Environ Health Perspect
DOI: 10.1289/EHP1013

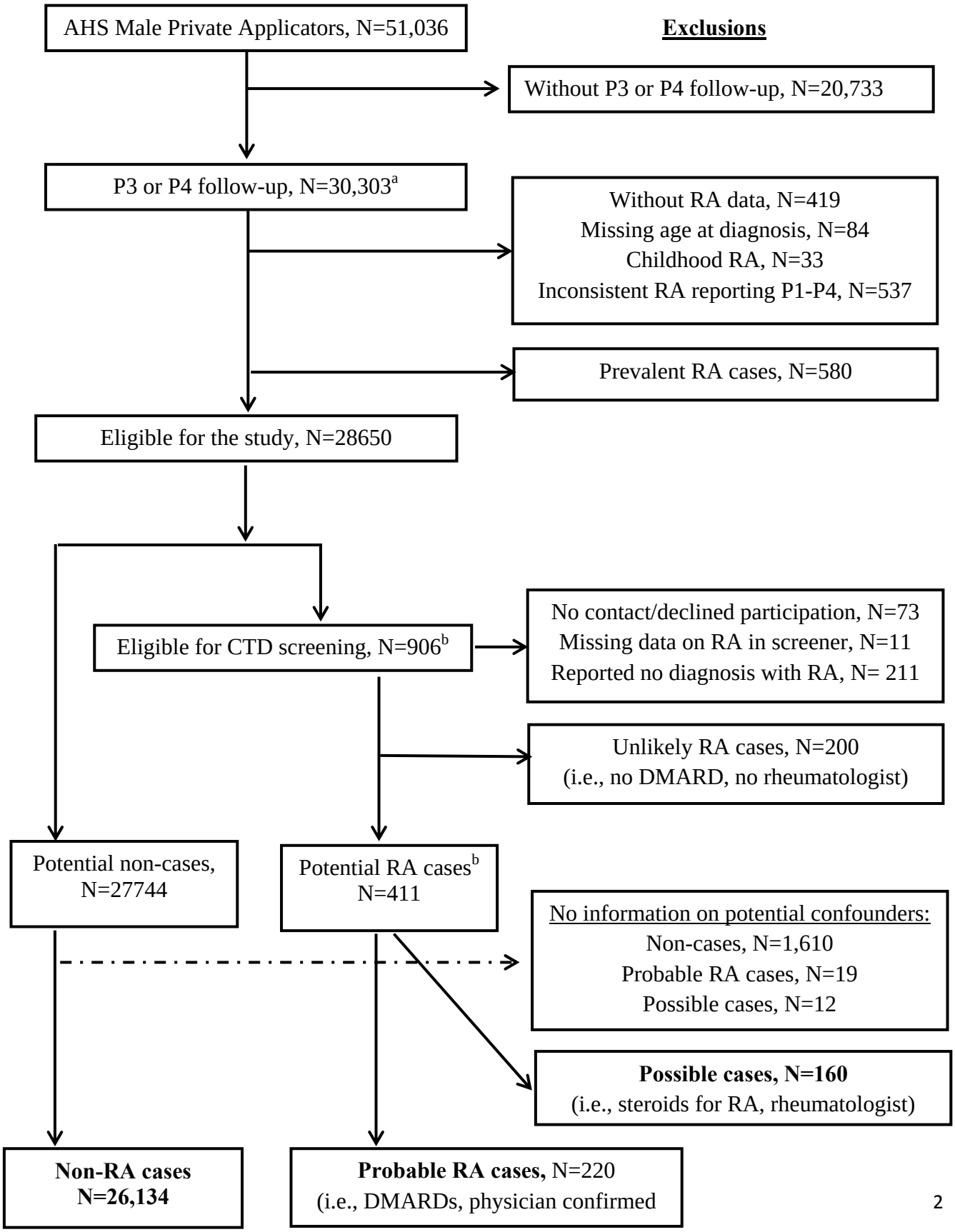
Supplemental Material

Pesticide Exposure and Risk of Rheumatoid Arthritis among Licensed Male Pesticide Applicators in the Agricultural Health Study

Armando Meyer, Dale P. Sandler, Laura E. Beane Freeman, Jonathan N. Hofmann, and Christine G. Parks

Table of Contents

Figure S1 – Identification of cases and non-cases



[a]Includes 25 self-reported cases of systemic autoimmune diseases (19 with RA) who were identified at enrollment, but lackedP3/P4 data. These were included because they were asked about RA in pilot validation study

[b]Includes 99 who were eligible to be screened for RA because they reported another systemic autoimmune disease (e.g., lupus); of these, 3 were identified as potential RA cases for the first time during screening

Table S1 – Exposure-response relationship between intensity-weighted lifetime use of specific pesticides and incident RA among male licensed pesticide applicators in the Agricultural Health Study

