

SHORT REPORT

Reported chemical sensitivities in a health survey of United Kingdom military personnel

S Reid, M Hotopf, L Hull, K Ismail, C Unwin, S Wessely

Occup Environ Med 2002;**59**:196–198

Objective: To report the prevalence of self reported chemical sensitivities in three cohorts of United Kingdom service personnel.

Method: Cross sectional postal survey of three cohorts of United Kingdom military personnel comprising Gulf veterans (n=3531), those who had served in Bosnia (n=2050), and those serving during the Gulf war but not deployed there (Era cohort, n=2614).

Results: Sensitivity to at least one everyday chemical was reported by a considerable proportion of all three cohorts, and particularly by veterans of the Gulf war (Era: 14%; Bosnia: 13%; Gulf: 28%).

Conclusion: Reported chemical sensitivities were common in all three military cohorts. Our understanding of chemical sensitivities remains limited and objective evidence for a causal link between low level exposures to chemicals and reported symptoms is lacking. Given their frequency in the population, further work in this area is necessary.

Exposure to everyday chemicals has become a focus of increasing concern among the general population over the past 2 decades. The actual risks are unclear but chemical sensitivities or intolerance have been reported in a growing number of cases described in the medical literature and general media.¹ The complaint of a multitude of symptoms triggered by exposure to low levels of common agents in the environment has often been described and its existence as a specific syndrome, multiple chemical sensitivity (MCS), has attracted considerable controversy.² Characteristically the symptoms are reported in the absence of abnormal physical investigations, yet are commonly attributed to immunological or neurological dysfunction despite the absence of compelling data.³ Some authors have highlighted the association between chemical sensitivities and psychological morbidity,⁴ and others emphasise the overlap with other medically unexplained illnesses such as chronic fatigue syndrome.⁵

Attempts to investigate the relation between reported chemical sensitivities and physical or psychological morbidity have been hindered by a lack of validated population studies. Much of the published work has relied on anecdote or selected case series. We are aware of only two epidemiologically valid samples, both from the United States. Kreuzer *et al*⁶ conducted a large telephone survey (n=4046) in an effort to determine the community prevalence of chemical sensitivities. They found a prevalence of 11.9% reporting sensitivity to more than one type of chemical, and 6.3% reported that they had been previously diagnosed as having multiple chemical sensitivity. Black *et al* surveyed 3695 Iowa military personnel⁷ and found a 3.4% prevalence of symptoms suggestive of MCS. The need for further epidemiological studies in this area was emphasised in a commentary by Kipen and Fiedler.⁸

We recently completed an epidemiological health survey of United Kingdom military personnel⁹ which included a questionnaire designed by Kipen *et al*¹⁰ for the purpose of measuring the prevalence of chemical sensitivity. This study reports the prevalence of self reported chemical sensitivities in three United Kingdom military cohorts.

METHODS

The sample was obtained from a cross sectional postal survey comparing the health profiles of three United Kingdom military populations, further details of which are described in our original paper.⁹ The three defined cohorts were (a) veterans deployed to the Gulf war; (b) veterans who served in the United Nations Bosnia peacekeeping forces between 1 April 1992 and 6 February 1997; and (c) veterans in active service on 1 January 1991, not deployed to the Gulf war (Era cohort). The subjects were sent a standardised postal questionnaire. After three mailings and telephone reminders, the response rate was 70.4% (n=3531) for the Gulf veterans, 61.9% (n=2050) for the Bosnia cohort, and 62.9% (n=2614) for the Era cohort. To assess potential response bias attempts were made to trace 200 participants who had not responded after two mailings. Characteristics of these non-responders were compared with responders in the main study.⁹

The survey included a shortened measure of symptoms of possible chemical sensitivity derived from the questionnaire of Kipen *et al*.¹⁰ Subjects were asked whether exposure to any of a list of 11 items brought about symptoms and whether this sensitivity developed subsequent to deployment to the Persian Gulf or Bosnia (or in the case of the Era cohort, after January 1991). A symptom was described as “an awareness of some discomfort or bothersome change—for example, sneezing, runny eyes, pain, swelling, nausea, or trouble concentrating”. Prevalences were calculated for reported sensitivity to each substance and odds ratios (ORs) with 95% confidence intervals (95% CIs) were calculated to enable comparison between cohorts.

