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McKenzie, D. P.; Ikin, J. F.; McFarlane, Alexander Cowell; Creamer, Mark C.; Forbes, A. B.; Kelsall, H. L.; Glass, Deborah C.; Ittak, P.; Sim, Malcolm R.

[Psychological health of Australian veterans of the 1991 Gulf War: an assessment using the SF-12, GHQ-12 and PCL-S](#), Psychological Medicine, 2004; 34 (8):1419-1430.

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6th May 2011

<http://hdl.handle.net/2440/6592>

Psychological health of Australian veterans of the 1991 Gulf War: an assessment using the SF-12, GHQ-12 and PCL-S

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ABSTRACT

Background. Elevated rates of psychological morbidity and symptomatology have been widely reported in 1991 Gulf War veterans. The present study used brief self-report instruments to compare the psychological health of Australian Gulf War veterans with that of a randomly sampled military comparison group.

Method. The 12-item Short Form Health Survey (SF-12), 12-item General Health Questionnaire (GHQ-12), Posttraumatic Stress Disorder Checklist – Specific (PCL-S) and Military Service Experience (MSE) questionnaire were administered to 1424 male Australian Gulf War veterans and 1548 male Australian Defence Force members who were operational at the time of the Gulf War conflict, but were not deployed there.

Results. The Gulf War veterans exhibited poorer psychological health, as measured by the above three instruments, than the comparison group members. For Gulf War veterans, the number of stressful experiences, as measured by the MSE questionnaire, was correlated with scores on the three instruments. SF-12 mental health component summary scores and PCL-S caseness, but not GHQ-12 caseness, differed significantly between Gulf War veterans and comparison group members who had been on at least one active deployment.

Conclusions. More than a decade after the 1991 Gulf War, Australian Gulf War veterans are exhibiting higher levels of current (past month) psychological ill-health, as measured using the GHQ-12 and PCL-S, as well as lower mental health status, as measured by the SF-12, than the comparison group. Although not a replacement for formal psychiatric diagnosis, instruments such as those above may aid in the assessment of veterans' psychological health.

INTRODUCTION

There has recently been a new war in Iraq, involving military forces from the United States, United Kingdom, Australia and other countries. Unfortunately, tensions in the Gulf (sometimes known as the Persian Gulf) region are likely to

remain. In order to best care for those forces returning from that region, and to improve preparation for future deployments, the long-term effects of the 1991 Gulf War on the health of veterans must be better understood.

Many studies have examined the psychological and physical health of Gulf War veterans. Indeed, in a recent editorial appearing in this journal, Hyams & Scott (2002) suggested that these veterans form one of the most highly studied adult populations. Increased numbers

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of psychiatric diagnoses, and or symptoms of substance misuse, anxiety, depression and post-traumatic stress disorder (PTSD), and non-specific psychological symptoms such as agitation and concentration difficulties, have been found in Gulf War veterans from Canada (Goss Gilroy Inc., 1998), Denmark (Ishoy *et al.* 1999), the UK (Unwin *et al.* 1999) and the USA (Iowa Persian Gulf Study Group, 1997; Joseph *et al.* 1997; Kang *et al.* 2003). A systematic review of published studies has been provided by Stimpson *et al.* (2003).

The psychological and physical health of Australian Gulf War veterans has not previously been objectively and comprehensively analysed. As part of the recent Australian Gulf War Veteran's Health Study, Ikin *et al.* (2004) compared DSM-IV (APA, 1994) diagnoses in Australian Gulf War veterans with those of a randomly sampled military comparison group. Diagnoses were made using the computerized version of the Composite International Diagnostic Interview (CIDI) (Robins *et al.* 1988; WHO Collaborating Centre for Mental Health and Substance Abuse, 1997).

Ikin *et al.* (2004) found that the two groups exhibited similar diagnostic patterns for the period prior to the Gulf War. The Gulf War veterans, however, were more likely than the comparison group to have met criteria for psychiatric diagnosis at some point since the Gulf War, as well as during the 12 months prior to CIDI administration (study conducted during 2000–2002). Commonly occurring diagnoses included PTSD, major depression and substance abuse.

Diagnostic systems such as the CIDI require administration by trained personnel and may be time-consuming when employed with large groups, with the average time to complete the computerized version reported to be around 75 minutes (WHO Collaborating Centre for Mental Health and Substance Abuse, 1997). The administration of such comprehensive systems might, therefore, be usefully supplemented by brief, self-report instruments. In addition, more detailed knowledge about the performance of such instruments in military populations is important to ensure their adequacy in the assessment of returning veterans.

