Gulf War illness: a view from Australia

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Australia sent a small, mostly naval, deployment to the 1991 Gulf War. When papers and media concerns arose about unexplained Gulf War illnesses in Gulf War troops from other countries, Australia decided to undertake its own study of Australian veterans. Undertaking a later study, more than 10 years after the Gulf War, allowed us to incorporate some methodological improvements on previous research, such as the inclusion of a face-to-face health assessment where more objective health data could be collected in addition to using a postal questionnaire. Despite the different Gulf War experience for the mostly naval Australian group, there were remarkable consistencies in the patterns of multiple symptom reporting found in overseas studies, including the fact that no unique symptom clusters were identified. In general, this excess symptom reporting was not found to occur with excesses in more objective measures of physical health. These objective physical measures included a wide range of haematological, biochemical and serological markers, a physical examination, spirometry and a step test of fatigability. In contrast, several psychological disorders, including anxiety, post-traumatic stress disorder, depression and substance abuse, were found to occur in excess in the Australian Gulf War group and were associated with Gulf War psychological stressors. These findings have helped raise awareness in Australia of psychological health problems in deployed military personnel.

Keywords: Gulf War veterans; epidemiology; methodology; symptoms

1. INTRODUCTION

What do you do when you are a country with a small population, which had a correspondingly small deployment to the 1991 Gulf War, and scientific papers and media reports begin to appear suggesting the presence of multiple unexplained symptoms among United States of America (US) and United Kingdom (UK) ground troops? The options are to ignore it and hope it will not become an issue in your own country, to take on board the findings among overseas Gulf War veterans and assume they apply to your own veterans as well, or to acknowledge that the situation may be different among your Gulf War veterans and commit to undertaking your own research.

This was the situation in the late 1990s in Australia, at a time when several overseas papers had been published (NIH Technology Assessment Workshop Panel 1994; Kizer *et al.* 1995; Joseph & the Comprehensive Clinical Evaluation Program Evaluation Team 1997; The Iowa Persian Gulf Study Group 1997; Wolfe *et al.* 1998; Coker *et al.* 1999; Ishøy *et al.* 1999; Unwin *et al.* 1999), the term ‘Gulf War Syndrome’ was being used in the popular press and there was increasing pressure from Australian veteran groups and the media to address concerns that our own veterans of the Gulf War were suffering from similar problems.

An important rationale for undertaking a study of one’s own veterans is that there may be important

differences in the composition of defence forces in different countries, which may impact on the way that they have responded to Gulf War exposures and experiences (The Iowa Persian Gulf Study Group 1997; Fukuda *et al.* 1998; Ismail *et al.* 2000; Kang *et al.* 2000; Cherry *et al.* 2001a,b). This may include differences in demographics and lifestyle factors, branches of service, proportion of reservist personnel and ranks serving in the deployed contingent, attrition rates, and available health services on return from deployment or on leaving the services, which can influence later health outcomes (Capleton *et al.* 2001; Chesbrough *et al.* 2002). In addition, there may be differences in fitness criteria and training in preparation for Gulf deployment and also differences in the way that Gulf War related health issues are detected and managed, which may influence the later health impact of Gulf War deployment. If so, studies of Gulf War veterans from other countries may not have adequately reflected the true situation in relation to health complaints following Gulf War service in Australian Defence Force (ADF) personnel.

Therefore, our federal Government decided upon the latter course of the three actions listed earlier and commissioned a comprehensive study of Australia’s own Gulf War veterans.