RESULTS

Table 1 provides details of self reported chemical sensitivities in the three cohorts. Sensitivity to at least one trigger was reported commonly in all three cohorts but was notably more common among Gulf veterans. Of the Gulf cohort 978 (27.7%) indicated that they were sensitive to at least one trigger compared with 261 (12.7%) of the Bosnia cohort and 371 (14.2%) of the Era cohort (OR: Gulf v Era 2.3, 95% CI 2.0 to 2.6; Bosnia v Era 0.9, 95% CI 0.7 to 1.0). Among the veterans deployed to the Gulf or Bosnia, vehicle exhaust, air pollution, cigarette smoke, cosmetics, and organic chemicals were all often reported as causing symptoms. In the Era cohort, as well as air pollution, newsprint and new office buildings were more likely to trigger symptoms. For the total sample (including all three

Abbreviations: MCS, multiple chemical sensitivity

Table 1 Prevalence of reported chemical sensitivities in the Gulf, Bosnia, and Era cohorts

	Era veterans (n=2614) n (%)	Bosnia veterans (n=2050) n (%)	Gulf veterans (n=3531) n (%)	Bosnia v Era Odds ratio (95% CI)	Gulf v Era Odds ratio (95% CI)
Smog or air pollution	119(4.6)	89(4.3)	387(11.0)	1.0(0.7 to1.3)	2.6(2.1 to3.2)
Cigarette smoke	10(0.4)	63(3.1)	313(8.9)	8.3(4.3 to16.0)	25.3(13.6to47.2)
Vehicle exhaust or fumes	6(0.2)	126(6.2)	429(12.2)	28.5(12.8to63.3)	60.1(27.4to132.1)
Copiers or laser printers	11(0.4)	8(0.4)	34(1.0)	0.9(0.4 to2.2)	2.3(1.2 to4.5)
Newspapers, magazines, or other newsprint	114(4.4)	8(0.4)	45(1.3)	0.1(0.0 to0.2)	0.3(0.2 to0.4)
Pesticides, herbicides, insecticides, or fertilisers	54(2.1)	32(1.6)	181(5.1)	0.8(0.5 to1.2)	2.6(1.9 to3.5)
New office buildings or homes—for example sealed windows	108(4.1)	23(1.1)	85(2.4)	0.3(0.2 to0.4)	0.6(0.4 to0.8)
Carpeting or curtains	38(1.5)	8(0.4)	38(1.1)	0.3(0.1 to0.6)	0.7(0.5 to1.2)
Organic chemicals, solvents, glue, paints, or fuel	12(0.5)	55(2.7)	292(8.3)	6.0(3.2 to11.1)	19.6(11.0to34.6)
Cosmetics, perfumes, hairspray, deodorants, soaps	3(0.1)	48(2.3)	319(9.0)	20.9(6.9 to63.3)	86.4(29.2to255.5)
Anything else	7(0.3)	34(1.7)	86(2.4)	6.3(2.8 to13.9)	9.3(4.4 to19.8)

cohorts), the median number of reported sensitivities was zero, with two sensitivities at the 95th centile. When the cohorts were considered individually the median number of sensitivities remained zero, but the number of sensitivities at the 95th centile differed: Gulf, four; Bosnia, two; Era, one (fig 1). The distribution of reported chemical sensitivities differed significantly between the Gulf and Era cohorts ($p < 0.001$, Mann-Whitney U test), but not the Bosnia and Era cohorts ($p = 0.34$, Mann-Whitney U test).