The present study seeks to extend the findings of Ikin *et al.* (2004) by using brief self-report

instruments to compare the psychological health of the Australian 1991 Gulf War veterans and the randomly sampled comparison group. These instruments consisted of the 12-item version of the Short Form Health Survey (SF-12; Ware *et al.* 1998), the 12-item version of the General Health Questionnaire (GHQ-12; Goldberg & Williams, 1988), and the Posttraumatic Stress Disorder Checklist – Specific (PCL-S; Weathers *et al.* 1993).

Stressful events, including fear of death and feelings of helplessness, are associated with increased rates of PTSD (Adler *et al.* 1996). The current study, therefore, used the Military Service Experience (MSE) questionnaire, specifically developed by Ikin *et al.* (2004), to examine the psychological stressors experienced by Australian Gulf War veterans. Finally, in order to determine whether increased psychological ill-health in Gulf War veterans is a result of deployment to war itself rather than something specific to a particular war, we compared the GHQ and PCL-S caseness of Gulf War veterans with that of comparison group members who had been on at least one active deployment.

Three major questions will be investigated in the present paper: (1) do Australian Gulf War veterans have lower scores (indicating poorer health) on the SF-12 and exhibit more GHQ-12 and PCL-S caseness than the comparison group; (2) is poor psychological health in Gulf War veterans related to the number of psychological stressors experienced during their Gulf War deployment, as measured using the MSE questionnaire, and (3) will differences in caseness also be apparent between Gulf War veterans and those comparison group members who have been actively deployed?

METHOD

Subjects

The Australian Gulf War veteran population consisted of 1833 males and 38 females who served in the Gulf region from 2 August 1990, the date of the invasion of Kuwait by Iraqi forces, to 4 September 1991, the end date of the Australian Department of Veterans' Affairs Nominal Roll for the Gulf War. Most (1579, 84.4%) of the 1871 personnel that deployed to the Gulf were in the Navy. The comparison

group of 2850 males and 74 females was randomly selected from 26411 Australian Defence Force personnel who were in operational units during the above time period, but did not deploy to the Gulf War conflict. The veteran and comparison groups were matched on sex, branch of service (Navy, Army, Air Force) and 3-year age band.

Due to the small number of female Gulf War veterans, analyses were limited to males. The participating Gulf War veteran study group consisted of 1424 males [1232 (86.5%) in the Royal Australian Navy, 87 (6.1%) in the Australian Army and 105 (7.4%) in the Royal Australian Air Force]. The participating comparison study group consisted of 1548 males. The combined male and female participation rates, for the Gulf War veterans and the comparison group members (80.5% and 56.8% respectively, not including persons deceased, or overseas during the study) were comparable to those reported in the review by Stimpson *et al.* (2003). The average age at time of study, of the Gulf War veteran and comparison groups respectively, was 38.1 years (s.d. = 6.4) and 39.3 years (s.d. = 6.4). Further details of the recruitment, and demographic characteristics of the groups, are provided by Ikin *et al.* (2004).

Instruments

Subjects completed the SF-12, GHQ-12, PCL-S and MSE as part of a comprehensive postal questionnaire.

Short-Form-12 Health Survey (SF-12)

The SF-12 (Ware *et al.* 1998) is a subset of, and has comparable validity to, the SF-36 (Ware *et al.* 1993), a widely employed measure of health status and health-related quality of life. Although no previous Gulf War studies appear to have employed the SF-12, several studies (e.g. Iowa Persian Gulf Study Group, 1997; Voelker *et al.* 2002) have used the SF-36.

The SF-12 has been validated internationally (Gandek *et al.* 1998; Sanderson & Andrews, 2002) and has been used in a variety of studies (e.g. Australian Bureau of Statistics, 1998; Herrman *et al.* 2002). The instrument has two summary scales, the 'Physical Component Summary' (PCS-12), an index of physical health and well-being, and the 'Mental Component

Summary' (MCS-12), an index of mental health and well-being (Ware *et al.* 1998). Both summary scales have the same items but are weighted differently. In both cases lower scores represent poorer health.

Twelve-item General Health Questionnaire (GHQ-12)

The GHQ, available in various lengths, is one of the most widely used self-report screening tests for non-psychotic psychological illness (Goldberg & Williams, 1988). The GHQ-12 has been shown to have high validity (Clarke *et al.* 1993; Goldberg *et al.* 1997; Donath, 2001) and has been used in a variety of general (Australian Bureau of Statistics, 1998; Pevalin & Goldberg, 2003), and military (Schei, 1994; Goyne, 2001) applications.

