Does Prior Psychological Health Influence Recall of Military Experiences? A Prospective Study

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In a prospective study, we evaluated pre- and postdeployment psychological health on recall of risk factors to assess recall bias. Measures of the General Health Questionnaire (GHQ), PTSD Checklist (PCL), and symptom clusters from the PCL were obtained from 681 UK military personnel along with information on traumatic and protective risk factors. Postdeployment psychological health was more important in explaining recall of traumatic experiences than predeployment psychological health. Predeployment intrusive cluster scores were highly associated with traumatic exposures. Postdeployment, but not predeployment GHQ showed small effects for most risk factors. With the exception of intrusive thoughts, there is insufficient evidence to suggest predeployment psychological status would be useful in correcting for recall bias in subsequent cross-sectional studies.

Most studies investigating the links between trauma and mental health, such as studies of civilian disasters, or the health of the armed forces after a dangerous deployment are compelled to use a cross-sectional design (Brewin, Andrews, & Valentine, 2000; Ozer, Best, Lipsy, & Weiss, 2003; Schnurr, Lunney, & Sengupta, 2004; Vogt & Tanner, 2007). Yet a major threat of cross-sectional studies is recall bias because there is a distinct possibility that current psychological symptoms can distort memories of exposures when completing a questionnaire. Those who are in good health may be more inclined to forget or downplay exposures whereas those who have a common mental health problem may ruminate or have flashbacks that prompt unpleasant memories of exposures more frequently (Hotopf & Wessely, 2005). Accordingly, significant associations in cross-sectional studies may be spurious, arising from differential reporting due to the mental health state of participants between the groups at the time of reporting.

Few studies have considered how psychological health may affect recall or the effect size of this possible distortion. Findings to date are disparate, and with few exceptions (King et al., 2000; Wessely et al., 2003) the majority are based on modest sample sizes (Bramsen, Dirkzwager, van Esch, & van der Ploeg, 2001; Dohrenwend et al., 2006; Roemer, Litz, Orsillo, Ehlich, & Friedman, 1998; Southwick, Morgan, Nicolaou, Andreas & Charney, 1997) or have focused on posttraumatic stress disorder (PTSD; Dohrenwend et al., 2006; Southwick et al.,1997). Among these studies, some have found recall of traumatic events to be consistent over time, and not affected by PTSD (Bramsen et al., 2001;

Dohrenwend et al., 2006), whereas others report an increase in recalled traumatic experiences associated with PTSD symptoms (King et al., 2000; Roemer et al., 1998; Southwick et al.,1997) and psychological distress (Bramsen et al., 2001), but not consistently so (Roemer et al., 1998; Southwick et al., 1997; Wessely et al., 2003). One study of UK Gulf war veterans found a relationship between current health perception and changes of endorsement of traumatic events, but only small associations between PTSD and changes of endorsement (Wessely et al., 2003).

Although these studies have made a move toward evaluating the role psychological status plays in recall of traumatic experiences, at least three concerns remain to be addressed. First, the nature of the experience could account for the conflicting findings. It could be argued that experiences that can be objectively corroborated such as "came under small arms fire" may be less prone to bias than more subjective experiences such as "thought that might be killed." Second, researchers focused on recall of combat-related experiences, which are largely unavoidable in military conflicts. Less studied is how psychological health can influence recall of possibly protective factors within the military experience such as unit cohesion, comradeship, and being informed of operational issues. Third, intrusive PCL symptoms may be more prone to recall bias than the numbing and avoidance symptoms because intrusive recollections may facilitate memories of traumatic events whereas numbing and avoidance may act as a barrier to the surfacing of unpleasant experiences (Ouimette, Read, & Brown, 2005).