	Non-cases (N=26,134)	Incident RA cases (N=220)	
	N (%)	N (%)	OR[a] (95%CI)
INSECTICIDES			
ORGANOCHLORINES			
Aldrin			
Never	11257 (83)	99 (78)	Reference
T1	1095 (8)	14 (11)	1.38 (0.77,2.50)
T2	116 (1)	2 (2)	1.73 (0.41,7.23)
T3	1084 (8)	12 (10)	1.18 (0.63,2.22)
p-trend			0.45
Chlordane			
Never	11035 (81)	93 (72)	Reference
T1	639 (5)	8 (6)	1.14 (0.54,2.38)
T2	1051 (8)	15 (12)	1.41 (0.81,2.48)
T3	825 (6)	13 (10)	1.48 (0.81,2.69)
p-trend			0.11
Toxaphene[b]			
Never	12143 (89)	104 (83)	Reference
T1	859 (6)	7 (6)	0.82 (0.38,1.78)
T2	392 (3)	9 (7)	2.00 (0.99,4.04)
T3	202 (1)	6 (5)	2.42 (1.03,5.68)
p-trend			0.02
ORGANOPHOSPHATES			
Chlorpyrifos			
Never	14678 (57)	111 (52)	Reference
T1	3756 (15)	34 (16)	1.27 (0.86,1.88)
T2	3727 (15)	37 (17)	1.42 (0.97,2.06)
T3	3602 (14)	32 (15)	1.25 (0.84,1.86)
p-trend			0.09
Dichlorvos			
Never	21220 (88)	170 (87)	Reference
T1	1052 (4)	9 (5)	1.33 (0.67,2.63)
T2	936 (4)	7 (4)	1.14 (0.53,2.44)
T3	796 (3)	9 (5)	1.76 (0.87,3.48)
p-trend			0.11
Fonofos			
Never	18544 (77)	141 (71)	Reference

T1	1825 (8)	24 (12)	2.27 (1.44,3.57)
T2	2074 (9)	12 (6)	0.98 (0.54,1.80)
T3	1725 (7)	22 (11)	2.10 (1.32,3.36)
p-trend			0.005
Terbufos			
Never	14178 (59)	116 (58)	Reference
T1	3548 (15)	27 (14)	1.14 (0.74,1.75)
T2	3464 (14)	29 (15)	1.25 (0.82,1.89)
T3	2954 (12)	28 (14)	1.33 (0.88,2.03)
p-trend			0.12
CARBAMATES			
Carbaryl[b]			
Never	7966 (59)	55 (44)	Reference
T1	2339 (17)	23 (18)	1.33 (0.81,2.18)
T2	1775 (13)	25 (20)	1.62 (0.96,2.71)
T3	1434 (11)	23 (18)	1.61 (0.90,2.86)
p-trend			0.05
HERBICIDES			
Alachlor			
Never	10698 (45)	80 (40)	Reference
T1	5931 (25)	50 (25)	1.25 (0.87,1.79)
T2	3001 (13)	24 (12)	1.17 (0.74,1.86)
T3	4362 (18)	44 (22)	1.37 (0.94,1.98)
p-trend			0.11
Atrazine			
Never	6685 (26)	52 (24)	Reference
T1	8199 (32)	60 (28)	1.10 (0.75,1.62)
T2	6002 (23)	49 (23)	1.28 (0.85,1.91)
T3	4914 (19)	54 (25)	1.62 (1.09,2.40)
p-trend			0.01
Chlorimuron ethyl			
Never	9217 (68)	81 (63)	Reference
T1	1116 (8)	12 (9)	1.47 (0.79,2.72)
T2	1881 (14)	20 (16)	1.34 (0.82,2.21)
T3	1397 (10)	16 (12)	1.42 (0.83,2.45)
p-trend			0.10
Imazethapyr			
Never	12842 (54)	111 (57)	Reference
T1	4910 (21)	50 (26)	1.74 (1.18,2.55)
T2	599 (3)	5 (3)	1.42 (0.56,3.59)
T3	5582 (23)	30 (15)	0.97 (0.62,1.52)
p-trend			0.82
Trifluralin			

Never	10781 (45)	89 (45)	Reference
T1	4520 (19)	35 (18)	1.11 (0.75,1.66)
T2	3572 (15)	31 (16)	1.34 (0.87,2.06)
T3	5204 (22)	43 (22)	1.25 (0.85,1.84)
p-trend			0.18
FUNGICIDES			
Chlorothalonil			
Never	24052 (93)	194 (91)	Reference
T1	862 (3)	7 (3)	0.82 (0.38,1.77)
T2	572 (2)	6 (3)	1.02 (0.44,2.35)
T3	304 (1)	7 (3)	2.35 (1.07,5.14)
p-trend			0.18
Metalaxyl			
Never	11164 (83)	96 (74)	Reference
T1	714 (5)	7 (5)	1.05 (0.48,2.28)
T2	991 (7)	14 (11)	1.20 (0.64,2.23)
T3	616 (5)	13 (10)	1.76 (0.91,3.41)
p-trend			0.13
OTHERS			
Methyl bromide			
Never	22116 (86)	166 (76)	Reference
T1	1004 (4)	16 (7)	1.74 (1.00,3.02)
T2	1469 (6)	17 (8)	1.18 (0.68,2.05)
T3	1203 (5)	19 (9)	1.54 (0.90,2.63)
p-trend			0.11

[a]Adjusted for age, state of enrollment, pack-years smoking, and education
[b]From take-home questionnaire
[c]Tertiles (T1, T2, T3) based on intensity-weighted lifetime days of use.