We employed the standard, or binary, method of scoring. In regard to choice of caseness threshold or cut-off score, previous Gulf War studies (Unwin *et al.* 1999) using the GHQ-12 have solely involved UK veterans and employed a fixed cut-off of three or more symptoms. There is strong evidence, however, that optimal GHQ cut-off scores vary geographically (Goldberg *et al.* 1997, 1998). Donath (2001) found the optimal cut-off for the general Australian population to be one or more symptoms. As Goyne (2001) has suggested that the optimal cut-off for Australian Defence Force members may be different to that of the general population we determined the optimal cut-off empirically, as described below.

Posttraumatic Stress Disorder Checklist – Specific (PCL-S)

The PCL (Weathers *et al.* 1993) is a self-report rating scale for assessing the 17 DSM-IV symptoms of PTSD.

Validation of the PCL has been carried out by Blanchard *et al.* (1996), Forbes *et al.* (2001) and Weathers *et al.* (1993). The instrument has been used in general psychiatric (Sampson *et al.* 2003), as well as military (Weathers *et al.* 1993; Barrett *et al.* 2002; Sutker *et al.* 2002) research.

We made a slight modification to the specific event version of the PCL (PCL-S). The stem question, originally reading: 'Please consider the event that you found most stressful or upsetting ...', was changed to 'Please consider the

event or group of events, military or non-military, in your life that you found most stressful or upsetting ...'. This change was implemented because PTSD may have been precipitated by a group of related events. As our study had a military focus, participants may otherwise have felt obliged to nominate stressful military, rather than non-military, events.

A PCL cut-off of 50 was originally recommended by Weathers *et al.* (1993), and was recently employed with US Gulf War veterans by Barrett *et al.* (2002). In a study of Australian Vietnam War veterans, Forbes *et al.* (2001) found little difference in screening and diagnostic performance between three cut-offs (45, 50, 55) and suggested that the originally recommended cut-off was suitable for use with Australian veterans. This threshold has, therefore, been adopted in the present study.

Military Service Experience (MSE) questionnaire

Psychological stressors were assessed using the MSE questionnaire (Ikin *et al.* 2004). This questionnaire consists of 44 items, each describing a potentially stressful experience for Australian Gulf War veterans, such as boarding hostile ships at sea, fear of entrapment below the waterline as a result of missile attack or collision with sea-mine, or threat of chemical or biological attack. The instrument was derived from various sources, including the Combat Exposure Scale (Keane *et al.* 1989), and findings from an Australian Gulf War veteran focus group. The MSE questionnaire was scored by summing the 44 binary-coded items.

Statistical analyses

For GHQ-12 and PCL-S caseness, odds ratios were first calculated using study group status only (crude odds ratios), and again after adjusting for possible confounding factors (adjusted odds ratios), using logistic regression. The possible confounding factors consisted of age as at 2 August, 1990 (<20, 20–24, 25–34, ≥35 years), branch of service, highest education level (≤10, 11 or 12 years of schooling, certificate or diploma, tertiary), marital status (married/*de facto*; separated, divorced or widowed; single/never married) and military rank. Rank was categorized as other rank –

non-supervisory, other rank – supervisory (at or above the rank of Leading Seaman in the Navy or Corporal in the Army and Air Force) and officer. Rank categories are comparable to the categories employed by Ismail *et al.* (2000).

If the number of subjects exhibiting caseness, in either study group, was small (arbitrarily but conventionally defined as being five or less), exact logistic regression (Mehta & Patel, 1995) was performed using LogXact 4 (Cytel Software Corporation, 2000).

Differences in mean SF-12 summary scores were obtained using multiple regression, before and after adjusting for possible confounding factors. In order to determine the optimal GHQ-12 threshold for our data, non-parametric (Hanley & McNeil, 1982) Receiver Operating Characteristic (ROC) analysis (Kraemer, 1992) was applied to the Gulf War veterans and comparison group combined. The criterion diagnosis was defined as the presence of any DSM-IV diagnosis, excluding current substance use disorder, alcohol use disorder and specific phobia, within the previous 4 weeks. These three diagnoses were excluded because it would not be expected that they would be detected by the GHQ and so should not be included in an assessment of its specificity and sensitivity. Substance abuse (including alcohol) in the CIDI is diagnosed on the basis of the quantity and regularity of consumption, no specific symptoms of distress being required to satisfy the diagnosis. Simple phobia is defined by the avoidance of a specific object or situation, with no anxiety or distress present if the individual is not confronted by the phobic stimulus. Again, this avoidance is not screened by the GHQ. All diagnoses were made using the computerized CIDI administered by psychologists, as described by Ikin *et al.* (2004). Confidence intervals (CI) for sensitivity, specificity and diagnostic efficiency (Kraemer, 1992) were calculated using the procedure described by McKenzie *et al.* (1997), and implemented by Mackinnon (2000).