Using data from a study in which psychological symptoms were collected before the onset of the Iraq war, and again up to 3 years after the start of the war, this study aims to assess whether information on predeployment measures of psychological health could reduce the potential for recall bias on postdeployment reported exposures and social support. We examine whether recall bias varies with the type of risk factor. We also assess whether the relationship varies according to the characteristics of symptoms reported, intrusive recollection or avoidance/numbing. Our study differs from other studies that have assessed recall bias in reporting exposure (Bramsen et al., 2001; Dohrenwend et al., 2006; King et al., 2000 Roemer et al., 1998; Southwick et al., 1997; Wessely et al., 2003) in so far as deployment experiences were obviously unavailable in the predeployment survey. An advantage of our study is that we have data on mental health before the military operation, which other studies exploring recall bias did not have. The rationale for this analysis was to asses whether a background of common mental health problems would be related to the report of exposures, which occurred after the baseline psychological assessment, and whether it decreases the association between postdeployment psychological health and reported experiences during deployment. It would be expected that postdeployment psychological symptoms would be more strongly associated with reported exposures during deployment than predeployment psychological symptoms. However, a measure of recall bias would be an association between predeployment psychological symptoms and reported exposures during deployment. This would be more compelling if the association persists after adjusting for postdeployment psychological symptoms. An additional issue is whether adjusting for predeployment mental health reduces the level of association between current mental health and reported exposures.

METHOD

Design and Participants

Participants were initially selected using multistage sampling (Rona, Jones, French, Hooper, & Wessely, 2004). This entailed the random selection of 100 units from the three services: Naval Services, Army, and Royal Air Force, and subsequently, the random selection of 45 individuals from each of these units to make 4,500 participants. The services were represented by their relative strengths at July 2001.

Two thousand eight-hundred twenty personnel from this triservice random sample completed the first part of the study in 2002, before preparations for the Iraq war (Rona et al., 2006). This involved the administration of either a full or an abridged version of a questionnaire designed to assess psychological health (see Measures subsection). The grounds for using two questionnaires is based on a prior objective of the baseline study, which was to inform on the acceptability of questionnaire length in an eventual screening

program for psychological symptoms of the British Armed Forces (Rona et al., 2004).

All individuals who had completed this first questionnaire, and for whom contact details were available, were invited to complete a second questionnaire. Completion of the second questionnaire was either during a base visit or by post between June 2004 and March 2006. Nonresponders received two additional mailings and were further traced using several national registers (Rona et al., 2006). In total 1,885 participants completed both questionnaires, 878 of whom had been deployed in the last 3 years. This analysis includes only personnel involved in the initial stage of hostilities in the Iraq war (codenamed TELIC 1), later phases of the Iraq war (TELIC 2–6), or another recent major deployment such as to Sierra Leone, Afghanistan before 2006, Kosovo, Macedonia and Southern Turkey aerial observation.

Measures

Predeployment measures. The full 2002 baseline questionnaire included the civilian version of the PTSD checklist (PCL-C), which assesses problems in the past month (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996), and the General Health Questionnaire 12 (GHQ-12.; Goldberg & Williams, 1988) as a measure of psychological distress. We used the PCL-C instead of the PCL-M because we reasoned that military personnel might also encounter traumatic experiences such as road traffic accidents outside their military duties. The GHQ was developed as an instrument to identify nonpsychotic psychiatric disorders in primary care. It has been used in many different settings, and has been shown to be consistent and valid when used in general populations (Goldberg et al., 1997; Pevalin, 2000), although the thresholds which maximize sensitivity and specificity vary between countries (Goldberg et al., 1997). The abridged 2002 questionnaire included a PCL reduced from 17 to 14 items and a selection of four items from the GHQ-12 following published criteria (Jacobsen, Hasvold, Høyer, & Hansen, 1995).The items omitted from the PCL were "trouble remembering important parts of a stressful experience," "feeling distant or cut off from other people," and "having difficulty concentrating." We have previously shown the reliability measures of the 14- and 17-item PCL as well as the GHQ-4 and GHQ-12 are acceptable (Jones, Rona, Hooper, & Wessely, 2006). In this study, the Cronbach's alpha for the 17- and 14-item PCL was high ($\alpha = .99$) as were the internal 14-item PCL ($\alpha = .90$), and 17-item PCL ($\alpha = .92$). The Cronbach's alpha for the full and abridged GHQ measures was also acceptable ($\alpha = .94$).

Posttraumatic stress disorder case status was defined as a score of 40 or more for the 14-item PCL. This is based on an arithmetic extrapolation from the 17-item PCL cutoff; i.e., case status on the 17-item PCL is a score of at least 50 out of 85, as the 14-item PCL has maximum score of 70, a score of over 40 would be equivalent to the 50 or more in the 17-item PCL (Jones

et al., 2006). Psychological distress was defined as a score of 2 or more for the four-item GHQ. The PCL includes intrusive, avoidance/numbing, and hyperarousal items (Blanchard et al., 1996). We also used PCL scores (range = 14 to 70) and the subscores of the intrusive items and avoidance/numbing items. We used all the PCL and GHQ items of the abridged questionnaire and the same items embedded in the PCL-17 and GHQ-12 of the full questionnaire. Information was obtained on gender, age, and rank at baseline, number of previous deployments in the second questionnaire, and time elapsing from exiting the operation until completion of the questionnaire for each participant. Of the 878 participants with a recent postdeployment, 681 (78%) provided information on time since exiting the operation.