Table S2 - Ever use of specific pesticides and incident RA among smokers and non-smokers male licensed pesticide applicators in the Agricultural Health Study

	Non,smokers			Smokers		
	Non-cases	Incident cases		Non-cases	Incident cases	
	N=15046	N=100		N=11088	N=120	
	N (%)	N (%)	OR[a] (95%CI)	N (%)	N (%)	OR[a] (95%CI)
INSECTICIDES						
ORGANOCHLORINES	7364 (50)	61 (62)	1.37 (0.88,2.15)	6533 (62)	72 (63)	0.99 (0.65,1.49)
Aldrin	1230 (15)	13 (25)	1.80 (0.96,3.37)	1140 (20)	16 (21)	1.25 (0.69,2.29)
Chlordane	1305 (16)	17 (31)	2.37 (1.33,4.23)	1285 (23)	19 (25)	1.05 (0.61,1.80)
DDT	1387 (17)	18 (33)	2.41 (1.36,4.25)	1533 (27)	22 (29)	0.92 (0.53,1.59)
Dieldrin	258 (3)	7 (13)	4.48 (2.01,10.01)	233 (4)	1 (1)	0.35 (0.05,2.56)
Heptachlor	943 (12)	8 (15)	1.34 (0.63,2.85)	780 (14)	7 (9)	0.74 (0.32,1.68)
Lindane	1176 (15)	10 (19)	1.32 (0.66,2.63)	830 (15)	8 (11)	0.75 (0.36,1.59)
Toxaphene	765 (10)	10 (19)	2.21 (1.11,4.42)	722 (13)	13 (18)	1.26 (0.68,2.35)
ORGANOPHOSPHATES	13571 (90)	96 (96)	NC	9927 (90)	107 (89)	1.20 (0.66,2.16)
Chlorpyrifos	6577 (44)	53 (54)	1.47 (0.99,2.18)	4684 (43)	51 (44)	1.13 (0.78,1.64)
Coumaphos	1368 (10)	6 (6)	0.63 (0.27,1.44)	891 (9)	7 (7)	0.81 (0.38,1.76)
Diazinon	1421 (18)	12 (23)	1.39 (0.73,2.66)	1370 (25)	22 (29)	1.13 (0.67,1.90)
Dichlorvos	1784 (13)	16 (17)	1.40 (0.82,2.40)	1071 (11)	10 (10)	1.22 (0.62,2.38)
Fonofos	3447 (24)	29 (30)	1.34 (0.86,2.07)	2292 (23)	29 (28)	1.94 (1.21,3.13)
Malathion	5181 (64)	33 (61)	0.88 (0.51,1.52)	3802 (68)	54 (71)	1.27 (0.77,2.12)
Parathion	510 (6)	4 (7)	1.18 (0.42,3.27)	512 (9)	7 (9)	0.79 (0.36,1.77)
Phorate	2626 (33)	20 (37)	1.22 (0.70,2.12)	1719 (31)	20 (27)	1.03 (0.59,1.79)
Terbufos	6230 (44)	43 (44)	1.01 (0.68,1.51)	3939 (39)	43 (41)	1.37 (0.91,2.06)
CARBAMATES	9485 (64)	72 (72)	1.25 (0.79,1.99)	7817 (73)	91 (78)	1.16 (0.73,1.84)
Aldicarb	454 (6)	3 (6)	0.98 (0.31,3.16)	496 (9)	10 (14)	1.19 (0.57,2.45)
Carbaryl	3011 (37)	25 (47)	1.50 (0.87,2.57)	2697 (48)	49 (64)	1.74 (1.03,2.92)
Carbofuran	4007 (28)	24 (25)	0.85 (0.54,1.36)	3059 (31)	39 (38)	1.40 (0.94,2.09)
PYRETHROIDS	3877 (28)	24 (26)	0.98 (0.61,1.57)	2360 (24)	28 (29)	1.46 (0.93,2.28)
Permethrin C[b]	1966 (14)	12 (13)	0.91 (0.50,1.67)	1386 (14)	19 (19)	1.40 (0.84,2.33)
Permethrin P[b]	2395 (17)	15 (15)	0.90 (0.52,1.57)	1242 (12)	10 (10)	1.07 (0.55,2.09)