The values of the crude, and the adjusted, odds ratios and differences between means were found to be highly similar, and so only the adjusted results are reported. Unless specified otherwise, all statistical analyses were carried out using the Stata 7 package (StataCorp, 2001).

Table 1. Mean SF-12 mental component (MCS-12) and physical component (PCS-12) summary scores: the effects of study group across subgroups of age and rank

	Gulf War veterans (<i>n</i> = 1374) Mean (s.d.)	Comparison group (<i>n</i> = 1513) Mean (s.d.)	Adj. difference* (95% CI)	<i>p</i> value
MCS-12				
All subjects	47.4 (11.2)	50.9 (9.5)	-3.4 (-4.2 to -2.6)	<0.001
Age (years)				
<20	45.0 (11.5)	51.9 (8.7)	-7.1 (-9.5 to -4.8)	0.001†
20-24	47.9 (11.5)	51.1 (9.3)	-3.9 (-5.4 to -2.5)	
25-35	48.0 (10.8)	50.8 (9.4)	-2.7 (-3.8 to -1.7)	
35+	48.8 (11.3)	50.2 (10.3)	-1.9 (-3.9 to 0.1)	
Rank				
Officer	49.3 (9.8)	51.7 (8.9)	-2.5 (-4.1 to -0.9)	0.009†
Other rank - supervisory	47.8 (11.2)	50.3 (9.8)	-2.6 (-3.7 to -1.5)	
Other rank - non-supervisory	45.9 (11.8)	51.1 (9.5)	-5.3 (-6.6 to -3.9)	
PCS-12				
All subjects	49.2 (9.2)	49.9 (9.0)	-0.9 (-1.6 to -0.2)	0.008
Age (years)				
<20	49.7 (9.8)	51.1 (8.1)	-1.4 (-3.5 to 0.6)	0.739†
20-24	49.8 (8.7)	51.0 (9.1)	-1.0 (-2.3 to 0.2)	
25-35	49.3 (8.9)	49.7 (8.7)	-0.4 (-1.4 to 0.5)	
35+	46.9 (10.6)	48.5 (9.8)	-1.8 (-3.6 to 0.0)	
Rank				
Officer	50.3 (8.8)	52.1 (8.0)	-1.6 (-3.0 to -0.2)	0.745†
Other rank - supervisory	49.1 (8.9)	48.7 (9.4)	-0.1 (-1.0 to 0.9)	
Other rank - non-supervisory	48.8 (9.8)	50.2 (8.9)	-1.7 (-2.9 to -0.5)	

* Differences between means are adjusted for service branch, rank, age category, education and marital status.

† *p* value for interaction.

RESULTS

SF-12

A total of 1374 (96.5%) of the 1424 Gulf War veterans in the study group, and 1513 (97.7%) of the 1548 comparison study group members fully completed the SF-12.

Table 1 shows the mean scores of the MCS-12 and the PCS-12 for the total study population and subgroups categorized by age and rank (due to the low numbers of Army and Air Force personnel, service branch subgroups were not compared). The Gulf War veterans had lower mean MCS-12 scores than the comparison group ($p < 0.001$), indicating poorer psychological health.

There was a statistically significant interaction ($p = 0.001$) between age group (linear trend) and study group. For the Gulf War veterans, MCS-12 means increased with age (slope = 0.81, indicating that the expected mean MCS-12 score increased by 0.81 with each increase in age category, 95% CI 0.07-1.54, $p = 0.032$), representing better mental health. The opposite relationship was observed for the comparison group (slope = -0.77, indicating that the

expected mean MCS-12 score decreased by 0.77 with each increase in age category, 95% CI -0.149 to -0.05, $p = 0.037$).

There was a statistically significant ($p = 0.009$) interaction between rank (assuming linear trend), and study group. In the case of the Gulf War veterans there was a statistically significant positive linear relationship between rank and mean MCS-12 score (slope = 1.84, 95% CI 0.90-2.77, $p < 0.001$), with the lower ranks having lower scores. This relationship was not observed in the comparison group ($p = 0.334$).

With regard to self-reported physical health, Gulf War veterans had a lower mean PCS-12 score than the comparison group ($p = 0.008$). There were no statistically significant interactions between study group and age category or rank. For both study groups, there was a negative linear relationship between age and mean PCS-12 scores (slope = -1.60, 95% CI -2.10 to -1.09, $p < 0.001$), with the higher age categories reporting poorer physical health. There was a positive linear relationship between rank and mean PCS-12 scores (slope = 1.51, 95% CI 0.86-2.16, $p < 0.001$), with the lower ranks reporting poorer physical health.