Postdeployment questionnaire. The postdeployment follow-up was carried out at the same time as a larger cross-sectional study designed to compare the health outcomes between those deployed to the Iraq War with those not deployed (Hotopf et al., 2006). The PCL and GHQ-12 were included in the follow-up questionnaire. Among those who were cases using the 17-item PCL (scoring 50 or more), 18 (95%) out of 19 were still a case with a score of 40 or more using the 14-item PCL and 3 out 851 were not a case with the 17-item PCL, but would have been a case with the 14-item PCL. The case status thresholds used were the same as those used in the predeployment stage for these measures to maintain consistency. Information on deployment experiences was adapted from the Deployment Risk and Resilience Inventory (King, King, & Vogt, 2003). They were categorized as either protective factors, such as "perception of comradeship," "unit cohesion," and "feeling informed about what was going on," or traumatic experiences such as "seeing a person wounded or killed," "came under small arms fire," "in a forward area in close contact with enemy," and "thought might be killed." We distinguished between objective or subjective traumatic experiences. This distinction is clearly not exact, but was based on experiences which at least in theory might be possible to verify (e.g., "came under small arms fire") to those which were open to subjective interpretation (e.g., "thought might be killed"). It is acknowledged that military experiences are best represented on a continuum ranging from subjective, intermediate to objective events. Even a statement such as "came under small arms fire" is open to a different interpretation; some individuals would endorse the statement only if his or her group were directly fired at, whereas others would endorse the statement even if the firing occurred at some distance. Protective factors were experiences that were deemed to enhance group cohesion and provide a sense of being supported by the group, such as "felt sense of comradeship."

Ethical approval was obtained from the Ministry of Defence (Navy) as well as King's College Hospital ethics committees. Participants were briefed about the nature of the study, and written consent was obtained.

Data Analysis

Multiple logistic analyses were carried out with the traumatic and protective risk factors as dependent variables. Two analyses were performed: one based on specific psychological health measures (PCL or GHQ) at pre- and postdeployment stages and the other assessing the subscores related to the intrusive recollections, and avoidance or numbing symptom clusters of the PCL. Analyses were adjusted for the possible confounding variables of age, rank, sex, service, type of deployment, and time since exiting the latest operation: TELIC 1, TELIC 2 or later, and other major deployment. We carried out separate analyses using binary PTSD status (case or not case) and continuous PCL scores as independent factors. This approach was used to increase statistical power given the relatively small number of PCL cases. We also carried out analyses using intrusive recollections and avoidance/numbing subscores. In contrast to other studies that assessed the impact of exposures on psychological health, the dependent variables were the exposure factors in this study. We assessed the effect size and pattern of association between psychological health and verifiable traumatic events, along with events more open to subjective interpretation.

Results are presented for three regression models. Model 1 assesses the effect of predeployment psychological health on each of the risk factors, adjusting for rank, service, and number deployments in the last 3 years, sex, and type of deployment. Model 2 is similar to Model 1, but with postdeployment psychological health replacing predeployment psychological health. This is comparable to a cross-sectional study analysis, but using exposure as dependent variable and psychological symptoms as independent factors. Model 3 additionally adjusts for predeployment case status if a current case, or adjusts for current case status if a predeployment case. As information on the time between exiting the deployment and completing the questionnaire was missing or wrongly stated in 22% of participants we carried out the analysis with and without adjustment for time elapsing from exiting theatre. In practice, this made no difference to the results[1] so we present only results on the analyses based on a smaller sample thus adjusting for time.