HERBICIDES						
2,4-D	11894 (80)	85 (86)	1.55 (0.88,2.73)	8542 (78)	84 (73)	0.93 (0.60,1.44)
2,4,5-T	1418 (18)	17 (31)	2.10 (1.18,3.72)	1194 (21)	12 (16)	0.74 (0.39,1.41)
2,4,5-TP	360 (4)	5 (9)	2.13 (0.84,5.37)	315 (6)	2 (3)	0.47 (0.12,1.95)
Alachlor	7989 (56)	60 (64)	1.38 (0.91,2.11)	5706 (56)	62 (57)	1.14 (0.77,1.68)
Atrazine	11346 (76)	81 (83)	1.52 (0.90,2.57)	7974 (72)	85 (71)	1.09 (0.72,1.64)
Butylate	2372 (29)	16 (29)	0.99 (0.55,1.77)	1540 (28)	19 (25)	1.04 (0.61,1.78)
Chlorimuron_ethyl	2645 (33)	24 (44)	1.59 (0.93,2.72)	1825 (33)	27 (35)	1.23 (0.76,1.98)
Cyanazine	6677 (47)	39 (41)	0.80 (0.53,1.21)	4283 (42)	37 (35)	1.02 (0.65,1.60)
Dicamba	8297 (58)	51 (55)	0.87 (0.57,1.30)	5105 (51)	41 (38)	0.80 (0.50,1.27)
EPTC	3210 (23)	12 (13)	0.51 (0.28,0.93)	1971 (20)	12 (12)	0.68 (0.36,1.27)
Glyphosate	11353 (76)	75 (75)	0.96 (0.61,1.51)	8707 (79)	91 (77)	0.88 (0.57,1.37)
Imazethapyr	7034 (50)	47 (51)	1.04 (0.69,1.56)	4258 (43)	39 (38)	1.27 (0.77,2.09)
Metolachlor	7179 (50)	47 (50)	0.99 (0.66,1.48)	4730 (47)	38 (36)	0.74 (0.49,1.12)
Metribuzin	3378 (42)	24 (44)	1.08 (0.63,1.84)	2128 (38)	24 (32)	0.98 (0.58,1.67)
Paraquat	1116 (14)	9 (17)	1.25 (0.61,2.56)	1015 (18)	15 (19)	0.85 (0.47,1.56)
Pendimethalin	2995 (37)	20 (36)	0.97 (0.56,1.69)	2188 (39)	29 (38)	0.93 (0.58,1.49)
Trifluralin	8097 (57)	57 (59)	1.09 (0.73,1.63)	5493 (54)	55 (53)	1.25 (0.83,1.90)
FUNGICIDES						
Benomyl	484 (6)	1 (2)	0.29 (0.04,2.13)	495 (9)	8 (10)	0.89 (0.41,1.92)
Captan	1752 (12)	13 (14)	1.12 (0.62,2.01)	1181 (12)	8 (8)	0.68 (0.33,1.42)
Chlorothalonil	895 (6)	11 (11)	1.96 (1.05,3.69)	966 (9)	13 (11)	1.04 (0.56,1.90)
Maneb	491 (6)	3 (5)	0.89 (0.28,2.85)	540 (10)	11 (15)	1.19 (0.59,2.39)
Metalaxyl	1184 (15)	9 (16)	1.14 (0.55,2.33)	1327 (24)	26 (34)	1.33 (0.76,2.32)
OTHERS						
80/20_mix	300 (4)	3 (6)	1.52 (0.47,4.89)	295 (5)	2 (3)	0.51 (0.12,2.12)
Methylbromide	1642 (11)	15 (15)	1.45 (0.83,2.51)	2183 (20)	38 (32)	1.57 (0.98,2.53)
Petroleum_oil	1801 (22)	9 (16)	0.68 (0.33,1.39)	1227 (22)	10 (13)	0.61 (0.31,1.19)
No. of pesticides applied						
0 – 5	3042 (20)	16 (16)	Reference	2699 (24)	28 (23)	Reference
6 – 9	4425 (30)	27 (27)	1.30 (0.69,2.44)	3095 (28)	41 (34)	1.51 (0.92,2.49)
10 – 13	3740 (25)	26 (26)	1.53 (0.80,2.92)	2534 (23)	21 (18)	1.04 (0.58,1.87)
14+	3768 (25)	30 (30)	1.67 (0.89,3.16)	2726 (25)	30 (25)	1.44 (0.83,2.47)

NC = not calculated due to fewer than 5 exposed or unexposed cases

[a]Adjusted for age, state of enrollment, pack-years smoking, and education

[b] Permethrin C: used on crops; Permethrin P: used on poultry and livestock

Table S3 – Ever use of specific pesticides and incident RA among male licensed pesticide applicators in the Agricultural Health Study, according to age