Table 2. *Twelve-item General Health Questionnaire (GHQ-12) and Posttraumatic Stress Disorder Checklist – Specific (PCL-S) caseness: the effects of study group across subgroups of age and rank*

	Gulf War veterans (<i>n</i> = 1422)		Comparison group (<i>n</i> = 1544)		Adj. OR†	95 % CI	<i>p</i> value
	<i>n</i>	(%)*	<i>n</i>	(%)*			
GHQ-12							
All subjects	564	(39.6)	502	(32.5)	1.4	1.2–1.6	<0.001
Age (years)							
<20	74	(42.8)	29	(22.8)	2.6	1.5–4.3	0.011‡
20–24	164	(40.6)	123	(31.3)	1.5	1.1–2.0	
25–34	267	(39.7)	266	(34.1)	1.3	1.0–1.6	
35+	59	(34.1)	84	(34.4)	1.1	0.7–1.6	
Rank							
Officer	94	(35.1)	117	(30.0)	1.3	0.9–1.8	0.088‡
Other rank – supervisory	267	(39.0)	260	(35.2)	1.2	1.0–1.5	
Other rank – non-supervisory	202	(43.2)	125	(30.0)	1.8	1.4–2.4	
PCL-S							
All subjects	105	(7.9)	66	(4.6)	2.0	1.5–2.9	<0.001
Age (years)							
<20	13	(7.9)	3	(2.6)	3.1§	0.8–17.7	0.121‡
20–24	31	(8.2)	14	(3.8)	2.2	1.1–4.3	
25–34	40	(6.4)	28	(3.8)	1.9	1.2–3.2	
35+	21	(12.5)	21	(9.0)	1.7	0.9–3.4	
Rank							
Officer	9	(3.6)	11	(3.0)	1.5	0.6–3.7	0.163‡
Other rank – supervisory	49	(7.6)	37	(5.3)	1.8	1.1–2.9	
Other rank – non-supervisory	47	(10.6)	18	(4.7)	2.9	1.6–5.2	

* Percentage of subjects within each subgroup of age or rank.

† Odds ratios are adjusted for service branch, rank, age category, education and marital status.

‡ *p* value for interaction.

§ This odds ratio is adjusted for service branch and rank only. Confidence interval (CI) for this adjusted odds ratio was obtained using exact logistic regression.

GHQ-12

A total of 1422 (99.9%) of the Gulf War veterans in the study group, and 1544 (99.7%) of the comparison study group members completed the GHQ-12.

In determining the optimal cut-off score for the GHQ-12, the prevalence of the criterion diagnosis defined earlier was observed to be 10%, for both study groups combined. ROC analysis found the optimal cut-off to be two or more symptoms, with a sensitivity of 72% (95% CI 66–77), specificity of 68% (95% CI 66–69), overall diagnostic efficiency of 68% (95% CI 66–70), and area under the ROC curve of 0.77 (95% CI 0.74–0.80).

Table 2 presents the prevalence of GHQ-12 cases, as defined above, for the study groups overall, and within subgroups of age and rank. Gulf War veterans were more likely than comparison group subjects to be suffering psychological distress or ill-health, as measured by the GHQ-12 ($p < 0.001$).

There was a statistically significant interaction ($p = 0.011$) between age and study group. The prevalence of GHQ caseness increased with age for the comparison group ($p = 0.034$), but decreased with age for the Gulf War veterans, the latter result not being statistically significant ($p = 0.338$). The interaction between study group and rank (assuming linear trend) narrowly failed to achieve statistical significance ($p = 0.088$).

PCL-S

A total of 1339 (94.0%) Gulf War veterans in the study group and 1452 (93.8%) comparison study group subjects completed the PCL-S.

Table 2 presents the prevalence of PCL-S cases for the study groups overall, and within subgroups of age and rank. Gulf War veterans were more likely than comparison group subjects to be suffering symptoms indicative of PTSD ($p < 0.001$).

Although there were no statistically significant interactions, power is lower than for the

Table 3. *The relationship between stressful Gulf War Military Service Experience (MSE) questionnaire score and SF-12 summary scores in Gulf War veterans*

	Mean	(s.d.)	Adj. diff.*	95% CI	p value
SF-12 mental component (MCS-12)					
MSE questionnaire score					
0-4	52.1	(8.4)	0.0	—	
5-8	49.8	(10.2)	-2.2	-3.7 to -0.6	
9-12	46.3	(10.8)	-5.5	-7.2 to -3.8	
>12	41.5	(12.0)	-10.0	-11.6 to -8.4	
Dose-response†	—	—	-0.7	-0.8 to -0.6	<0.001
SF-12 physical component (PCS-12)					
MSE questionnaire score					
0-4	51.9	(6.6)	0.0	—	
5-8	50.3	(8.3)	-1.8	-3.2 to -0.5	
9-12	49.4	(9.8)	-2.7	-4.1 to -1.3	
>12	45.6	(10.5)	-6.5	-7.9 to -5.1	
Dose-response†	—	—	-0.5	-0.54 to -0.37	<0.001

* Differences in means are adjusted for service branch, rank, age category, education and marital status.