2. AUSTRALIA’S INVOLVEMENT IN THE GULF WAR

Following Iraq’s invasion of Kuwait on 2 August 1990, Australia deployed 1871 ADF personnel to the Gulf region as part of the multinational response. There

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One contribution of 17 to a Theme Issue ‘The health of Gulf War veterans’.

were several different deployments of the ADF, which all entered the Gulf region between 2 August 1990 and 4 September 1991. The majority were Royal Australian Navy personnel whose role included participation in a blockade of the Gulf of Oman, being part of the anti-air and anti-surface screen for US aircraft carriers during the war and the provision of supplies and medical support. Operations Damask I, II and III primarily involved Royal Australian Navy ships which were deployed in August 1990, November 1990 and April 1991, respectively. The Royal Australian Air Force supplied transport and logistic support, but did not fly combat missions. There was considerable diversity among the personnel in the Australian deployment, who included medical and nursing staff, mine clearance divers, intelligence officers, linguists and weapons inspectors. In addition, medical, dental and preventive health teams were deployed in Operation Habitat, a humanitarian mission to the Kurds in northern Iraq. Some ADF personnel deployed to the region with UK and US forces including with the United States Naval Ship (USNS) Comfort (Kirkland 1991; Waters 1992).

From this, it is clear that the type of deployment and potential patterns of exposures in the Australian veterans and those in other small deployments are likely to be different from those in larger deployments, and the results of overseas studies may not be generalizable to Australian Gulf War veterans. This provided a further strong rationale for an Australian study.

3. ADVANTAGES AND DISADVANTAGES OF GULF WAR VETERAN HEALTH RESEARCH IN THE AUSTRALIAN CONTEXT

The Australian research effort into the health of Gulf War veterans started some years after that in other countries, which has some advantages and some disadvantages.

One potential disadvantage was that our deployed number of 1871 was dwarfed by those of other countries, such as the US and UK which had about 697 000 (Kang *et al.* 2000) and 53 400 troops (Unwin *et al.* 1999) deployed to the Gulf, respectively. Therefore, our power to investigate less common outcomes, such as motor neurone disease (Haley 2003; Horner *et al.* 2003), would be low, so there was a need to concentrate on more prevalent outcomes. This population size problem also raised legitimate questions as to what a potentially small study could contribute to international understanding of Gulf War illness.

A second potential disadvantage was the increasing length of time since the Gulf War, which at that point was about 8 years. While this could confer an advantage in that it could have allowed time for some longer latency health problems to develop, this could be offset by a potential reduction in data quality due to reduced ability to recall events from the time of the Gulf War, especially where self-report could not be validated by more objective means (Rothman & Greenland 1998; Checkoway *et al.* 2004).

One advantage of such a study would be that we could focus our attention on Gulf War veterans who were naval personnel, rather than army personnel who

had a land-based deployment. This was an important consideration because most of the previous Gulf War research had focused on army veterans and it was not clear if the previous findings were a feature of land-based deployment. If findings could be shown to be similar across different branches of the forces, which had quite different patterns of exposure, then this would give a degree of consistency to the international literature. Another important consideration is that naval personnel are grouped into larger organizational units occupying a very small space (i.e. in a few ships), compared with land-based army units, which are smaller and more mobile and potentially have greater variability in their Gulf War exposures and experiences. This means that there is greater potential for investigating temporal and spatial consistency with a naval study group.

Another advantage of coming after several published studies was that it would give us the opportunity to appraise the methodology used in previous studies, identify weaknesses and develop more robust methods to investigate the health of Gulf War veterans. For example, much of the published Gulf War health research in the late 1990s involved either self-referral clinical evaluation programmes and registry studies (Joseph & the Comprehensive Clinical Evaluation Program Evaluation Team 1997; Coker *et al.* 1999), which did not comprise representative samples, or studies involving data collection via postal or telephone questionnaire alone (The Iowa Persian Gulf Study Group 1997; Unwin *et al.* 1999; Kang *et al.* 2000; Cherry *et al.* 2001b), which have potential for recall bias and lack of validation of outcomes and/or exposures. Another consistent problem had been low response rates, particularly for comparison groups (Goss Gilroy Inc. 1998; Holmes *et al.* 1998; Ishøy *et al.* 1999; Unwin *et al.* 1999; Kang *et al.* 2000). The later timing of our study afforded us the opportunity to communicate with overseas researchers to obtain assistance and advice, including the use of parts of questionnaires and other data forms to enable comparisons to be made between the findings of our study and those of overseas Gulf War veteran populations (The Iowa Persian Gulf Study Group 1997; VA Cooperative Study CSP No. 458 1998; Unwin *et al.* 1999; Cherry *et al.* 2001b).