RESULTS

We have compared the characteristics of respondents and nonrespondents in this study in previous articles (Jones et al., 2006; Rona et al., 2006). Response rates were higher among officers, older personnel, the Army, women, and those who have been

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[1] *Additional Analyses:* We carried out analyses excluding the variable 'time from exiting deployment' as covariate (N = 878) and the results were comparable to those presented in Tables 2 to 4. We also carried out analyses based only on participants who completed the full questionnaire (N = 436). Again, the results were similar to those presented in Tables 2 to 4, but with wider 95% CI. Additional analysis performed on hyper-arousal cluster scores of the PCL gave results comparable to those presented for avoidance/numbing cluster scores.

Table 1. Prevalence and Relative Frequency of Psychological Distress (GHQ) and PTSD Symptoms in the Baseline and Follow-Up Stages of the Study Deployed Personnel Only

| | Baseline GHQ | | | | | |
| | Yes | | No | | Total | |
Follow-up	N	%	N	%	N	%
GHQ						
Yes	54	6	110	13	164	19
NO	102	11	612	70	714	81
Total	156	18	722	82	878	100
			PTSD			
PTSD						
Yes	3	<1	16	2	19	2
No	14	2	845	96	859	98
Total	17	2	861	98	878	100

Note. GHQ = General Health Questionnaire; PTSD = Posttraumatic stress disorder.

deployed. The median time from exiting theatre and completing the questionnaire was 525 days with an interquartile range of 261–685 days. The prevalence of psychological ill health at baseline was very similar between responders and nonresponders. The response rate for the follow-up stage of the study was 67% ($N = 1885$). Table 1 shows that the prevalence of psychological distress based on the GHQ and PTSD did not change after deployment and that the degree of persistent distress was either moderate based on the GHQ (6.2%) or very low, based on the PCL (<0.3%).

Exposure and Posttraumatic Stress Disorder

In the analyses utilizing a binary PCL case status, only a postdeployment PTSD case was positively associated with combat-associated exposures, and the effect sizes varied from medium to large (Table 2). However, the 95% confidence intervals (95% CI) were wide. Predeployment PTSD case status did not modify the association between current PTSD and exposures. Posttraumatic stress disorder case status was not associated with the more subjective experiences such as "thought might be killed" for any of the models.

In the analyses using PCL score, there were consistent positive associations between postdeployment PCL and all exposures, which were hardly modified by predeployment PCL score (all at least $p < .001$; Table 3). Some of the predeployment PCL scores were positively associated with exposures, but these associations tended to diminish in Model 3, with the exception of the exposure, experienced hostility from civilians ($p < .05$).

In terms of protective factors (Tables 2 and 3), postdeployment PTSD showed an intermediate negative association in relation to sense of comradeship, and adjusting for predeployment PTSD case status made no significant difference to the association. There was a negative association between most protective factors and PCL scores, which remained significant after adjusting for predeployment PCL scores only for sense of comradeship. There was a trend for most predeployment PCL scores to be negatively associated with protective factors, but this tendency became less apparent in Model 3.

Intrusive and Avoidance Symptoms

Many participants who did not reach the PTSD case status threshold endorsed items related to intrusive recollections or avoidance/numbing symptoms. Postdeployment intrusive recollections or avoidance/numbing scores were equally highly positively associated with exposures regardless of whether adjustments for predeployment scores were included in the model (Table 4). Predeployment intrusive scores were generally positively associated with exposures during deployment and continued, but the association decreased or became nonsignificant, in Model 3. There was evidence that postdeployment intrusive recollections and avoidance/numbing scores were negatively associated with protective factors, but less so in relation to "I felt well informed about what was going on." This association became nonsignificant in Model 3. Only predeployment avoidance score was negatively associated with the protective factor, "could go to most people in my unit if I had a personal problem,", and remained significant in Model 3 ($p < .05$).

General Health Questionnaire

Postdeployment GHQ was associated with most exposures, but the effect sizes of the associations were small (Table 2). Predeployment GHQ was associated with only one exposure and made little difference to the association between postdeployment GHQ and exposures.

Postdeployment GHQ was associated with the protective factors "could go to most people in my unit if I had a personal problem" and "felt well informed about what was going on" these effect sizes were intermediate (Table 2). Predeployment GHQ was associated with "I felt well informed about what was going on," but the effects of pre- and postdeployment GHQ on this factor were independent.