† Dose-response slope is the expected increase in mean MCS-12 or PCS-12 score per unit increase in the MSE questionnaire score.

Table 4. *The relationship between Gulf War Military Service Experience (MSE) questionnaire score and GHQ-12 and PCL-S caseness in Gulf War veterans*

	n	(%)	Adj. OR*	95% CI	p value
GHQ-12 caseness					
MSE questionnaire score					
0-4 (n=320)	66	(21)	1.0	—	
5-8 (n=415)	128	(31)	1.7	1.2-2.5	
9-12 (n=316)	144	(46)	3.2	2.3-4.7	
>12 (n=369)	226	(61)	6.1	4.2-8.7	
Dose-response†	—	—	1.13	1.11-1.16	<0.001
PCL-S caseness					
MSE questionnaire score					
0-4 (n=320)	5	(2)	1.0‡	—	
5-8 (n=415)	12	(3)	2.0‡	0.6-7.3	
9-12 (n=316)	21	(7)	4.2‡	1.5-14.7	
>12 (n=369)	67	(19)	13.8‡	5.3-45.7	
Dose-response†	—	—	1.22	1.17-1.27	<0.001

* Odds ratios are adjusted for service branch, rank, age category, education and marital status using logistic regression.

† Dose-response slope is the expected proportionate increase in the odds ratio per unit increase in the MSE questionnaire score.

‡ These odds ratios are adjusted for service branch, rank and age (<25 v. ≥25 years) only. Confidence interval (CI) values for these adjusted odds ratios were obtained using exact logistic regression.

previous analyses due to the smaller number of observed cases. Tests for trend show that there were statistically significant relationships between age and PCL-S caseness [odds ratio (OR) 1.81, 95% CI 1.41-2.33, $p < 0.001$], and rank and PCL-S caseness (OR 0.46, 95% CI 0.32-0.66, $p < 0.001$) for both study groups.

PCL-S caseness was more prevalent in the older age groups, and in the lower ranks.

Effects of stressful military experiences

For Gulf War veterans only, Table 3 summarizes the relationship between scores on the

Gulf War service-related MSE questionnaire and SF-12 summary scales. Table 4 shows the relationship between MSE questionnaire scores and GHQ-12 and PCL-S caseness.

A lower MCS-12 score was associated with an increasing MSE questionnaire score. A similar result was obtained for the PCS-12, although the relationship was less marked. Perceived exposure to an increasing number of psychological stressors, as indicated by an increasing score on the MSE questionnaire, was significantly ($p < 0.001$) associated with increasing prevalence of both GHQ-12 and PCL-S caseness. The

expected increase in the odds of caseness, per unit increase in MSE questionnaire score, was 13% for the GHQ-12 and 22% for the PCL-S.

The effect of other deployments

Approximately one third of the comparison group ($n=514$) reported that they had been on at least one active deployment. Of these, 507 completed the SF-12, 513 completed the GHQ-12 and 488 completed the PCL-S. Mean MCS-12 scores were significantly lower in Gulf War veterans (mean = 47.4, s.d. = 11.2) than comparison group members who had active deployments (mean = 50.4, s.d. = 9.6) (adjusted difference between means = -2.5, 95% CI -3.6 to -1.4, $p < 0.001$). The difference between mean PCS-12 scores (mean = 49.2, s.d. = 9.2; *versus* mean = 49.5, s.d. = 9.3 respectively) for the above two groups was not statistically significant ($p = 0.501$).

PCL-S caseness remained significantly elevated (OR 1.9, 95% CI 1.1-3.1, $p = 0.015$) in Gulf War veterans (7.9%), compared to comparison group members with active deployments (4.5%). The difference in GHQ-12 caseness (39.6% *v.* 36.1%) between the above two groups was not statistically significant ($p = 0.370$).

The adjusted odds ratios given above are only slightly smaller than those obtained when Gulf War veterans were compared with all comparison group members. As expected, however, the confidence intervals are slightly wider than those previously presented, as a result of reduced sample sizes.

