



## The impact of posttraumatic stress disorder on impairment in the UK military at the time of the Iraq war

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### ARTICLE INFO

#### Article history:

Received 18 July 2008

Received in revised form 11 September 2008

Accepted 12 September 2008

#### Keywords:

Posttraumatic stress disorder  
Functional impairment  
Military  
Avoidance  
Intrusiveness

### ABSTRACT

The aims of this study were to assess: (1) the relationship between PTSD and impairment, (2) whether there is a threshold in the association of PTSD score and impairment, and (3) whether any of the PTSD criteria are more strongly associated with impairment. We studied 10,069 service personnel from a representative sample of the British Armed Forces to assess the effects of the Iraq war. Participants completed the PTSD checklist (PCL), the general health questionnaire-12 (GHQ-12), the alcohol use disorder identification test (AUDIT) and five questions to assess impairment. 78% of those with a PCL-score of 50 or more endorsed at least one impairment item in comparison to 27% of those with a score below 50. The odds ratio (OR) of impairment in the PCL group with a score of 50 or more was 16.7 (95% CI 12.9–21.6). There was an increasing risk of impairment with an increasing category of PCL-score without a noticeable threshold. For each PTSD subscale: intrusiveness, avoidance/numbing and hyperarousal, divided into four score categories, there was an increased association with impairment, but the association of avoidance/numbing with impairment was the greatest and independent of the other two criteria (OR 7.2 (95% CI 4.8–10.9)). Having a good relationship with a partner had minimal effect on the level of association between PTSD and impairment. Functional impairment is a serious problem for those with PTSD. The impairment is not confined to those with the highest PCL-score. Avoidance/numbing is the criterion which makes the greatest independent contribution to impairment

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### 1. Introduction

Functional impairment is a common feature of posttraumatic stress disorder (PTSD) in civilians (Amaya-Jackson et al., 1999; Breslau et al., 2004; Marshall et al., 2001; Stein et al., 1997) and military personnel (Caspi et al., 2007; Dohrenwend et al., 2006; Grubaugh et al., 2005; Schnurr et al., 2000). However, among military studies there is variation in the prevalence and level of severity of impairment in those with PTSD (Dohrenwend et al., 2006; Frueh, 2007). Impairment is not only a characteristic of PTSD patients, but also of those who do not entirely fulfill the diagnostic criteria, usually called partial PTSD (Breslau et al., 2004; Grubaugh et al., 2005; Marshall et al., 2001; Schnurr et al., 2000; Stein et al., 1997; Weiss et al., 1992;). Some commentators have emphasized that co-morbidities, including depression, may be partly responsible for this association (Momartin et al., 2004; North et al., 1999).

Most reports concerning PTSD and impairment in the military have been restricted to Vietnam veterans (Frueh, 2007) or to spe-

cific ethnic groups (Caspi et al., 2007). It has been reported that impairment is common among Vietnam veterans with current PTSD (Dohrenwend et al., 2006), but some have argued that the measurement scale used in that study was skewed towards identifying impairment (Frueh, 2007). This view is supported by the high percentage of those with PTSD whose level of impairment consisted of "some difficulty in social, occupational or school functioning but generally functioning pretty well". Others have argued that this level of impairment is the appropriate threshold in veterans experiencing PTSD 11–12 years after the event (Kilpatrick, 2007).

The short forms of the quality of life questionnaire (the SF-12 or SF-36) (Ware et al., 1993) have been used in the military to assess quality of life (Boehmer et al., 2003; McKenzie et al., 2004; Proctor et al., 2001; Voelker et al., 2002), but rarely for inferring what impact PTSD has on personnel's social and work functioning (Grubaugh et al., 2005; Schnurr et al., 2000). Whilst there is an implicit acceptance that those with PTSD will endure some degree of impairment, some studies have shown that numbing and avoidance may be more important in their contribution to the level of impairment than other PTSD criteria (Foa et al., 1995; Norman et al., 2007; North et al., 1999). It has been reported that endorsement of

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questions on numbing and avoidance is among the lowest prevalence in subjects who experienced a recent trauma (North et al., 1999; Schutzwohl and Maercker, 1999). We do not know whether these findings are relevant to a military population.