DISCUSSION

Predeployment PTSD and GHQ case status are not associated with combat-related exposures or protective factors, but predeployment PTSD score is related. Predeployment PTSD and psychological distress do not modify the association between postdeployment

Table 2. Association Between Pre- and Postdeployment GHQ and PCL Case Status and Recall of Risk Factors During Deployment

Exposure (*n*; %)	GHQ[a] Pre-deployment Model 1 OR (95% CI)	GHQ[a] Post-deployment Model 2 OR (95% CI)	GHQ[b] Pre-deployment OR (95% CI)	GHQ[b] Post-deployment Model 3 OR (95% CI)	PTSD[a] Pre-deployment Model 1 OR (95% CI)	PTSD[a] Post-deployment Model 2 OR (95% CI)	PTSD[b] Pre-deployment OR (95% CI)	PTSD[b] Post-deployment Model 3 OR (95% CI)
Traumatic exposure factors								
Saw personnel wounded or killed (203; 30%)	1.47 (0.94–2.29)	1.79** (1.16–2.77)	1.33 (0.84–2.09)	1.70* (1.09–2.65)	1.09 (0.34–3.51)	4.40* (1.26–15.41)	1.01 (0.31–3.35)	4.40* (1.26–15.41)
Came under small arms fire (171; 25%)	0.83 (0.51–1.37)	1.36 (0.85–2.16)	0.77 (0.46–1.28)	1.43 (0.89–2.31)	0.64 (0.16–2.49)	3.55* (1.07–11.80)	0.58 (0.14–2.33)	3.66* (1.09–12.22)
In a forward area in close contact with enemy (271; 41%)	1.29 (0.84–1.98)	1.47 (0.96–2.26)	1.20 (0.78–1.87)	1.42 (0.92–2.20)	0.63 (0.20–2.01)	6.22* (1.27–30.38)	0.57 (0.17–1.88)	6.44* (1.32–31.49)
Thought might be killed (305; 42%)	1.65* (1.09–2.48)	1.99** (1.33–3.01)	1.49 (0.98–2.27)	1.88** (1.24–2.85)	1.93 (0.62–5.95)	3.03 (0.81–11.29)	1.86 (0.60–5.83)	2.97 (0.79–11.09)
Experienced hostility from civilians (272; 40%)	1.63* (1.06–2.51)	2.13** (1.38–3.28)	1.45 (0.93–2.26)	2.00** (1.30–3.12)	2.13 (0.65–6.96)	4.01* (1.02–15.68)	2.09 (0.63–6.98)	3.97* (1.01–15.68)
Protective factors								
Sense of comradeship with others in unit (553; 82%)	0.72 (0.44–1.17)	0.79 (0.49–1.27)	0.74 (0.45–1.21)	0.83 (0.51–1.35)	1.37 (0.29–6.39)	0.30* (0.09–0.96)	1.50 (0.32–7.07)	0.29* (0.09–0.94)
Could go to most people in unit with personal problems (311; 46%)	0.83 (0.55–1.23)	0.58** (0.38–0.87)	0.91 (0.60–1.36)	0.59* (0.39–0.89)	0.47 (0.15–1.53)	0.44 (0.13–1.47)	0.49 (0.15–1.58)	0.45 (0.13–1.52)
I felt well informed about what was going on (409; 60%)	0.64* (0.43–0.96)	0.63* (0.42–0.94)	0.69 (0.46–1.01)	0.67 (0.45–1.00)	1.85 (0.56–6.10)	1.67 (0.50–5.59)	1.82 (0.55–6.0)	1.63 (0.49–5.47)

Note. GHQ = General Health Questionnaire; PTSD = posttraumatic stress disorder; PCL = PTSD Checklist. *N* = 664–681.
[a]Models 1 and 2 adjusted for age- rank- gender- service- type of deployment and length of time between exiting theatre and completing questionnaire. [b]Model 3 as Models 1 and 2 plus either pre- or postdeployment case status.
* *p* < .05. ** *p* < .01. *** *p* < .001.