Third, having a deployment of manageable size of less than 2000 people meant we could design a study for *all* persons deployed to the Gulf War, without the need to undertake sampling with its potential for sampling error. However, this raises an interesting methodological question about the statistical conventions to apply and the scope of any inferences from a study which includes a large fraction or the whole of the total number of eligible persons, rather than a sample of it. This issue was first raised (Haley 1998) in relation to the methods and conclusions of studies of mortality, hospitalizations and risk of birth defects in US veterans (Gray *et al.* 1996; Kang & Bullman 1996; Cowan *et al.* 1997). After considerable deliberation, we decided that we wished to provide both a description of the comparative health status of our local forces and address the general scientific questions of health effects of Gulf War deployment. We saw a clear concept of our small local Australian contingent of Gulf War veterans

being hypothetically part of a larger 'super-population' of Gulf War veterans globally. Hence, we adopted the super-population or 'model-based' approach to statistical analysis.

Our decision to use the super-population or model-based approach to statistical analysis was consistent with that of five research studies which had been published at the time of our deliberations, in which *all* persons deployed to the Gulf were included in the study, together with a substantial fraction of the total number of eligible but non-deployed veterans (Gray *et al.* 1996; Kang & Bullman 1996; Cowan *et al.* 1997; Goss Gilroy Inc. 1998; Macfarlane *et al.* 2000). This is considered further later in this paper when we discuss our study findings. Our approach has not been raised as a methodological criticism in any of the papers we have subsequently submitted for publication.

4. THE AUSTRALIAN GULF WAR VETERANS' HEALTH STUDY

It was decided to undertake a study of the entire cohort of 1871 Australian veterans (predominantly naval) who served in the Gulf region during the period 2 August 1990 to 4 September 1991 rather than a sample of these veterans to ensure that the maximum statistical power was obtained. It was also decided to collect data by both postal questionnaire and by a comprehensive face-to-face medical assessment. Although this latter aspect added to the expense and resource requirements of the study and the time commitment for participants, it was considered to be important to build on what was known from overseas studies and help overcome criticisms of much of the previous Gulf War literature, much of which had relied on self-report through postal questionnaires.

The Australian Gulf War Veterans' Health Study came considerably later than the main cross-sectional studies of US, UK, Canadian and Danish veterans (The Iowa Persian Gulf Study Group 1997; Goss Gilroy Inc. 1998; Ishøy *et al.* 1999; Unwin *et al.* 1999; Kang *et al.* 2000; Cherry *et al.* 2001a,b), but around the same time as a study of French veterans (Salamon 2004). Our study was conducted from August 2000 to April 2002, around 10 years after the Gulf War itself.

Like overseas studies, we looked to compare the health of Gulf War veterans with that of a military comparison group. This group of 2924 individuals was randomly selected from 26 411 ADF personnel who were in operational units at the time of the Gulf War but who did not deploy to that conflict, and frequency matched by service type, gender and 3-year age bands. The use of an operationally ready comparison group helped to overcome any possible 'healthy warrior' effect whereby deployed veterans may be healthier than service personnel who are not deployed (Haley 1998).

As other research groups have found (Unwin *et al.* 1999; Kang *et al.* 2000), our ability to make contact with individuals was the key to recruitment and participation. Typically, however, in previous Gulf War veteran research, participation rates in the comparison groups have been low, rendering the results of these studies vulnerable to participation bias. With a rigorous and sustained contact and recruitment

strategy applied equally to both groups, we achieved an 80.5% participation rate in Gulf War veterans, although only a 56.8% participation rate in comparison group subjects. This highlighted the difficulties faced by researchers in contacting and recruiting young, highly mobile, mainly male, military and ex-military populations, particularly in comparison groups. This probably also reflected an apparent lack of incentive for non-Gulf War comparison group members to participate in Gulf War veteran health research, who may not have appreciated the broader relevance of this research to military populations.