	Age < 50			Age >= 50		
	Non-cases N=15814	Incident RA N=111		Non-cases N=10320	Incident RA N=109	
	N (%)	N (%)	OR[a] (95%CI)	N (%)	N (%)	OR[a] (95%CI)
INSECTICIDES						
ORGANOCHLORINES	6340 (41)	52 (48)	1.03 (0.69,1.54)	7557 (77)	81 (77)	1.13 (0.71,1.80)
Aldrin	490 (6.3)	4 (7.0)	0.81 (0.29,2.30)	1880 (32.4)	25 (35.2)	1.38 (0.82,2.35)
Chlordane	947 (12.1)	15 (26.3)	1.82 (0.97,3.39)	1643 (28.4)	21 (29.2)	1.01 (0.60,1.71)
DDT	455 (5.8)	8 (13.8)	1.15 (0.51,2.59)	2465 (42.3)	32 (44.4)	1.15 (0.71,1.87)
Dieldrin	61 (0.8)	0 (0.0)	NC	430 (7.5)	8 (11.3)	1.91 (0.89,4.11)
Heptachlor	443 (5.7)	1 (1.8)	0.28 (0.04,2.01)	1280 (22.0)	14 (19.7)	0.99 (0.53,1.85)
Lindane	1006 (12.9)	7 (11.9)	0.91 (0.41,2.03)	1000 (17.3)	11 (15.5)	0.95 (0.49,1.83)
Toxaphene	558 (7.1)	8 (14.0)	1.35 (0.62,2.95)	929 (16.0)	15 (21.4)	1.40 (0.78,2.51)
ORGANOPHOSPHATES	14323 (91)	104 (94)	1.67 (0.77,3.63)	9175 (89)	99 (91)	1.42 (0.73,2.77)
Chlorpyrifos	7148 (45.4)	54 (50.0)	1.21 (0.83,1.77)	4113 (40.3)	50 (46.7)	1.34 (0.91,1.97)
Coumaphos	1329 (9.0)	5 (5.0)	0.52 (0.21,1.28)	930 (10.3)	8 (8.6)	0.87 (0.42,1.81)
Diazinon	1421 (18.2)	18 (31.0)	1.42 (0.78,2.61)	1370 (23.7)	16 (22.9)	0.91 (0.51,1.62)
Dichlorvos	1731 (11.6)	10 (9.7)	0.94 (0.48,1.83)	1124 (12.3)	16 (17.2)	1.82 (1.04,3.20)
Fonofos	3469 (23.0)	29 (28.2)	1.56 (0.99,2.47)	2270 (24.7)	29 (30.2)	1.76 (1.09,2.87)
Malathion	5015 (64.0)	33 (55.9)	0.69 (0.41,1.16)	3968 (67.9)	54 (76.1)	1.55 (0.89,2.69)
Parathion	471 (6.1)	3 (5.1)	NC	551 (9.6)	8 (11.3)	1.06 (0.50,2.28)
Phorate	2251 (28.7)	15 (25.9)	0.99 (0.53,1.84)	2094 (36.1)	25 (35.2)	1.15 (0.67,1.96)
Terbufos	6477 (42.9)	42 (40.2)	1.03 (0.67,1.54)	3692 (40.0)	44 (44.9)	1.48 (0.97,2.26)
CARBAMATES	9919 (64)	81 (74)	1.22 (0.77,1.93)	7383 (74)	82 (77)	1.09 (0.68,1.74)
Aldicarb	593 (7.6)	7 (12.1)	0.94 (0.40,2.24)	357 (6.2)	6 (8.6)	1.12 (0.46,2.77)
Carbaryl	2892 (36.9)	32 (55.2)	1.44 (0.81,2.59)	2816 (48.2)	42 (59.2)	1.50 (0.89,2.52)
Carbofuran	3869 (25.8)	30 (29.4)	1.05 (0.68,1.62)	3197 (34.9)	33 (34.4)	1.03 (0.67,1.58)
PYRETHROIDS	12505 (79)	80 (72)	0.76 (0.49,1.17)	8518 (83)	95 (87)	1.74 (0.97,3.13)

Permethrin C[b]	2332 (15.7)	18 (17.7)	1.09 (0.65,1.82)	1020 (11.3)	13 (14.1)	1.24 (0.69,2.25)
Permethrin P[b]	2710 (18.0)	13 (12.5)	0.78 (0.43,1.42)	927 (10.1)	12 (12.8)	1.51 (0.81,2.83)
HERBICIDES	15497 (98)	107 (96)	0.52 (0.19,1.42)	10090 (98)	106 (97)	0.89 (0.28,2.87)
2,4-D	12219 (77.7)	78 (72.9)	0.86 (0.55,1.35)	8217 (80.6)	91 (85.1)	1.66 (0.95,2.89)
2,4,5-T	947 (12.1)	9 (15.3)	1.16 (0.56,2.39)	1665 (28.5)	20 (28.6)	1.08 (0.63,1.83)
Alachlor	8236 (54.7)	58 (55.2)	1.01 (0.68,1.49)	5459 (58.4)	64 (66.0)	1.51 (0.99,2.33)
Atrazine	11707 (74.3)	86 (77.5)	1.35 (0.85,2.15)	7613 (74.2)	80 (74.8)	1.12 (0.71,1.78)
Butylate	2254 (28.8)	11 (18.3)	0.57 (0.29,1.11)	1658 (28.4)	24 (33.3)	1.41 (0.85,2.35)
Chlorimuron ethyl	2846 (36.4)	20 (33.3)	0.93 (0.54,1.61)	1624 (27.7)	31 (43.1)	2.04 (1.27,3.27)
Cyanazine	6810 (45.2)	31 (30.1)	0.57 (0.37,0.93)	4150 (44.8)	45 (46.9)	1.49 (0.94,2.37)
Dicamba	8510 (56.7)	42 (41.2)	0.62 (0.39,0.98)	4885 (52.9)	50 (51.0)	1.26 (0.78,2.02)
EPTC	3445 (23.1)	10 (9.6)	0.41 (0.21,0.79)	1736 (19.1)	14 (15.4)	0.93 (0.51,1.67)
Glyphosate	12344 (78.3)	85 (77.3)	0.82 (0.52,1.31)	7716 (75.3)	81 (75.0)	0.96 (0.61,1.50)
Imazethapyr	7593 (50.6)	43 (42.2)	0.99 (0.62,1.58)	3699 (40.5)	43 (45.3)	1.85 (1.11,3.05)
Metholachlor	7685 (50.9)	42 (40.4)	0.73 (0.49,1.09)	4224 (45.6)	43 (45.3)	1.01 (0.72,1.66)
Metribuzin	3219 (41.1)	15 (25.4)	0.53 (0.29,1.00)	2287 (39.2)	33 (45.8)	1.65 (0.98,2.76)
Paraquat	1201 (15.3)	11 (18.3)	0.73 (0.36,1.50)	930 (15.9)	13 (18.3)	1.02 (0.53,1.95
Pendimethalin	3172 (40.5)	21 (35.0)	0.78 (0.46,1.33)	2011 (34.3)	28 (38.9)	1.19 (0.74,1.93)
Trifluralin	8434 (55.8)	54 (52.4)	1.04 (0.69,1.58)	5156 (55.7)	58 (59.2)	1.43 (0.93,2.21)
FUNGICIDES	5541 (35)	48 (43)	1.04 (0.67,1.60)	3771 (37)	43 (39)	1.00 (0.65,1.54)
Benomyl	508 (6.5)	3 (5.1)	0.40 (0.12,1.31)	471 (8.1)	6 (8.3)	0.85 (0.35,2.06)
Captan	1891 (12.7)	12 (11.5)	0.90 (0.50,1.65)	1042 (11.4)	9 (9.8)	0.90 (0.45,1.80)
Chlorothalonil	1132 (7.2)	13 (11.8)	1.25 (0.67,2.33)	729 (7.1)	11 (10.2)	1.30 (0.67,2.53)
Maneb	495 (6.3)	6 (10.3)	0.96 (0.39,2.39)	536 (9.2)	8 (11.1)	0.97 (0.43,2.17)
Metalaxyl	1411 (18.0)	16 (27.1)	1.00 (0.51,1.96)	1100 (18.9)	19 (26.4)	1.35 (0.74,2.44)
OTHERS						
80/20 Mix	182 (2.3)	0 (0.0)	,,,	413 (7.1)	5 (6.9)	1.06 (0.42,2.67)
Methylbromide	2166 (13.8)	26 (23.4)	1.21 (0.70,2.09)	1659 (16.2)	27 (25.0)	1.61 (0.94,2.75)
Petroleum oil	1840 (23.6)	11 (18.3)	0.77 (0.40,1.50)	1188 (20.5)	8 (11.1)	0.51 (0.24,1.07)
No. of pesticides applied						
0 – 5	3386 (22)	25 (23)	Reference	2355 (23)	19 (18)	Reference
6 – 9	4745 (30)	42 (38)	1.37 (0.82,2.28)	2775 (27)	26 (24)	1.36 (0.74,2.50)