Table 3. Association Between Pre- and Postdeployment PCL Scores and Recall of Risk Factors During Deployment

Exposure (*n*; %)	PCL/10[a]		PCL/10[b]	
	Pre-deployment Model 1 OR (95% CI)	Post-deployment Model 2 OR (95% CI)	Pre-deployment Model 3 OR (95% CI)	Post-deployment Model 3 OR (95% CI)
	Traumatic exposure factors			
Saw personnel wounded or killed (203; 30%)	1.39** (1.10–1.77)	1.67*** (1.34–2.08)	1.05 (0.79–1.40)	1.63*** (1.26–2.11)
Came under small arms fire (171; 25%)	1.09 (0.85–1.39)	1.51*** (1.21–1.88)	0.76 (0.56–1.05)	1.72*** (1.31–2.26)
In a forward area in close contact with enemy (271; 41%)	1.36** (1.08–1.73)	1.63*** (1.29–2.05)	1.06 (0.81–1.40)	1.58*** (1.22–2.06)
Thought might be killed (305; 45%)	1.37** (1.08–1.72)	1.59*** (1.27–1.99)	1.08 (0.83–1.42)	1.53*** (1.19–1.97)
Experienced hostility from civilians (272; 40%)	1.89*** (1.45–2.46)	2.14*** (1.66–2.77)	1.38* (1.02–1.88)	1.85*** (1.39–2.45)
	Protective factors			
Sense of comradeship with others in unit (553; 82%)	0.82 (0.64–1.06)	0.70** (0.56–0.87)	1.01 (.745–1.36)	0.70** (0.54–0.90)
Could go to most people in unit with personal problems (311; 46%)	0.74* (0.58–0.93)	0.76** (0.62–0.94)	0.82 (0.63–1.07)	0.83 (0.66–1.05)
I felt well informed about what was going on (409; 60%)	0.83 (0.66–1.03)	0.87 (0.71–1.05)	0.86 (0.67–1.10)	0.93 (0.74–1.17)

Note. PCL = PTSD (posttraumatic stress disorder) Checklist. *N* = 664–681.

[a]Models 1 and 2 adjusted for age- rank- gender- service- type of deployment and length of time between exiting theatre and completing questionnaire.

[b]Model 3 as Models 1 and 2 plus either pre- or post-deployment PCL scores. PCL scores were divided by 10 thus ORs correspond to 10 points difference assuming linearity.

* *p* < .05. ** *p* < .01. *** *p* < .001.

PTSD and psychological distress and reported exposures during deployment regardless of the use of continuous score or case status as independent variables. As expected, postdeployment PTSD and psychological distress are more influential in explaining recall of potentially traumatic experiences than predeployment psychological ill health. Our results provide support for King et al. (2000) who found minimal evidence of an effect of baseline PTSD on exposure reporting at follow-up.

Predeployment and postdeployment intrusive scores were highly associated with traumatic exposure factors, as also reported by Roemer et al. (1998), this association between predeployment intrusive scores and some combat exposure events remained even after adjustment for postdeployment intrusive scores. Predeployment intrusive score reduced only marginally the association between postdeployment intrusive scores and traumatic exposures. In contrast, predeployment avoidance/numbing scores were associated with only two exposures and the association disappeared after adjustment for postdeployment avoidance/numbing scores.

A possible explanation is that avoidance behaviour may lead to a downplaying of the impact of traumas, or possibly the forgetting of traumas over time (Ouimette et al., 2005).

Our analysis demonstrates that adjusting for predeployment case status or score would not reduce the potential for recall bias in the postdeployment stage, but intrusive thoughts may have an effect. Our study demonstrated that predeployment PTSD score is weakly associated with most risk factors when using PCL symptom score, but not when using PTSD case status. Given that this association preceded exposure to risk factors during deployment, it would indicate recall bias as a possible source. However, because adjustment for predeployment PCL score did not modify the association between PCL score and risk factors, a prospective study is unlikely to correct for the small effect of recall bias.

We found little support for the hypothesis suggested by Southwick and colleagues (1997) that the association between PTSD and traumatic experiences would be higher in relation to objective rather than more subjective statements of exposures.

Table 4. Association Between Pre- and Postdeployment Avoidance/Numbing and Intrusive Scores and Recall of Risk Factors During Deployment