We report the results of a study carried out between 2004 and 2006 to assess the effect of the Iraq war on psychological symptoms (Hotopf et al., 2006). As well as assessing PTSD symptoms we used some items of the SF-36 to assess quality of life in relation to occupational and social functional limitations. We also assessed respondents' satisfaction with long term relationships. The aim of this study is to assess the relationship between PTSD and functional impairment and whether there was a threshold in the association of PTSD score and impairment. We also examined whether any of the component criteria of the PTSD construct, intrusiveness, numbing/avoidance and hyper-arousal, were more strongly associated with impairment than other criteria, and the influence of co-morbidity and relationship satisfaction with a partner on any possible associations.

## 2. Material and methods

### 2.1. Sample

The study was based on the first wave of a cohort study of UK Armed Forces personnel comparing the health of those who participated in TELIC 1 (the codename used by the UK military for the major combat phase of the Iraq war between 18th January and 28th April 2003) with an era group selected from those who did not participate in TELIC 1 but were serving in the military at that time (Hotopf et al., 2006). We surveyed a random sample stratified by service and enlistment type (regular and reserve). The sampling fraction of reserves in comparison to regulars was in a proportion of 2:1. Those sampled were contacted regardless of whether they had left the Armed Forces. Participants could complete the questionnaire at a base visit or by post. Base visits were restricted to locations with a large number of subjects in the study. Between 20% and 45% of those allocated a visit completed the questionnaire during a visit but a sizeable group completed and returned the questionnaire at a later date. Non-responders received two further mailings and were further traced through their units, or for those who left the services through electoral registers, telephone directories, or the National strategic tracing service. In total, 4722 personnel who were deployed on TELIC 1 and 5550 who were in the era sample completed a questionnaire. The overall response rate was 61%. Further details can be found elsewhere (Hotopf et al., 2006). The study received ethical approval from the Ministry of Defence (Navy) personnel research ethics committee and the King's College Hospital Local Research Ethics Committee. The nature of the study was fully explained to participants and the study was carried out in accordance with the latest version of the declaration of Helsinki.

### 2.2. Information obtained

We used the 17-item National Center for Post Traumatic Stress Disorder Checklist (PCL-C) as a measure of symptoms of PTSD (Blanchard et al., 1996); five items of the SF-36 that specifically assessed functional impairment, one item of physical or emotional problems interfering with normal social activities with family, friends, neighbors, or groups, and four items of problems with work or other regular activities as a result of physical health (Ware et al., 1993); the general health questionnaire-12 (GHQ-12) to measure symptoms of psychological distress (Goldberg et al., Goldberg and Williams, 1988); the alcohol use disorder identification test (AUDIT) to assess alcohol use (Babor et al., 2001); and one item on the level of satisfaction with a long term relationship and an-

other having considered separation or divorce (Fowers and Olson, 1993).

Caseness on the PCL was defined as a score of 50 or more (minimum and maximum scores were 17 and 85). This cut-off has been chosen consistently in our studies and has been recommended when the PCL checklist is used as a continuous variable (Hotopf et al., 2006; Forbes et al., 2001). We did not use the definition of one positive endorsement for intrusiveness (criterion B), three endorsements for numbing/avoidance (criterion C) and two endorsements for hyper-arousal (criterion D) because we wanted to assess the relationship of an increasing score with impairment that the unequal stringency between criteria B, C and D would jeopardize. We favored this approach because the definition of partial PTSD is inconsistent (Grubaugh et al., 2005; Schnurr et al., 2000; Schutzwohl and Maercker, 1999; Stein et al., 1997) and an approach based on scores would allow us to distribute our sample into four groups to assess the nature of the relationship between categories of PTSD score and impairment. The two measures of PTSD caseness, score of 50 or more or fulfilling the DSM-IV criteria of caseness, had a kappa statistic of agreement 0.71 (95% CI 0.67–0.74) (Cohen, 1960). A score of 50 or more was a more stringent case definition than the DSM-IV criteria. The four groups of PCL scores and each of the criterion scores, intrusiveness, avoidance/numbing and hyper-arousal are shown in Tables 3 and 4. GHQ-12 caseness was defined as a score of 4 or more. This cut-off has been used consistently in our studies despite the variation of thresholds used in the literature (Hotopf et al., 2006). We used a score of at least 16 on the AUDIT corresponding to "high level of alcohol problems" (Babor et al., 2001; Fear et al., 2007).