DISCUSSION

This paper presents the first prevalence figures for reported chemical sensitivities in a United Kingdom population, albeit a military one. Strengths of the study include the large sample with a relatively high response rate. On the other hand, all responses were questionnaire based and as in previous studies, there was no objective measurement of reported sensitivities.⁴⁻⁷ For our symptom measure we used a shortened version of a validated questionnaire of chemical sensitivity but this was compensated for by its ease of use (the original questionnaire includes 122 items). The higher response rate from Gulf veterans may reflect an increased concern about illness after deployment. Responders to the survey were more likely to be still in service but did not differ from traced non-responders in several health outcomes, including the proportion given medical discharges. Those non-responders who were followed up had worse health perception than responders, although the difference was not significant.⁹

Reported chemical sensitivities were common in all three military cohorts. There have been few previous population based estimates of chemical sensitivities. Bell *et al* reported a

15% prevalence¹¹ and Meggs *et al*, 33%¹² but their findings were based solely on reports of feeling ill after smelling various chemical odours. Kreuzer *et al* conducted the first rigorous large scale survey in which 15.9% reported being “allergic or unusually sensitive to everyday chemicals”, and 11.9% reported sensitivity to more than one type of chemical.⁶ The similarity with our estimate (14.2% in the Era cohort) is surprising given the differences between the populations. We would expect the military sample to be a healthier population than that of Kreuzer *et al*, and the sample was overwhelmingly male (92%). A possible explanation may be that occupational exposures—such as diesel fumes and pesticides, which were commonly reported in the military cohorts,⁹—are likely to be less prevalent in a civilian population. Occupational exposures have been highlighted as a potential cause of chemical sensitivities¹³ although knowledge of occupational exposure goes hand in hand with recall bias, which may also be of relevance in explaining differences between the Gulf and Era/Bosnia cohorts.¹⁴

A striking, secondary finding is that nearly 30% of the veterans of the Gulf conflict reported at least one chemical sensitivity after their deployment. The Iowa study found that Gulf veterans were twice as likely to report illness due to chemical sensitivity when compared with those not deployed (12.8% *v* 6.1%).⁷ This finding is explored further in another paper,¹⁴ but it reinforces findings reported previously that veterans of the Gulf war report significantly more symptoms of ill health than soldiers not deployed to the Gulf.⁹⁻¹⁵ The reasons for this are, as yet, unclear.

The prevalence estimates from this study suggest that a significant proportion of United Kingdom veterans experience problematic sensitivity to everyday chemicals. Previously little

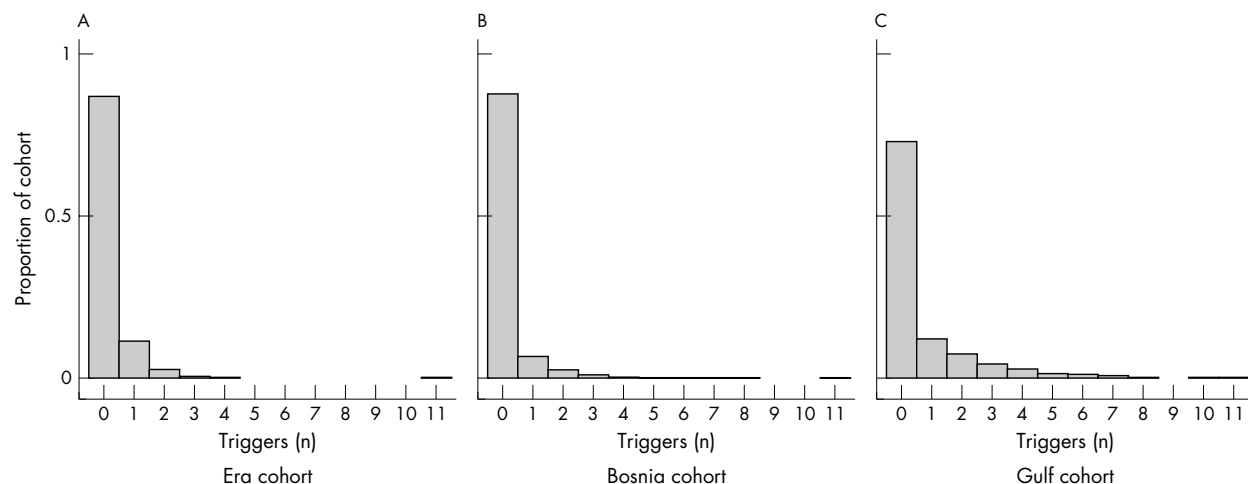


Figure 1 Distribution of the numbers of chemical sensitivities reported in each military cohort.