DISCUSSION

Our study found significantly lowered psychological health, as measured by the SF-12 mental health component summary scale (MCS-12), GHQ-12 and PCL-S, in Australian veterans of the 1991 Gulf War, compared with the military comparison group. This finding supports and extends that obtained for Australian Gulf War veterans by Ikin *et al.* (2004) using more comprehensive 12-month CIDI diagnoses. The veteran group exhibited high levels of current (past month) psychological ill-health, as measured using the GHQ-12 and PCL-S, and low levels of mental health status, as measured by the MCS-12, more than a decade after the end of the Gulf War. This has important

implications for veterans of the recent war in Iraq. The impact of traumatic events on long-term psychological health tends to be underestimated in both defence (McFarlane, 2003), and general (McFarlane, 2000*a*) populations. In addition to causing suffering and distress, psychological ill-health has adverse effects on cognitive processing, including target detection and reaction times (Clark *et al.* 2003; Farrin *et al.* 2003; Hammar *et al.* 2003), with major implications for the capability of those individuals who may be unwell, yet remain in the services.

We also found Australian Gulf War veterans to have lower physical health status, as measured by the SF-12 physical health component summary scale (PCS-12), than the comparison group members, although the difference in physical health was not as great as the difference in SF-12 mental health.

Younger Gulf War veterans, and older comparison group members, were more likely to exhibit psychological distress as measured by the GHQ-12. McCabe *et al.* (1996) observed that GHQ-12 scores increased with age in the general population. Goynes (2001) found GHQ-12 (Likert-scaled) scores to be lowest for the youngest Australian Army officers, although there was no age relationship for the non-officer group (corresponding to our other ranks - non-supervisory and other ranks - supervisory categories combined).

We found that PCL-S caseness increased with age, for both study groups. The group differences (Gulf War veterans having lower values) in MCS-12 scores decreased as age increased, although the reasons for this are unclear.

The group difference in MCS-12 scores (Gulf War veterans having lower values) was much larger for the lowest ranks. Our results further suggested that the group difference in GHQ-12 and PCL-S caseness was strongest for the lowest ranks, with the findings for the GHQ-12, but not the PCL-S, narrowly missing statistical significance ($p = 0.088$). Subjects in the lowest ranks typically recorded the highest levels of GHQ-12 and PCL-S caseness in both study groups. Goynes (2001) did not find any differences in GHQ-12 Likert scores between Australian soldiers and officers, but found differences within the officers. The highest-ranking officers had the highest scores (higher levels

of psychological distress), reflecting possible differences in age, experience, or level of responsibility.

Ismail *et al.* (2000) found an inverse relationship between rank and GHQ-12 caseness for UK Gulf War veterans (a comparison group was not used), with lower ranks exhibiting higher caseness. In addition, Ismail *et al.* (2000) found such a relationship between rank and PTSD, as measured using several items from the Mississippi Scale for Combat-Related Post-traumatic Stress Disorder (Keane *et al.* 1988), and suggested that rank could be a proxy for socio-economic status. The latter is associated with psychological morbidity in civilian populations (McCabe *et al.* 1996). We found, however, that the interaction between study group and rank for MCS-12 scores, as well as the overall inverse relationship between rank and GHQ-12 and PCL-S caseness within both study groups, persisted after adjustment for demographic and socio-economic variables including age, marital status and education.

We found strong relationships between increasing numbers of psychological stressors experienced during the Gulf War, as measured by the MSE questionnaire, and decreased psychological health. The link between perceived traumatic or stressful exposure and subsequent psychopathology needs to be interpreted cautiously (McFarlane, 2000*b*), particularly because the health problems and possible exposures of Gulf War veterans have been the subject of high media coverage (Wessely *et al.* 2003). It is reasonable to assume that such persistent reports of increased health risks would have a negative psychological impact. Further, as PTSD symptoms increase, memories of traumatic or stressful events may be affected (McNally, 2003). Amplification of such memories has been demonstrated in Gulf War veterans by Southwick *et al.* (1997) and King *et al.* (2000). Wessely *et al.* (2003) demonstrated, however, that changes in the recall of perceived exposures by Gulf War veterans were more associated with changes in the perception of health than with changes in the number of PTSD symptoms or the level of GHQ-12 caseness. Such findings question the validity of any retrospectively determined relationship between level of perceived exposure to trauma and degree of PTSD or other symptoms. The absence

of recall bias cannot be ruled out in our study. Veterans reporting poor psychological health potentially exhibited heightened recall of psychological stressors, as reflected in their MSE scores.

We found no statistically significant difference in GHQ-12 caseness between the Gulf War veterans and those members of the comparison group who had been on at least one active deployment, in contrast to Unwin *et al.* (1999) who found that UK Gulf War veterans had significantly higher levels of GHQ-12 caseness than Bosnia veterans. We did, however, find significant differences, in both PCL-S caseness and MCS-12 scores, between Gulf War veterans and members of the comparison group who had been on at least one active deployment.