### 2.3. Analysis

We assessed the level of impairment for each of the five SF-36 items and the number of positively endorsed impairments by PTSD caseness with and without co-morbidity for psychological distress (GHQ-12) and/or alcohol problems. Multiple logistic regressions were carried out separately for each SF-36 item as the dependent variable and PCL categorical scores as independent factor, and in separate analyses, for each PTSD criterion categorical scores (intrusiveness, avoidance/numbing and hyper-arousal). All analyses were adjusted for age, sex, education, type of engagement (regular or reserve), rank, marital status, service (Naval Services, Army and Royal Air Force), and also for pain in the joints and stiffness in the joints to account for physical symptoms as a reason for endorsing impairment statements. We also analyzed the single item "physical and emotional problems limiting work and social activities" as a dependent variable adjusting for the demographic variables and the effect of intrusiveness, avoidance/numbing or hyper-arousal individually and for each after adjustment for the other two criteria. In separate multiple logistic analyses we assessed whether a good long-term relationship with a partner decreased the association between PTSD symptoms and impairment. All analyses were weighted according to sampling fraction. The model adequacy was checked in all analyses using a specification test and goodness of fit with the Hosmer and Lemeshow test (Vittinoff et al., 2005). With one exception, explained in the results section, model adequacy was demonstrated. In preliminary analyses we used the PCL score and score for each PTSD criterion as continuous variables but these gave a statistically significant lack of model fit. Thus we decided to use categorical data. The use of categories instead of continuous variables for PCL and criteria groups may have resulted in some loss of statistical power to detect differences, but this loss of power may have been small as we used four categories for each risk factor (Austin and Brunner, 2004). We did not under-adjust in relation to our confounders as we did not collapse the measurement scales used in the questionnaire.

**Table 1**

Functional impairment according to posttraumatic stress disorder, psychological distress (GHQ-12) and severe alcohol problem

	Not PTSD case N = 9675	All PTSD cases N = 394	Case on PTSD and GHQ but not on alcohol N = 192	Case on PTSD and alcohol but not case on GHQ N = 21	Case on PTSD and GHQ and alcohol N = 152	Case on PCL not case on GHQ or alcohol N = 29	Case on GHQ but not on PTSD N = 1658
<i>Health interfered social life</i>							
Not at all	6590/9593 (69%)	53/390 (14%)	16/191 (9%)	10/20 (49%)	16/150 (11%)	11/29 (40%)	524/1643(32%)
Slightly	1577/9593 (16%)	60/390 (15%)	28/191 (14%)	3/20 (14%)	24/150 (16%)	5/29 (16%)	452/1643(27%)
Moderately	769/9593 (8%)	84/390 (21%)	48/191 (24%)	5/20 (27%)	19/150 (12%)	12/29 (40%)	304/1643(19%)
Quite a bit	523/9593 (6%)	115/390 (29%)	54/191 (28%)	1/20 (5%)	60/150 (40%)	0/29	273/1643(17%)
Extremely	134/9593 (1%)	78/390 (21%)	45/191 (25%)	1/20 (5%)	31/150 (21%)	1/29 (4%)	90/1643(6%)
Cut down time on work/other activities (yes)	961/9242 (10%)	155/362 (43%)	77/179 (42%)	3/20 (16%)	69/136 (51%)	6/27 (24%)	376/1526 (24%)
Accomplished less than would like (yes)	1791/9298 (19%)	249/369 (66%)	132/182 (71%)	8/20 (38%)	98/139 (70%)	11/28 (40%)	712/1560 (45%)
Limited in type of work (yes)	1402/9260 (16%)	180/365 (50%)	88/178 (50%)	3/20 (16%)	81/140 (58%)	8/27 (29%)	462/1542 (31%)
Difficulty performing work (yes)	1431/9254 (15%)	203/370 (54%)	114/185 (61%)	5/20 (24%)	79/137 (57%)	5/28 (17%)	580/1549 (37%)