10 – 13	3994 (25)	21 (19)	0.86 (0.47,1.57)	2280 (22)	26 (24)	1.79 (0.96,3.33)
14+	3617 (23)	23 (21)	0.99 (0.55,1.78)	2877 (28)	37 (34)	2.16 (1.19,3.90)

NC = not calculated due to fewer than 5 exposed or unexposed cases

[a]Ajusted for age, state of enrollment, pack-years smoking, and education

[b] Permethrin C: used on crops; Permethrin P: used on poultry and livestock

Table S4 – Main characteristic of probable and possible RA cases and non-cases among male licensed private applicators in the Agricultural Health Study

	Non-cases (N=26,134) N (%)	Probable + Possible Incident RA cases (N=380) N (%)	OR[a] (95%CI)
Age at enrollment (years)			
<40	7858 (30)	54 (14)	Reference
40-49	7956 (30)	118 (31)	2.16 (1.56,2.98)
50-59	6035 (23)	122 (32)	2.94 (2.13,4.06)
60+	4285 (16)	86 (23)	2.92 (2.07,4.11)
Body Mass Index (Kg/m2)			
< 25	6157 (26)	62 (17)	Reference
25 to <30	12353 (51)	193 (54)	1.51 (1.13,2.01)
≥ 30	5551 (23)	101 (28)	1.79 (1.30,2.47)
State of enrollment			
Iowa	17972 (69)	209 (55)	Reference
North Carolina	8162 (31)	171 (45)	1.66 (1.35,2.04)
Race			
White	25454 (97)	359 (95)	Reference
Non-white	659 (3)	20 (5)	2.01 (1.27,3.17)
Education			
High school or less	14117 (54)	250 (66)	Reference
> high school	12017 (46)	130 (34)	0.70 (0.56,0.87)
Smoking status at enrollment			
Never Smoked	15046 (58)	171 (45)	Reference
Past Smoker	7637 (29)	138 (36)	1.33 (1.06,1.68)
Current Smoker	3392 (13)	70 (19)	1.83 (1.38,2.42)
Pack-years of cigarette smoked			
None	15046 (58)	172 (45)	Reference
<5	3460 (13)	44 (12)	1.07 (0.76,1.49)
5-18	3760 (15)	69 (18)	1.46 (1.10,1.93)
> 18	3868 (15)	95 (25)	1.80 (1.39,2.33)
Alcohol consumption (times/week)			
None	8143 (32)	143 (39)	Reference
≤ 1	11778 (47)	148 (40)	0.84 (0.67,1.07)
> 1	5331 (21)	77 (21)	0.97 (0.73,1.29)

[a]Adjusted for continuous age

Table S5 – Ever use of specific pesticides associated with possible and probable incident RA among male licensed pesticide applicators in the Agricultural Health Study

