in addition to radiation. We compared the self-reported exposure and the expected occupational exposure based on the self-reported occupation between cases with definitive BE and controls without BE. We examined the associations adjusting for age, sex, race, and patient recruitment source in a multivariable logistic regression analysis. RESULTS: We examined 226 cases of definitive BE and 1,424 controls without BE. There was a greater proportion of patients with self-reported asbestos exposure in cases than controls (16.2 % vs. 12.0 %; p = 0.08) but no significant differences in metal dust, organic solvents, or pesticides. The multivariate model did not show an independent association between self-reported asbestos exposure and BE. For the calculated occupational exposure, there were no significant differences between cases and controls for asbestos (29.6 % vs. 27.5 %; p = 0.5), metal dust, organic solvents, pesticides, or radiation exposure. Among commonly reported occupation, there were significantly greater proportion of retail sales workers in BE cases than controls (10.8 % vs. 4.9 %; p = 0.01). CONCLUSIONS: Exposure to asbestos and sedentary jobs may be risk factors for Barrett's esophagus. Further studies are needed to confirm this finding.	Digestive Diseases & Sciences	58	7	1967-75	Self-reported exposure			Case-control	Pesticides in general	other	other	USA	hic

ID	Author	Title	Publication year	Abstract	Journal	Volume	Issue	Pages	EAM 1	EAM 2	EAM 3	Study design	Specificity of EAM	Health outcome type	Health outcome assessment type	Study location (country)	WHO Atlas category
1268	Z. Qureshi, J. Kramer, L. Whitehead, D. Ramsey and H. El-Serag	Occupational history and the risk of barrett's esophagus	2012	Purpose: Case-control studies in the United States and Europe have linked exposure to volatile sulfur compounds, solvents, and pesticide to increased risk of esophageal adenocarcinoma. However, the association between occupational exposures and the risk of Barrett's esophagus (BE) is unclear given the absence of studies in this area. Methods: A cross-sectional study in a single VA Medical Center of patients undergoing esophagogastroduodenoscopy (EGD) who were either referred directly or recruited from primary care clinics during 2008-11. A survey was completed before the EGD with detailed questions on occupational exposures (for > 8 hours per week for >1 year) to 4 exposures (metal dust, asbestos, organic solvents, and pesticides). In addition, there were questions about the industry that subjects worked in, as well as the main occupational activities and age at which they started the job they held longest. An industrial hygienist (LW) assigned the self-reported jobs and their activities into one of 99 occupational categories utilizing ONET, the standardized occupational coding system of the U.S. Department of Labor. Each occupational category was then assigned an expected level of exposure to the same 4 exposures in addition to radiation according to a semi quantitative scale with 0 for minimal exposure and 3 for significant exposure. We compared the self- reported exposure and the expected occupational exposure based on the self-reported occupation between cases with definitive BE (endoscopic BE plus intestinal metaplasia) and controls without BE. We examined the associations adjusting for age, sex, race, and patient source in a multivariable logistic regression analysis. Results: We examined 246 cases of definitive BE and 1461 controls without BE. There was a statistically significant greater proportions of patients with selfreported asbestos exposure in cases than controls (16.9% vs. 11.7%, p = 0.026) but no significant differences in metal dust, organic solvents, or pesticides. The multivariate model showed an independent association between self reported asbestos exposure and BE (odds ratio 1.84, 95% CI: 1.20-2.82, p = 0.006). For the calculated occupational exposure, there were no significant differences between cases and controls in asbestos (28.8% vs. 27.4%, p = 0.81), metal dust, organic solvents, or pesticides. However, radiation exposure was significantly higher in cases than controls (5.3% vs. 4.5%, p: 0.04) but the significance of this association did not persist in multivariable analysis (p= 0.59). Conclusion: Exposure to asbestos may be a risk factor for Barrett's esophagus. Further studies are needed to confirm of these findings.	American Journal of Gastroenterology	107	NA	S18	Expert case-by-case assessment			Cross-sectional	Pesticides in general	other	other	USA	hic
1269	Z. Sutoluk, Z. Kekec, N. Daglioglu and I. Hant	Association of chronic pesticide exposure with serum cholinesterase levels and pulmonary functions	2011	The present study focused on the analysis of serum cholinesterase levels and the pulmonary function tests in seasonal farm workers who were chronically exposed to pesticides, mostly organophosphorus, in comparison with non-farm workers in the farming areas of Cukurova region, Turkey. Serum cholinesterase levels and pulmonary function tests using spyrometer in 50 male seasonal farm workers (study group) were compared to 50 male non-farm workers (control group) in this cross-sectional study. The mean serum cholinesterase enzyme level in the farm worker group (7095.5<U+00AC><U+00B1>1699.4 U/L) was significantly lower than those of the control group (9716.4<U+00AC><U+00B1>1484.4 U/L) (p <.001). There was no significant difference between pulmonary function tests of 2 groups (p >.05). These results show that chronic environmental organophosphorus exposure caused a decrease in the serum cholinesterase enzyme levels in farm workers, emphasizing the importance of primary prevention. <U+00AC><U+00A9> 2011 Copyright Taylor and Francis Group, LLC.	Archives of Environmental and Occupational Health	66	2	95-99	Biomonitoring (blood)			Cross-sectional	Chemical class	respiratory	medical test result	Turkey	umic
1270	Z. Xue, X. Li, Q. Su, L. Xu, P. Zhang, Z. Kong, J. Xu and J. Teng	Effect of synthetic pyrethroid pesticide exposure during pregnancy on the growth and development of infants	2013	Antenatal urine of 497 pregnant women was collected in the Department of Gynecology and Obstetrics of a county hospital in Jiaozuo, Henan. The content of the main metabolites of synthetic pyrethroid pesticides in urine were determined. After 1 year, physical development indices of 1-year old infants, such as height, weight, and head and chest circumference, were measured. The neural and mental development of the infants was assessed by the Development Screen Test (DST) scale. We observed that the level of synthetic pyrethroid pesticide exposure was negatively related to the neural and mental development of infants (beta = -0.1527, P < 0.05). Therefore, direct or indirect exposure to synthetic pyrethroid pesticides should be avoided during pregnancy.	Asia-Pacific Journal of Public Health	25	4	72S-9S	Self-reported job history	Biomonitoring (urine)		Cross-sectional	Job title	offspring	medical test result	China	umic
1271	Z. Zhou, S. Xue, Y. Hu and H. Wu	Effect of chlordimeform on cardiovascular function in occupational exposures	1999	To understand the possible effects of an insecticide, chlordimeform, on the human cardiovascular system, this work was carried out. Pre- and post- exposure, the medical examinations, especially cardiovascular functions, were meticulously done in farmers spraying 0.125% solution of chlordimeforme for 3 consecutive days and packers packing chlordimeform for one month. The exposure level was measured by means of the urinary excretion of chlordimeform and its main metabolite, 4-chlor-o-tolumidine, as well as the air concentration in the work place and skin contamination by using a regional proportional sampling strategy. The alterations, though mild and diverse, were significant compared to their own pre-exposure background. The changes in heart rate, blood pressure and some EKG parameters, such as T wave, P wave, PR interval and Qt interval were noticed. The cardiovascular functional changes were usual and sensitive findings in the exposed persons, and their importance in health surveillance needs to be emphasized.	Journal of Occupational Health	41	2	59-61	Biomonitoring (urine)	Environmental air monitoring		Cohort (prospective)	Specific active ingredient	circulatory	medical test result	China	umic