Percentages weighted to account for sampling fractions (reserves sampled 2:1).

### 3. Results

Two hundred and three subjects were excluded from the analysis because of missing information on PTSD. Table 1 gives the distribution of impairment according to PTSD caseness, and PTSD caseness stratified by caseness for the GHQ-12 and/or severe alcohol problem, and for GHQ-12 but not PTSD caseness. 87.3% of the PTSD cases were also positive for GHQ-12, 43.9% were also positive for severe alcohol problem and 7.4% were positive for PTSD only. There was a marked increase in the percentage with impairment in the PTSD cases compared to non-cases, and to a lesser extent GHQ-12 but not PTSD. Impairment among PTSD cases was related to co-morbidity with psychological distress only and psychological distress plus severe alcohol problems. Impairment was less marked in the minority of PTSD cases without psychological distress either with or without a severe alcohol problem. Thus a severe alcohol problem did not further increase the prevalence of impairment in PTSD cases.

Those who fulfilled criteria of caseness for both PTSD and GHQ-12, regardless of having a severe alcohol problem, endorsed more

impairment items than those who fulfilled caseness only for PTSD. Those who were PTSD cases but not GHQ cases endorsed slightly more impairment items than those who were not PTSD cases (results not shown). Non-PTSD cases (73%) endorsed no impairment on the five SF-36 items. The equivalent prevalences were 54% for those who were PTSD only cases and 17% for those who were comorbid for PTSD and GHQ-12.

The relative frequency for each of the statements in the PCL checklist varied from 5.0% (trouble remembering important parts of stressful experience) to 21.6% (trouble falling or staying asleep) (Table 2). The three highest percentages were for three items within criterion D (hyper-arousal), and the lowest percentages tended to be within criteria B (intrusiveness).

There was a marked increase in the odds ratios (OR) of impairment with increasing PCL score category regardless of the outcome used (Table 3). However, the OR was higher for the outcome "physical or emotional problems interfered with social activities" than for the four items exploring physical health limiting work or social activities. Even the groups with the smallest increased score, either for the full PCL or each criterion had a moderate effect on

**Table 2**

Prevalence of each item on PCL stratified by criteria: B (intrusiveness), C (avoidance/numbing) and D (hyper-arousal)

Criteria		N = 10,069 n (%)
B	Repeated, disturbing memories, thoughts or images of a stressful experience?	986 (9.8)
	Repeated, disturbing dreams of a stressful experience?	774 (7.7)
	Suddenly acting or feeling as if a stressful experience were happening again (as if you were reliving it)?	526 (5.2)
	Feeling very upset when something reminded you of a stressful experience?	986 (9.8)
	Having physical reactions (e.g. heart pounding, trouble breathing, sweating) when something reminded you of a stressful experience?	585 (5.8)
C	Avoiding thinking about or talking about a stressful experience?	1191 (11.8)
	Avoiding activities or situations because they reminded you of a stressful experience?	625 (6.2)
	Trouble remembering important parts of a stressful experience?	507 (5.0)
	Loss of interest in activities that you used to enjoy?	1241 (12.3)
	Feeling distant or cut-off from other people?	1164 (11.6)
	Feeling emotionally numb?	1088 (10.8)
D	Feeling as if your future will somehow be cut short?	1006 (10.0)
	Trouble falling or staying asleep?	2179 (21.6)
	Feeling irritable or having angry outbursts?	1778 (17.6)
	Having difficulty concentrating?	1441 (14.3)
	Being watchful or on guard?	985 (9.8)
	Feeling jumpy or easily startled?	718 (7.1)

Percentages weighted to account for sampling fractions (reserves sampled 2:1).