	Non-cases (N=26,134) N (%)	Probable + Possible Incident RA cases (N=380) N (%)	OR[a] (95%CI)
INSECTICIDES			
ORGANOCHLORINES	13897 (55)	241 (66)	1.25 (0.98,1.58)
Aldrin	2370 (17)	47 (22)	1.23 (0.86,1.75)
Chlordane	2590 (19)	54 (26)	1.18 (0.85,1.64)
DDT	2920 (21)	69 (32)	1.23 (0.88,1.70)
Dieldrin	491 (4)	10 (5)	1.17 (0.61,2.27)
Heptachlor	1723 (13)	27 (13)	0.97 (0.63,1.49)
Lindane	2006 (15)	29 (14)	0.95 (0.64,1.42)
Toxaphene	1487 (11)	29 (14)	1.03 (0.69,1.55)
ORGANOPHOSPHATES	23498 (90)	344 (91)	1.32 (0.93,1.88)
Chlorpyrifos	11261 (43)	157 (42)	1.03 (0.84,1.27)
Coumaphos	2259 (10)	23 (7)	0.71 (0.46,1.08)
Diazinon	2791 (21)	52 (25)	1.06 (0.76,1.48)
Dichlorvos	2855 (12)	38 (11)	1.14 (0.80,1.61)
Fonofos	5739 (24)	90 (26)	1.44 (1.11,1.87)
Malathion	8983 (66)	140 (65)	0.99 (0.74,1.32)
Parathion	1022 (8)	20 (9)	0.96 (0.59,1.44)
Phorate	4345 (32)	73 (35)	1.34 (0.99,1.83)
Terbufos	10169 (42)	140 (40)	1.13 (0.91,1.42)
CARBAMATES	17302 (68)	254 (73)	1.07 (0.83,1.38)
Aldicarb	950 (7)	24 (11)	1.26 (0.79,2.01)
Carbaryl	5708 (42)	107 (50)	1.09 (0.80,1.47)
Carbofuran	7066 (29)	117 (34)	1.17 (0.93,1.46)
PYRETHROIDS	6237 (26)	61 (25)	1.07 (0.89,1.44)
Permethrin C[b]	3352 (14)	50 (15)	1.11 (0.82,1.51)
Permethrin P[b]	3637 (15)	36 (11)	0.89 (0.62,1.27)
HERBICIDES			
2,4,D	20436 (79)	290 (78)	1.09 (0.84,1.41)
2,4,5,T	2612 (19)	43 (20)	0.96 (0.68,1.37)
2,4,5,TP	675 (5)	18 (9)	1.65 (1.01,2.70)
Alachlor	13695 (56)	205 (58)	1.14 (0.92,1.42)
Atrazine	19320 (74)	284 (75)	1.25 (0.98,1.60)
Butylate	3912 (29)	55 (26)	0.99 (0.72,1.36)
Chlorimuron ethyl	4470 (33)	81 (38)	1.39 (1.05,1.84)
Cyanazine	10960 (45)	135 (39)	1.00 (0.78,1.27)
Dicamba	13402 (55)	155 (45)	0.87 (0.67,1.11)
EPTC	5181 (22)	50 (15)	0.77 (0.57,1.06)
Glyphosate	20060 (77)	285 (76)	0.90 (0.70,1.14)
Imazethapyr	11292 (45)	141 (41)	1.20 (0.92,1.55)
Metolachlor	11909 (49)	158 (46)	1.04 (0.83,1.29)
Metribuzin	5506 (40)	81 (38)	1.15 (0.85,1.56)
Paraquat	2131 (16)	42 (20)	1.06 (0.73,1.53)

Pendimethalin	5183 (38)	86 (40)	1.10 (0.83,1.45)
Trifluralin	13590 (56)	182 (52)	1.06 (0.85,1.33)
FUNGICIDES			
Benomyl	979 (7)	16 (8)	0.75 (0.44,1.28)
Captan	2933 (12)	34 (10)	0.86 (0.60,1.22)
Chlorothalonil	1861 (7)	46 (12)	1.58 (1.05,2.06)
Maneb	1031 (8)	18 (9)	0.75 (0.45,1.27)
Metalaxyl	2511 (18)	56 (26)	1.17 (0.82,1.66)
OTHERS			
80/20 Mix	595 (4)	8 (4)	0.76 (0.37,1.55)
Methylbromide	3825 (15)	85 (23)	1.19 (0.89,1.59)
Petroleum oil	3028 (22)	34 (16)	0.73 (0.51,1.06)
No. of pesticides applied			
0 – 5	5741 (22)	86 (23)	Reference
6 – 9	7520 (29)	106 (28)	1.15 (0.86,1.54)
10 – 13	6274 (24)	85 (23)	1.19 (0.87,1.64)
14+	6494 (25)	100 (27)	1.32 (0.97,1.80)

[a] Adjusted for age, state of enrollment, pack-years smoking, and education

[b] Permethrin C: used on crops; Permethrin P: used on poultry and livestock

Table S6 – Lifetime days of pesticide use in relation to probable + possible incident RA among male licensed pesticide applicators in the Agricultural Health Study