In anticipation of a possible disparity in participation rates between the groups, we collected some brief demographic and Short Form 12 (SF-12) Health Survey (Ware *et al.* 1998) data from non-participants via a telephone-administered questionnaire. This enabled us to investigate possible participation bias in our study, and although only about one-quarter of non-participants supplied these additional data, we had demographic and rank data on all non-participants. Study participants who completed the postal questionnaire also completed the SF-12 in that instrument. To summarize, a prediction model was used to impute SF-12 scores for all non-participants by using the relationship observed between SF-12 scores and study group, age, rank, service type and serving status in those non-participants who completed the telephone questionnaire. Then by using the relationship observed between the SF-12 scores of participants, the above demographic variables and defined health outcomes, it was possible to impute health outcome results for all non-participants.

This procedure, replicated 100 times, was applied to several of the major health outcomes under study: self-reported fatigue in the past month, having any neurological symptoms in the past month, doctor diagnosed conditions of asthma, back/neck problems, and post-traumatic stress disorder (PTSD) and Computerized International Diagnostic Interview (CIDI)-defined psychological conditions (World Health Organization 1997). Each time we computed an age-, rank-, and service-adjusted odds ratio for the relative health of Gulf War veterans versus those in the comparison group, as if the study had achieved full participation. In all cases, the predicted 'full-participation' age-, rank-, and service-adjusted odds ratios of difference in the prevalence between veterans and the comparison group was only marginally lower than the corresponding odds ratio observed for participants. In addition, we used a second method based on grouped (not individual) data. In summary, this method hypothesized the extent (via the prevalence) of ill-health among non-participants within each age category of the Gulf War and comparison groups. These hypothesized prevalences were then applied in order to obtain an overall age-adjusted odds ratio as if there had been complete participation from the outset. The findings of this analysis increased our confidence that participation bias is unlikely to explain the differences (or lack thereof) that we found between study groups.

Factors that may have contributed to a very high response rate in Gulf War veterans included cohesion in the relatively small Australian Gulf War veteran

community, which may not be the case in other countries where the numbers of veterans is much larger. In addition, a veterans' Consultative Forum, which represented and consulted with over 10 veteran community groups, met regularly with the study team and with representatives of the Department of Veterans' Affairs (DVA) and the Department of Defence, which in turn fed back information to its constituent members. The Consultative Forum process added greatly to the credibility of the study and ensured that it addressed the concerns of the veteran community itself. This built confidence in the conduct of the study, gave the veteran community a degree of ownership and kept veteran groups informed on study progress and findings. In turn, this strengthened a shift towards a greater acceptance of mental health problems in the veteran and defence communities, which involved quite a large cultural change.

A Scientific Advisory Committee, comprising an epidemiologist, biostatistician, Commanding Officer of the First Task Group Medical Support Element during the Gulf War, psychiatrist and an infectious diseases physician, met regularly with study investigators and DVA and Department of Defence representatives. This committee provided independent advice on the development, conduct and analysis of the study and their involvement contributed further to the credibility of the study within the veteran and military communities.

As well as being asked to complete a lengthy postal questionnaire, which contained several standardized questionnaires, participants were asked to attend one of 10 medical clinics around Australia to undertake a comprehensive face-to-face health assessment by teams comprising a doctor, nurse and psychologist. This was a considerable advancement on much of the published research at the time. This assessment included anthropometric measurements, tests of lung function, skin testing for atopy, a fitness step test, a full physical examination, questionnaires relating to respiratory health and chronic fatigue, an interviewer administered psychological assessment using the CIDI, and several blood tests. The specific laboratory investigations included those for serious inflammation or significant haematological, liver or renal disease, including erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), complete blood examination (CBE), liver function tests (LFT), renal function tests (urea, creatinine and electrolytes); as well as commoner infective causes for chronic health problems (Epstein-Barr virus antibody test (EBV IgG), cytomegalovirus antibody test (CMV IgG) and hepatitis C core antibody serology). Study participants were provided with an individual medical report of their own results, which again helped to promote credibility and acceptance of the study.