**Table 3**  
Associations of PCL score, criterion B (intrusiveness), criterion C (avoidance/numbing) and criterion D (hyper-arousal) categorized into four groups with functional impairment

Group (Score)	Outcome				
	Physical and emotional problems with social activities (quite a bit or more)	Cut down time on work because of physical health	Accomplished less because of physical health	Limited in kind of work because of physical health	Difficulty performing work because of physical health
	OR (95% CI) N = 9334	OR (95% CI) N = 8981	OR (95% CI) N = 9040	OR (95% CI) N = 9001	OR (95% CI) N = 8996
<i>PCL score</i>					
2 (30–39)	4.26 (3.44–5.26)	2.40 (1.98–2.93)	3.22 (2.74–3.77)	2.08 (1.74–2.47)	2.97 (2.50–3.52)
3 (40–49)	8.01 (6.19–10.37)	3.35 (2.57–4.38)	4.57 (3.61–5.78)	2.52 (1.95–3.25)	4.26 (3.33–5.45)
4 (50 or +)	16.72 (12.94–21.60)	6.11 (4.74–7.89)	8.72 (6.79–11.20)	4.63 (3.60–5.94)	6.34 (4.95–8.13)
<i>Criterion B</i>					
2 (8–11)	3.07 (2.52–3.75)	2.20 (1.82–2.65)	2.45 (2.11–2.85)	1.89 (1.60–2.24)	2.09 (1.76–2.47)
3 (12–14)	4.79 (3.57–6.43)	2.62 (1.95–3.53)	3.35 (2.59–4.32)	2.33 (1.77–3.08)	3.23 (2.47–4.22)
4 (15 or +)	9.62 (7.47–12.39)	4.60 (3.57–5.94)	5.01 (3.93–6.37)	3.17 (2.46–4.09)	4.33 (3.37–5.55)
<i>Criterion C</i>					
2 (12–16)	3.70 (2.99–4.59)	2.67 (2.21–3.24)	3.48 (2.98–4.06)	2.22 (1.87–2.63)	2.97 (2.50–3.51)
3 (17–21)	7.19 (5.61–9.23)	3.73 (2.92–4.77)	5.16 (4.16–6.41)	2.84 (2.25–3.59)	4.32 (3.45–5.40)
4 (22 or +)	18.70 (14.40–24.28)	6.56 (5.05–8.51)	10.90 (8.36–14.20)	5.21 (4.02–6.75)	8.15 (6.30–10.56)
<i>Criterion D</i>					
2 (10–13)	3.33 (2.71–4.09)	2.16 (1.79–2.61)	2.86 (2.48–3.32)	1.88 (1.59–2.21)	2.43 (2.07–2.86)
3 (14–16)	7.22 (5.63s–9.25)	3.11 (2.41–4.01)	4.54 (3.64–5.65)	2.64 (2.08–3.34)	3.96 (3.17–4.95)
3 (17 or +)	14.24 (10.90–18.60)	6.19 (4.77–8.05)	7.91 (6.10–10.25)	3.63 (2.80–4.71)	5.82 (4.49–7.54)

Reference groups: PCL score = less than 30; Criterion B score = less than 8; Criterion C = less than 12; Criterion D = less than 10.  
Adjusted for sex, rank, age, marital status, education, service and type of engagement, joint pain and joint stiffness.

impairment (OR between 1.88 and 4.26). In general, the OR more than doubled in the highest score group of PCL or criterion B, C and D in comparison to the second highest score group. Avoidance/numbing (criterion C) had consistently the highest OR of impairment of similar effect size to the full PCL categories. Intrusiveness (criterion B) was the criterion which had the lowest association with impairment, while hyper-arousal (criterion D) was intermediate.