| | Avoid/numb[a] | | Avoid/numb[b] | | Intrusive[a] | | Intrusive[b] | |
| | Pre-deployment Model 1 OR (95% CI) | Post-deployment Model 2 OR (95% CI) | Pre-deployment Model 3 OR (95% CI) | Post-deployment Model 3 OR (95% CI) | Pre-deployment Model 1 OR (95% CI) | Post-deployment Model 2 OR (95% CI) | Pre-deployment Model 3 OR (95% CI) | Post-deployment Model 3 OR (95% CI) |
Exposure (n; %)								
Traumatic exposure factors								
Saw personnel wounded or killed (203; 30%)	1.69 (0.93–3.07)	4.27*** (2.22–8.23)	0.86 (0.42–1.73)	4.61*** (2.19–9.74)	3.94*** (1.91–8.13)	4.48*** (2.19–9.16)	2.46* (1.12–5.42)	3.20** (1.48–6.95)
Came under small arms fire (171; 25%)	0.88 (0.47–1.66)	2.84* (1.49–5.42)	0.41** (0.19–0.90)	4.49*** (2.08–9.70)	1.96 (0.95–4.04)	3.74*** (1.82–7.68)	1.09 (0.47–2.52)	3.60** (1.63–7.98)
In a forward area in close contact with enemy (271; 41%)	1.66 (0.92–3.00)	3.12** (1.61–6.02)	1.03 (0.53–2.03)	3.06** (1.47–6.37)	2.59** (1.27–5.29)	4.24*** (2.03–8.86)	1.57 (0.72–3.41)	3.56** (1.61–7.87)
Thought might be killed (305; 45%)	1.78 (1.00–3.18)	3.17*** (1.67–6.03)	1.15 (0.60–2.22)	2.96** (1.45–6.06)	2.81** (1.38–5.71)	5.97*** (2.77–12.87)	1.58 (0.73–3.41)	5.05*** (2.24–11.4)
Experienced hostility from civilians (272; 40%)	3.83*** (1.98–7.39)	7.21*** (3.45–15.08)	2.06 (0.98–4.34)	5.16*** (2.32–11.44)	5.0*** (2.31–10.87)	4.77*** (2.21–10.27)	3.28** (1.44–7.49)	3.15** (1.39–7.15)
Protective factors								
Sense of comradeship with others in unit (553; 82%)	0.69 (0.36–1.34)	0.46* (0.23–0.90)	0.95 (0.44–2.01)	0.47* (0.22–0.99)	0.62 (0.29–1.30)	0.43* (0.22–0.87)	0.87 (0.38–1.98)	0.46* (0.212–0.99)
Could go to most people in unit with personal problems (311; 46%)	0.40** (0.22–0.73)	0.45* (0.24–0.83)	0.49* (0.25–0.97)	0.62 (0.31–1.24)	0.73 (0.38–1.40)	0.51* (0.27–0.98)	0.95 (0.47–1.93)	0.52 (0.26–1.06)
I felt well informed what was going on (409; 60%)	0.76 (0.44–1.32)	0.78 (0.43–1.40)	0.79 (0.42–1.47)	0.87 (0.45–1.69)	0.61 (0.32–1.17)	0.60 (0.32–1.11)	0.72 (0.36–1.47)	0.68 (0.34–1.33)

Note. PCL = PTSD (posttraumatic stress disorder) Checklist. N = 664–681.
[a]Models 1 and 2 adjusted for age- rank- gender- service- type of deployment and length of time between exiting theatre and completing questionnaire. [b]Model 3 as Models 1 and 2 plus either pre- or post-deployment intrusive and avoidance/numbing scores. Scores were divided by 10 thus ORs correspond to 10 points difference assuming linearity.
* $p < .05$. ** $p = .005$. *** $p = .001$.

Although, in support of Southwick et al. we demonstrated that postdeployment PTSD case status was more associated with statements such as "saw personnel wounded or killed" or "came under small arms fire" than statements such as "thought might be killed." These more objective traumatic exposures have been found to have a satisfactory level of agreement in previous studies (Roemer et al., 1998; Southwick et al., 1997; Wessely et al., 2003). Our finding provides some support to Dohrenwend et al. who showed self-report exposure in war-zone areas among Vietnam veterans with PTSD were highly correlated with military collected data on military occupational specialty, killed-in-action rate, and military unit (Dohrenwend et al., 2006).

Our findings can contribute to the discussion on the extent of recall bias in cross-sectional studies, but from a different angle to others studies (Bramsen et al., 2001; Dohrenwend et al., 2006; Southwick et al.,1997). We have demonstrated that a background of previous psychological ill health may influence the reporting of traumatic and protective exposures, but they act independently of the possible effect of current psychological ill health. Thus, this extra information is unlikely to reduce the potential for recall bias in cross-sectional studies. Our finding showed that those with a higher PCL score, and less markedly those who were PTSD cases, tended to endorse negative views on sense of comradeship and communication with others in the unit. The effect size of this finding was low or moderate. As social withdrawal is a common feature in individuals with PTSD (Johnson et al., 1997; Somasundaram, 1996), recall bias would be a plausible interpretation in analyses evaluating the potential of protective factors in the aetiology of PTSD. However, our results provide some comfort in that the effect is of small magnitude. Our findings would suggest that measures of cohesion and morale should be based not only on an individual's perception, but also on independent measures of support within the unit or among those deployed to the same area and in the same period.