To standardize pathology testing and to eliminate inter-laboratory error in this national study, a single pathology laboratory in Adelaide, South Australia undertook all the laboratory analyses. Quality control was a critical consideration, and for the 2810 participants who had laboratory investigations there was a very low proportion of missing values for all tests: urea, creatinine and electrolytes (0.2%), LFTs (0.1%),

CRP (0.0%), random plasma glucose (0.6%), serology tests (all 0.1%), CBE (1.6%) and ESR (2.4%). The slightly higher proportions of missing values for CBE and ESR were attributed to the inherent sensitivity of these tests to handling procedures, and the time between blood collection and analysis. This demonstrated that such laboratory investigations are feasible in this type of study.

(a) *Study results*

Some of our findings were confirmatory of findings of previous overseas studies and the implications of this are worth discussing. For example, we found a pattern of increased self-reporting of all recent general health symptoms, which was remarkably consistent with the pattern found in the UK study (Unwin *et al.* 1999), from which we had used the same symptom questionnaire (Kelsall *et al.* 2004a). Not only were *all* symptoms reported more commonly, but the most commonly reported symptoms and their order in each of our groups were almost exactly the same as in the UK study (figure 1). The main difference in the patterns between the two studies was in the degree of difference between the symptoms reporting of the two groups, which was less in the Australian study. This was because our comparison group rates were higher than the UK era rates, not because our Gulf War veteran rates were lower than those in UK Gulf War veterans.

In addition, our factor analysis of self-reported symptoms did not display evidence of a pattern of symptoms among Gulf War veterans different from that in the comparison group, even though prevalences were uniformly higher in the Gulf War group (Forbes *et al.* 2004). This was consistent with all but one of the previous factor analyses.

When we looked at symptom reporting and objective health measures for particular bodily systems, we found a consistent pattern of increased symptom reporting with no difference in objective health measures between the groups. For example, although the Australian Gulf War veterans had increased reporting of self-reported respiratory symptoms, as well as self-reported asthma and bronchitis, this did not result in poorer lung function (Kelsall *et al.* 2004b). Similarly, in our assessment of neurological health, we found increased reporting of neurological type symptoms in Gulf War veterans, but no evidence for increased neurological effects based on objective physical signs through a neurological examination (Kelsall *et al.* 2005).

In keeping with the general finding of increased symptom reporting, but no objective abnormalities, we found that the laboratory investigation results were all very similar in Gulf War veterans and the comparison group. For example, Gulf War veterans did not have significantly more anaemia or inflammation, or more serological test results that are indicative of prior exposure to viral infections with EBV, CMV or hepatitis C than the comparison group. Gulf War veterans had a greater proportion of results that may indicate renal impairment, but the numbers were small and needed to be interpreted with caution. Gulf War veterans had a slightly greater proportion of combinations of liver enzymes that may be indicative of liver disease than the comparison group, but the differences were not

Figure 1. Pattern of self-reported symptoms in the past month by Gulf War deployment status in (a) Australian and (b) United Kingdom troops (Unwin *et al.* 1999; Kelsall *et al.* 2004a). (b) is reprinted from Unwin, C. *et al.* 1999 Health of UK servicemen who served in Persian Gulf War. *Lancet* 353, 169–178, © 1999, with permission from Elsevier.

statistically significant. This may be explained by the finding of increased substance abuse in the Gulf War group (Ikin *et al.* 2004).