We explored whether criteria B, C and D were still highly associated with physical and emotional problems limiting work and social activity when adjusted for the other criteria (Table 4). Avoidance/numbing symptoms continued to be highly associated with impairment after adjustment for hyper-arousal and intrusion, as were hyper-arousal symptoms, but at a lower level. Intrusiveness hardly made any independent contribution to impairment after adjustment for the other two criteria. However, as the goodness of fit was poor when the three domains were included in the

model ( $p = 0.004$ ), these results should be interpreted with care. For this reason we have included the intermediate models adjusting for only one criterion at a time. Such analyses showed that the independent effect of each criterion was unlikely to be due to the poor fit of the fully adjusted model.

PTSD cases were usually less satisfied with their relationship and more often said they had discussed divorce with their spouse in the last 12 months than non-PTSD cases. However, a satisfactory marriage/long term relationship or suggestions of divorce only slightly decreased the association between full PCL or each criterion of PTSD and impairment (Table 5).

#### 4. Discussion

PTSD caseness and each criterion of PTSD were strongly associated with impairment. There was an exponential relationship between PCL score and impairment, and each PTSD criterion and

**Table 4**  
Association of criterion B (intrusiveness), criterion C (avoidance/numbing) and criterion D (hyper-arousal) in four groups, with interference with social activity

Independent variable:	Outcome Physical health and emotional problems interfere with social activities (quite a bit or extremely)				
	Adjusted for demographics only	Adjusted for demographics + re-experiencing	Adjusted for demographics + avoidance	Adjusted for demographics + arousal	Adjusted for demographics + the other two criteria <sup>a</sup>
<i>Intrusiveness</i>					
2 (8–11)	3.53 (2.90–4.29)		1.57 (1.23–2.02)	1.95 (1.55–2.45)	1.40 (1.10–1.80)
3 (12–14)	5.80 (4.38–7.67)	N/A	1.42 (1.01–2.02)	1.95 (1.40–2.73)	1.13 (0.79–1.61)
4 (15 or +)	12.14 (9.53–15.48)		1.83 (1.30–2.57)	2.73 (1.97–3.78)	1.32 (0.93–1.89)
<i>Avoid/numb</i>					
2 (12–16)	4.37 (3.56–5.36)	3.59 (2.83–4.56)		2.74 (2.09–3.57)	2.50 (1.89–3.30)
3 (17–21)	8.53 (6.69–10.88)	6.35 (4.73–8.53)	N/A	4.03 (2.91–5.59)	3.58 (2.54–5.06)
4 (22 or +)	23.60 (18.42–30.25)	15.39 (10.92–21.68)		8.43 (5.81–12.23)	7.23 (4.81–10.85)
<i>Hyper-arousal</i>					
2 (10–13)	3.85 (3.16–4.69)	2.93 (2.34–3.65)	2.06 (1.59–2.68)	N/A	1.95 (1.50–2.54)
3 (14–16)	8.77 (6.90–11.15)	5.63 (4.21–7.52)	2.90 (2.08–4.04)		2.76 (1.97–3.88)
3 (17 or +)	18.78 (14.61–24.14)	9.86 (7.13–13.64)	3.91 (2.67–5.72)		3.66 (2.47–5.44)

Reference groups: Re-experiencing score = less than 8; Avoidance/numbing = less than 12; and Hyper-arousal = less than 10.  
Adjusted for sex, rank, age, marital status, education, service and type of engagement.

<sup>a</sup> The model adequacy using the Hosmer and Lemeshow test for the analysis adjusted for the other two domains was poor ( $p = 0.004$ ). The model adequacy for all other analyses was good.