We have demonstrated that predeployment intrusive recollections, in contrast to avoidance/numbing scores, are highly associated with potentially traumatic exposure factors during deployment. We believe that intrusive symptoms could weaken the interpretation of cross-sectional studies assessing the effect of traumatic exposures on PTSD. This cannot easily be accounted for in cross-sectional studies, but equally it would be difficult to take into account in prospective studies. This finding would suggest that traumatic exposures would need to be assessed using independently collected data (Dohrenwend et al., 2006; Frueh et al., 2005). However, independent sources of exposure could be insufficiently sensitive to account for an individual's experiences during deployment. An alternative would be to obtain self-reported information from other unit members. Accordingly, a mixed approach combining self-reported information from the individual and unit, as well as independently obtained information may provide the best analytical strategy.

There was a consistent pattern between postdeployment GHQ and traumatic or protective exposures. The associations were unaffected by adjustment for predeployment GHQ. The small magnitude of the association in our study would explain the inconsistent findings in the literature. Bramsen et al. (2001) found an effect of mood in the reporting of exposures, but others (Roemer et al.,1998; Wessely et al., 2003) have not found such an association. Wessely et al. showed that GHQ scores were associated with number of newly endorsed changes of exposures in the Gulf war, but not in the Bosnia operation (Wessely et al., 2003). Our analysis would indicate that traumatic experiences could be related to current mood. However, it would be difficult to take into account participants' previous psychological distress to adjust for possible recall bias as there would be too few participants who would have persistent mental health problems in population studies, as shown by Milliken, Auchterlonie, and Hoge (2007).

Our study is one of the largest prospective studies of the effect of psychological health on the recall of military experiences, and the first to investigate the difference between subjective and objective risk factors, although Southwick et al. (1997) refer to it. We also assessed the possible contribution of intrusive recollection symptoms to the reporting of traumatic exposures.

One of the weaknesses of our study was that the analysis was based on a shortened version of the psychological measures (see Methods section). Although these measures had been validated elsewhere, it is acknowledged that there is a possibility that using the full measures may have altered the results. To investigate this possibility, we reran the analysis using data from those who completed the full questionnaire. Results using the full questionnaire were little different except for the expected loss of power. A second weakness of the study was that we were unable to explore changes in the reporting of experiences as baseline data were collected before the Iraq war. Another weakness was that the sample included only a small number of PTSD cases. However, the use of PCL scores overcame this limitation. Nonetheless, the wide confidence intervals in some of our findings, means that caution should be applied when drawing conclusions about the effect of PTSD on recall.

The response rate of 67% is very respectable compared to other studies of military populations, which contain an overrepresentation of young, mobile men; nevertheless response bias is always an issue. We have previously demonstrated in a limited intensive follow-up study that non-esponders did not have different outcomes in comparison to responders (Hotopf et al., 2006). Additionally, in a larger study that ran alongside this sample (but did not overlap) we found no evidence of nonresponse bias (Tate et al., 2007).

We advise caution in results based on questionnaire completion because it may inflate estimates of PTSD (Hotopf & Wessely, 2005), but in our study the prevalence of PTSD was low as has been shown in our larger survey (Hotopf et al., 2006).

In conclusion, we have shown that information on predeployment psychological health is unlikely to be a major cause of recall

bias for PTSD and psychological distress. The weak association documented in our study would not be effective in reducing the potential for recall bias in epidemiological studies. We do not believe that longitudinal studies would be able to account for the influence of current symptoms on recall bias in relation to experiences on deployment. The only exception to this overview is the somewhat large effect of predeployment intrusive score on reporting traumatic exposures that would indicate that PTSD may be more prone to recall bias than other psychological health symptoms, especially in individuals with high intrusive scores. We propose using a mixed approach based on individual and unit-reported experiences in conjunction with information on conflict participation and intensity from independent sources.

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