We found one exception to this pattern of increased symptoms with no difference in objective measures in our assessment of fatigue in the study groups. Fatigue is one of the most common and troublesome symptoms reported by Gulf War veterans, being reported by up to 50% of overseas and 66% of Australian Gulf War veterans and more commonly than by non-Gulf comparison groups (Unwin *et al.* 1999; Kang *et al.* 2000; Cherry *et al.* 2001b; Kelsall *et al.* 2004a). More Australian Gulf War veterans had fatigue at all levels: extreme tiredness or fatigue in the last month, prolonged fatigue ($\geq$ one month), chronic fatigue ($\geq$ six months), medically unexplained chronic fatigue and chronic fatigue syndrome (CFS). The odds ratios increased with increasing refinement and the inclusion of objective clinical evaluation of the nature of the fatigue according to established 1994 CFS case definition criteria (Fukuda *et al.* 1994).

The strongest and most consistent findings in our study, using objective assessment, related to the psychological health of veterans. Prevalences of *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition (DSM-IV) psychological disorders were measured using the interviewer-administered and computer-assisted version of the CIDI (World Health Organization 1997), carried out face-to-face by psychologists trained in its administration. Gulf War

veterans were at greater risk of developing post-Gulf War anxiety disorders including PTSD, affective and substance use disorders—and the prevalence of such disorders remained elevated a decade after deployment (Ikin *et al.* 2004). Further psychological assessment of Australian veterans using self-administered standardized questionnaires supported this finding of increased psychological ill-health. This included poorer current (past month) psychological ill-health, as measured using the 12-item General Health Questionnaire (GHQ-12) (Goldberg & Williams 1988) and the PTSD Checklist-Specific (PCL-5) (Weathers *et al.* 1993), as well as lower mental but not physical health status, as measured by the SF-12, which was worse in Gulf War veterans than the comparison group (McKenzie *et al.* 2004).

When we examined the psychological stressors reported by Australian Navy Gulf War veterans in relation to the Gulf War and other military service, assessed using a 44-item self-administered Military Service Experiences questionnaire (Ikin *et al.* 2004, 2005), we found that Australian Navy Gulf War veterans reported few direct-combat encounters during the Gulf War. However, they reported many other stressful experiences, including fear of death and perceived threat of attack, more frequently in relation to the Gulf War than other military service (Ikin *et al.* 2005). In further analyses, we also identified chemical and environmental exposures specifically associated with the 1991 Gulf War. Six of 28 investigated

exposures were experienced more frequently during the Gulf War than during other deployments (Glass *et al. in press*). This is expanded further in our paper on Gulf War exposures in this edition.

Increased reporting of multiple symptoms by Gulf War veterans has been a consistent finding across all Gulf War veteran health studies, including our own, and this consistent pattern of overall elevation is likely to be a more significant finding than increases in the specific symptoms themselves. Given the differences in the types of veterans and their Gulf War experiences and exposures between the UK and Australian veterans, and the different length of follow-up, the finding of a consistent pattern of lower prevalence tends to suggest that this symptom reporting pattern is a characteristic of military service, which seems to have been amplified across the board by service in the Gulf, rather than being an indication of specific pathology.

This conclusion is strengthened by the finding of few differences when the health of Gulf War veterans and comparison group members was compared across several health outcomes using more objective measures of health as described above, with the exceptions being in relation to chronic fatigue and psychological health outcomes.

Throughout our study, we employed a model-based mode of statistical inference (Nordberg 1989) in which the interest centred on describing the (unknown) relationship between measures of current health status and deployment to the Gulf War, service type, age, rank, other background characteristics and relevant exposures. These relationships were expressed by probability models, with the particular health outcomes of individuals randomly sampled for inclusion in this study assumed to be a stochastic (i.e. random) realization from these probability models. As all factors involved in the stratified sampling scheme (i.e. service type, age, rank and gender) were incorporated into the probability models, unweighted methods of estimation were used throughout.

Some authors choose an alternative mode of statistical inference in which health outcomes of all individuals are regarded as deterministic rather than stochastic. The only source of uncertainty in observed relationships between current health status and deployment and other factors is regarded as arising from the taking of a random sample as opposed to a complete census of the entire military population eligible for deployment at the time of the Gulf War. In this sense, the population of persons eligible for Gulf War deployment represents a fixed and finite population.