**Table 5**

Association of interference with social activities with PTSD adjusted for marital satisfaction (four categories) and divorce suggested ( $N = 7079$ )

Adjustment	Outcome Physical health and emotional problems interfere with social activities (quite a bit or extremely)	
	Demographics	Demographics + satisfied with spouse ce:hsp sp="0.25"/>+ divorce suggested
<i>PCL score<sup>a</sup></i>		
1	5.25 (4.14–6.67)	4.88 (3.82–6.23)
2	8.90 (6.59–12.02)	8.00 (5.88–10.87)
3	21.36 (15.89–28.75)	18.85 (13.93–25.52)
<i>Intrusiveness score</i>		
1	3.91 (3.11–4.92)	3.62 (2.86–4.57)
2	5.62 (4.02–7.84)	5.16 (3.68–7.23)
3	12.33 (9.17–16.58)	10.84 (8.04–14.63)
<i>Avoidance score</i>		
1	4.63 (3.65–5.88)	4.32 (3.38–5.53)
2	8.58 (6.42–11.47)	7.71 (5.70–10.42)
3	24.04 (17.77–32.52)	21.42 (15.74–29.15)
<i>Arousal score</i>		
1	3.68 (2.91–4.65)	3.44 (2.72–4.37)
2	8.21 (6.18–10.91)	7.31 (5.47–9.77)
3	19.38 (14.33–26.22)	16.67 (12.19–22.79)

Reference groups: PCL score = less than 30; criterion B score = less than 8; criterion C = less than 12; and criterion D = less than 10.

Adjusted for sex, rank, age, education, service and type of engagement.

<sup>a</sup> Categories correspond to those in Tables 3 and 4.

impairment, without an apparent threshold. There was a gradient in the association of each criterion of PTSD and functional impairment, the strongest association was with avoidance/numbing, intermediate with hyper-arousal and lowest with intrusiveness. The avoidance/numbing and hyper-arousal criteria, but not intrusiveness, were independently associated with impairment. Relationship satisfaction had a minimal effect on the level of association with impairment.

#### 4.1. PTSD and functional impairment

A major criticism of the diagnosis of PTSD using the DSM-III-R was that it did not require symptoms to lead to functional impairment thus it was possible to over diagnose large number of people with productive lives but only mild PTSD symptoms (McNally, 2007). Spitzer and colleagues (2007) suggested that without significant distress or impairment in social, occupational or other important area of functioning PTSD should not be diagnosed. Such an extra criterion would have eliminated only 7.7% of the 394 subjects with a score of 50 or more on the PCL who did not endorse any of the five impairment statements in this study. Our study is consistent with those showing that PTSD greatly increases functional impairment (Dohrenwend et al., 2006; Grubaugh et al., 2005; North et al., 1999; Schnurr et al., 2000; Zatzick et al., 1997). However, the level of impairment in the National Vietnam Veterans Readjustment Study (NVVRS) was mild when first assessed many years after the Vietnam War, as was the case in a study of personnel who participated in mustard gas experiments during World War II in which age might have compounded the perception of impairment (Dohrenwend et al., 2006; Schnurr et al., 2000). A comparison of our study and that of Dohrenwend and colleagues (2006) should be made with caution because of differences in age distribution; time between deployment and assessment, cultural background and measurement methods. Notwithstanding these differences, 71% of the PTSD cases in our study have experienced at least a moderate interference with normal life compared to 43% in the NVVRS study (Dohrenwend et al., 2006). If any level of impairment were considered acceptable the prevalences would be 86% and 100% respectively. 53% of non-PTSD cases in the NVVRS

study and 31% in our study report any level of impairment but only 22.8% and 15% respectively report at least a moderate level of impairment. These comparisons highlight the need to use thresholds which are compatible with at least a moderate level of impairment otherwise impairment would encompass a large percentage of the military without PTSD and its use would become meaningless.