	Non-cases (N=26,134) N (%)	Probable + Possible Incident RA Cases (N=380) N (%)	OR[a] (95%CI)
INSECTICIDES			
ORGANOCHLORINES			
Aldrin			
Never	11257 (83)	164 (78)	Reference
< 20	1095 (8)	21 (10)	1.21 (0.75,1.96)
>=20 to <24.5	116 (1)	13 (6)	1.18 (0.65,2.12)
>=24.5	1084 (8)	11 (5)	1.28 (0.68,2.41)
p-trend			0.32
Chlordane			
Never	11035 (81)	158 (75)	Reference
< 8.75	639 (5)	12 (6)	1.03 (0.56,1.88)
>=8.75 to <20	1051 (8)	19 (9)	1.08 (0.66,1.75)
>=20	825 (6)	22 (10)	1.48 (0.93,2.34)
p-trend			0.15
Toxaphene[b]			
Never	12143 (89)	180 (87)	Reference
< 8.75	859 (6)	4 (2)	0.90 (0.33,2.46)
>=8.75 to <38.75	392 (3)	10 (5)	0.66 (0.34,1.25)
>=38.75	202 (1)	14 (7)	1.87 (1.06,3.30)
p-trend			0.47
ORGANOPHOSPHATES			
Chlorpyrifos			
Never	14678 (57)	216 (58)	Reference
< 14.5	3756 (15)	47 (13)	0.93 (0.68,1.28)
>=14.5 to <56	3727 (15)	57 (15)	1.14 (0.85,1.53)
>=56	3602 (14)	51 (14)	1.05 (0.77,1.43)
p-trend			0.54
Dichlorvos			
Never	21220 (88)	304 (90)	Reference
< 20	1052 (4)	9 (3)	0.92 (0.47,1.80)
>=20 to <116	936 (4)	11 (3)	0.96 (0.52,1.77)
>=116	796 (3)	15 (4)	1.33 (0.79,2.26)
p-trend			0.46
Fonofos			
Never	18544 (77)	254 (74)	Reference
< 20	1825 (8)	31 (9)	1.62 (1.10,2.39)
>=20 to <56	2074 (9)	25 (7)	1.12 (0.73,1.71)
>=56	1725 (7)	34 (10)	1.76 (1.21,2.56)
p-trend			0.005
Terbufos			
Never	14178 (59)	208 (60)	Reference
< 24.5	3548 (15)	48 (14)	1.14 (0.83,1.58)
>=24.5 to <63.75	3464 (14)	44 (13)	1.07 (0.76,1.49)
>=63.75	2954 (12)	46 (13)	1.24 (0.89,1.72)
p-trend			0.22
CARBAMATES			
Carbaryl[b]			
Never	7966 (59)	106 (50)	Reference
< 14.5	2339 (17)	31 (15)	0.93 (0.62,1.39)
>=14.5 to <56	1775 (13)	30 (14)	1.25 (0.81,1.94)
>=56	1434 (11)	43 (20)	1.18 (0.77,1.79)
p-trend			0.36

HERBICIDES			
2,4,5-T[b]			
Never	11038 (81)	169 (81)	Reference
< 8.75	474 (3)	4 (2)	0.48 (0.18,1.32)
>=8.75 to <24.5	1555 (11)	18 (9)	0.93 (0.56,1.52)
>=24.5	499 (4)	18 (9)	1.18 (0.72,1.95)
p-trend			0.84
Alachlor			
Never	10698 (45)	147 (43)	Reference
< 24.5	5931 (25)	50 (14)	0.92 (0.67,1.28)
>=24.5 to <108.5	3001 (13)	67 (19)	1.15 (0.85,1.54)
>=108.5	4362 (18)	81 (23)	1.36 (1.03,1.79)
p-trend			0.03
Atrazine			
Never	6685 (26)	93 (25)	Reference
< 29.5	8199 (32)	85 (23)	1.16 (0.85,1.57)
>=29.5 to <116	6002 (23)	92 (25)	1.13 (0.84,1.52)
>=116	4914 (19)	102 (27)	1.51 (1.13,2.03)
p-trend			0.01
Imazethapyr			
Never	12842 (54)	203 (59)	Reference
< 14.5	4910 (21)	68 (20)	1.29 (0.95,1.76)
>=14.5 to <29.5	599 (3)	42 (12)	1.17 (0.81,1.69)
>=29.5	5582 (23)	29 (8)	1.09 (0.72,1.65)
p-trend			0.49
Trifluralin			
Never	10781 (45)	167 (49)	Reference
< 29.5	4520 (19)	62 (18)	1.05 (0.78,1.42)
>=29.5 to <108.5	3572 (15)	44 (13)	1.01 (0.71,1.43)
>=108.5	5204 (22)	71 (21)	1.11 (0.82,1.48)
p-trend			0.56
FUNGICIDES			
Chlorothalonil			
Never	24052 (93)	327 (89)	Reference
< 12.5	862 (3)	11 (3)	1.09 (0.59,2.01)
>=12.5 to <87.5	572 (2)	14 (4)	1.50 (0.86,2.63)
>=87.5	304 (1)	16 (4)	1.71 (1.01,2.89)
p-trend			0.02
Metalaxyl			
Never	11164 (83)	160 (74)	Reference
< 12.25	714 (5)	12 (6)	0.95 (0.52,1.72)
>=12.25 to <28	991 (7)	12 (6)	1.07 (0.58,2.00)
>=28	616 (5)	31 (14)	1.70 (1.07,2.69)
p-trend			0.05
OTHERS			
Methyl bromide			
Never	22116 (86)	292 (78)	Reference
< 15.5	1004 (4)	29 (8)	1.27 (0.84,1.92)
>=15.5 to <54.25	1469 (6)	20 (5)	0.91 (0.56,1.48)
>=54.25	1203 (5)	35 (9)	1.49 (1.00,2.21)
p-trend			0.12

[a]Adjusted for age, state of enrollment, pack-years smoking, and education
[b]From take-home questionnaire