The percentages of subjects currently (past month) with PTSD as measured by the self-administered PCL-S (7.9% for Gulf War veterans and 4.6% for the comparison group) were higher than the percentages diagnosed as having recent (12 month) PTSD (5.1% and 1.7% respectively) using the clinician-administered CIDI, reported by Ikin *et al.* (2004). Further analysis of these data indicates that the percentages obtained for past month PTSD diagnosis using the CIDI (4.6% and 1.3%) are similar to those obtained for past 12-month CIDI PTSD diagnoses, and remain lower than the percentages obtained using the PCL-S. The difference between the level of PCL-S caseness and the level of CIDI PTSD diagnosis is larger than expected, both instruments being based upon the DSM-IV diagnostic criteria for PTSD. Forbes *et al.* (2001) found, however, that Australian Vietnam veterans self-rated their PTSD symptoms as slightly more severe than the clinician ratings.

The differences in prevalence between the self-reported PCL-S and the more comprehensive CIDI PTSD diagnosis may reflect a similar over-reporting of symptom severity, differences between the two instruments in their application of the DSM-IV criteria, or simply that the cut-off score we employed may not be suitable for this population. These issues will form the basis of future research.

The use of brief instruments such as the ones applied here, may be problematic. Self-report can be misleading, especially in defence applications (Schei, 1994; Goyne, 2001). For

example, respondents may use questionnaires as an opportunity to express their dissatisfaction with military life. In a similar vein, questionnaires may exacerbate the effects of response style or frame (Anastasi & Urbina, 1997). As participants were aware of the study's purpose, they may have tended towards a response set of how Gulf veterans are 'expected' to appear. Regrettably, there is little that can be done to eliminate such biases in large survey designs of this kind. Finally, a search for optimal cut-off scores in screening tests, rather than optimal combinations of symptoms, may encourage a focus on the quantity, and not type, of symptoms present (Kraemer, 1992; Clarke & McKenzie, 1994).

Possible problems notwithstanding, more research is required into optimal thresholds for the PCL-S in different populations. Although it has been suggested that the GHQ-12 may lack face validity as a general measure of psychological stress for the Australian Defence Force (Chapman, 2001; Goynes, 2001), this should not preclude its use as a general measure of psychological health. The use of such a measure is important, as a focus on PTSD alone may miss other psychological disorders. Finally, the use of the SF-12 allows mental, as well as physical, health status to be assessed and compared.

CONCLUSIONS

Australian Gulf War veterans have slightly poorer physical health status, but markedly poorer mental health status, as measured by the SF-12, than members of the comparison group. Similarly, Gulf War veterans have higher levels of psychological ill-health, as measured by the GHQ-12 and PCL-S, than the comparison group. The results for the MCS-12 and PCL-S, but not the GHQ-12, persisted when the Gulf War veterans were compared with only those comparison group members who had been actively deployed. This suggests that there is something unique to the Gulf War experience.

Screening for psychiatric disorders, whether performed before or after stressful events, can be highly problematic (Wessely, 2003) and care must be taken not to extrapolate a need for widespread treatment from the current results. While self-report data should always be treated

cautiously, it is worth noting that our overall results bear out those found by Ikin *et al.* (2004) using the CID. Brief instruments such as the ones used in our study may aid in the assessment of the psychological health of current and future veterans.

ACKNOWLEDGEMENTS

The Australian Gulf War Veterans' Health Study was funded by the Australian Government – Department of Veterans' Affairs. The study was overseen by a Scientific Advisory Committee, headed by Professor Terry Dwyer, and by a veterans' Consultative Forum. We are grateful to members of both groups for their contribution and support. We gratefully acknowledge the contribution of Dr Keith Horsley, Dr Warren Harrex, Mr Bob Connolly and his contact and recruitment team at the Department of Veterans' Affairs, and the staff at Health Services Australia who conducted the medical and psychological assessments. We thank Dr Leigh Blizzard for his valuable statistical advice, and thank Associate Professor David Clarke for his incisive reading of this manuscript. Lastly, but most importantly, we sincerely and wholeheartedly thank the Gulf War veterans and comparison group members for their participation.

DECLARATION OF INTEREST

This research was funded by the Australian Government – Department of Veterans' Affairs. Professor A. C. McFarlane is Chair of the Mental Health Consultative Group to the Director General of the Health Service Branch of the Australian Defence Force. The Australian Centre for Posttraumatic Mental Health is partially funded by the Department of Veterans' Affairs.

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