A series of statistical analyses using this 'finite population' approach was conducted in our study for the analysis of self-reported health symptoms, medical conditions and psychological diagnoses. These analyses incorporated sampling weights, stratification and finite population correction factors. The resulting odds ratios were generally within 5–10% of the unweighted odds ratios presented in our results, with 95% confidence intervals generally 5–10% narrower than their unweighted counterparts. The rather small gains in precision that arose were due to the expected gain in precision from the use of finite population correction factors being offset by the inefficiency of a large

variation in sampling weights, particularly for the Army and Air Force comparison group sampled subjects.

5. CONTRIBUTION OF THE AUSTRALIAN STUDY TO THE UNDERSTANDING OF GULF WAR ILLNESS

So, how has this study added to the body of literature and our understanding about Gulf War illness? We believe that this has occurred on several fronts. Firstly, it has highlighted some important consistencies with several of the overseas findings, especially in relation to patterns of symptom reporting, despite a clearly different Gulf War experience by the ADF personnel. This suggests a general 'Gulf War effect' rather than an effect related to a specific Gulf War exposure.

Secondly, our consistent finding of minimal differences in objective health measures despite increased symptom reporting related to several body systems is an important finding, which could not be investigated in those previous studies which relied solely on self-report. Thirdly, we developed several methodological measures that helped to exclude important sources of bias, such as participation bias and inappropriate control selection, which had been the criticisms of previous Gulf War research. We hope that this methodology will be useful to include in future veteran health studies.

In addition, our regular involvement of the veteran community through a Consultative Forum has ensured that the findings of the study have gained acceptance among the veterans themselves. That there has been some reassurance to the veteran community provided by our study is of particular importance. For some, anecdotal evidence has suggested that participating in the study process and receiving written feedback on their individual health measures has helped them move forward in their lives.

Our findings have also helped to shift the debate in Australia away from a focus on specific medical, chemical or environmental exposures in relation to veterans' physical health towards a greater acceptance of mental health issues in the ADF. Our Government's response to and progress in implementing our study's recommendations is publicly available and we quote '...There is a far greater understanding and acceptance within the ADF that conflict results in adverse psychological outcomes and that deliberate effort is required to prevent and minimize this. In August 2003, ADF Health Bulletins were issued detailing the ADF policy for mental health support to operationally deployed forces and for the management of personnel involved in 'critical incidents' or 'potentially traumatizing events.'...' (Australian Government Department of Veterans' Affairs 2003). In addition, a commitment has been given to undertake health reviews of all future deployments involving ADF personnel.

There are also further ways that smaller deployments can contribute to the Gulf War research effort, including international collaborations and pooling of data for research questions of broad interest. Possible areas of collaboration include the study of less common outcomes or further study of smallish Gulf War

subgroups, e.g. the Australian Operation Habitat personnel pooled with overseas groups that may have been in Kurdistan; agreement on an approach to follow-up studies and standardization of health outcome and exposure assessment methodology; a comparison of 'in-country' factors that may influence health outcomes or development of Gulf War illnesses; and possible agreement and consistency on a definition of multi-symptom illness or multiple symptom reporting.

Since our initial round of analyses of the Australian Gulf War Veterans' Health Study, we have undertaken further analyses of other aspects of military service, as this dataset has proven to be a very useful resource to investigate a wide range of health topics in military personnel. One example is our finding that onset of a psychiatric disorder during military service is related to a greater risk of separation overall, and that the greatest risk of separation occurs within the year following symptom onset (Creamer *et al.* in press).

So, in summary, our view from Australia is that Gulf War service has had an adverse impact on the psychological health of Australian Gulf War veterans and that this study has brought about a greater understanding of this problem which should assist in developing measures to minimize its impact in future war deployments. We do not believe that just applying the findings of overseas studies would have had the same significance or impact on bringing about this cultural change. Therefore, we believe that studies of small deployments can serve a very useful purpose and contribute to a greater understanding of health issues of Gulf War and other war veterans.

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