Main messages

- A significant proportion of United Kingdom military personnel report problematic sensitivity to everyday chemicals.
- Nearly 30% of Gulf war veterans report at least one chemical sensitivity after their deployment.

Policy implications

- Although affecting a significant proportion of the population, our understanding of the nature of symptoms due to reported chemical sensitivities is limited. Further investigation is necessary, of what may be an important but neglected public health problem.

priority has been given to researching chemical sensitivities, as is shown by the lack of studies outside of the United States. Objective evidence for a causal link between low level chemical exposures and reported symptoms is lacking, and current publications do not provide definitive answers to these questions. Further studies in the general population are now required, taking account of both health beliefs and chemical exposures, if we are to gain an understanding of the development of chemical sensitivities.

Authors' affiliations

S Reid, M Hotopf, L Hull, K Ismail, C Unwin, S Wessely, Gulf War Illnesses Research Unit, Guy's, King's, and St Thomas's School of Medicine, London SE5 8AZ, UK

Correspondence to: Dr S Reid, Paterson Centre for Mental Health, St Mary's Hospital, South Wharf Road, London W2 1PD, UK; steve.reid@kcl.ac.uk

Accepted 17 October 2001

REFERENCES

- 1 Reid S. Multiple chemical sensitivity: is the environment really to blame? *J R Soc Med* 1999;**92**:616–19.
- 2 AAAAI Board of Directors. Idiopathic environmental intolerances. *J Allergy Clin Immunol* 1999;**103**:36–40.
- 3 Graveling RA, Pilkington A, George JPK, et al. A review of multiple chemical sensitivity. *Occup Environ Med* 1999;**56**:73–85.
- 4 Simon GE, Katon WJ, Sparks PJ. Allergic to life: psychological factors to environmental illness. *Am J Psychiatry* 1990;**147**:901–6.
- 5 Buchwald D, Garrity D. Comparison of patients with CFS, FMS, and multiple chemical sensitivity. *Arch Intern Med* 1994;**154**:2049–53.
- 6 Kreutzer R, Neutra RR, Lashuay N. Prevalence of people reporting sensitivities to chemicals in a population-based survey. *Am J Epidemiol* 1999;**150**:1–12.
- 7 Black DW, Doebbeling BN, Voelker MD, et al. Multiple chemical sensitivity: symptom prevalence and risk factors in a military population. *Arch Intern Med* 2000;**160**:1169–76.
- 8 Kipen HM, Fiedler N. Invited commentary: sensitivities to chemicals: context and implications. *Am J Epidemiol*. 1999;**150**:13–16.
- 9 Unwin C, Blatchley N, Coker W, et al. Health of UK servicemen who served in the Persian Gulf war. *Lancet* 1999;**353**:169–78.
- 10 Kipen H, Hallman W, Kelly-McNeil K, et al. Measuring chemical sensitivity prevalence: a questionnaire for population studies. *Am J Public Health* 1995;**85**:574–7.
- 11 Bell IR, Schwartz GE, Peterson JM, et al. Self-reported illness from chemical odours in young adults without clinical syndromes or occupational exposures. *Arch Environ Health* 1993;**48**:6–13.
- 12 Meggs WJ, Dunn KA, Davidoff AL, et al. Prevalence and nature of allergy and chemical sensitivity in a general population. *Arch Environ Health* 1996;**51**:275–82.
- 13 Ziem G, McTamney J. Profile of patients with chemical injury and sensitivity. *Environ Health Perspect* 1997;**105**:417–36.
- 14 Reid S, Hotopf M, Hull L, et al. Multiple chemical sensitivity and chronic fatigue syndrome in British Gulf War veterans. *Am J Epidemiol* 2001;**153**:604–9.
- 15 The Iowan Persian Gulf Study Group. Self reported illness and health status among Gulf War veterans. *JAMA* 1997;**277**:238–45.