Our results are also in accord with reports which show that impairment is not restricted to those who fulfill the PTSD criteria (Breslau et al., 2004; Caspi et al., 2007; Grubaugh et al., 2005; Schnurr et al., 2000; Schutzwahl and Maercker, 1999; Stein et al., 1997). It extends our knowledge by demonstrating a lack of threshold between PTSD score and impairment, thus even a slight increase in PTSD score had an effect on impairment. However, the OR of impairment was much higher in the group with the highest PTSD scores; a finding previously noted in studies which have explored differences between PTSD and partial PTSD (Breslau et al., 2004; Schutzwahl and Maercker, 1999; Stein et al., 1997). Our results add support to studies which have failed to demonstrate a discrete diagnostic PTSD category using taxometric procedures (Broman-Fulks et al., 2006; Ruscio et al., 2002). Discussions on the most appropriate threshold to diagnose PTSD might be elusive because PTSD may reflect the upper end of a continuum rather than a discrete clinical entity. Adherence to a rigid diagnosis of PTSD may leave a substantial group of service personnel feeling that they do not get appropriate care if they do not completely fulfill the PTSD criteria, but suffer meaningful levels of impairment.

PTSD diagnosis based on checklist methods have been criticized because the questions may not be well understood by those completing the questionnaire; by their over-inclusiveness, as different psychological conditions manifest themselves with similar unspecific symptoms; and because some cognitive or affective responses to distress or threat may be normal rather than an expression of disorder (McHugh and Treisman, 2007). We would fully concur that the PTSD diagnosis should not be solely questionnaire based and that many PTSD symptoms are non-specific. However, the PCL checklist must tap into an important dimension of psychological wellbeing in our study, as such a large proportion of those with a high score acknowledged impairment.

#### 4.2. Criteria of PTSD and functional impairment

Our study demonstrated that the contribution to impairment of each PTSD criterion is unequal. Avoidance/numbing made the greatest independent contribution to impairment. Similar findings have been reported in civilian studies (Breslau et al., 2004; Foa et al., 1995; Norman et al., 2007; North et al., 1999). Further support for the specific detrimental effect of avoidance/numbing comes from a study which showed a higher proportion of subjects reporting these symptoms received treatment for the disorder (North et al., 1999). In contrast, we found a lack of independent contribution of intrusiveness on impairment. McMillen and colleagues (2000) in a study of those who experienced an earthquake came to the conclusion that intrusive symptoms, the modern "hallmark" of PTSD, are likely to be different in their impact to those of the other criteria. Our study provides evidence for the assertion that intrusive symptoms may not affect the ability of the individual to cope at work and socially; it is possible that such symptoms may overlap with normal memory or alternatively be a more recent cultural addition in the constellation of psychiatric injury (Jones et al., 2003).

Our results cannot be explained, as in previous studies, by the relatively low prevalence of symptoms of avoidance/numbing compared to the other two criteria (North et al., 1999; Schutzwahl and Maercker, 1999). In our study, the prevalences of items of intrusiveness, and avoidance/numbing were similar. Hyper-arousal

made a distinctive independent contribution to impairment, and its effect size was intermediate between avoidance/numbing and intrusiveness. Some commentators have hypothesized that dissociative responses in terms of avoidance/numbing may serve a protective function (Bryant, 2007). However, excessive or prolonged avoidance/numbing mechanisms, especially numbing as shutting down mechanism, may preclude adequate resolution or processing of the event (Foa et al., 1995). Our results indicate that numbing/avoidance symptoms far from being protective are associated with impairment. It would be necessary to conceptualize in which way subjects who do not endorse sufficient criteria B, C and D to warrant a PTSD diagnosis, but have severe impairment can also be included within the PTSD paradigm.

#### 4.3. PTSD and co-morbidities

We assessed the contribution of psychological distress and severe alcohol problems to the association between PTSD caseness and impairment. The majority of those who reach a score of 50 were also case positive for the GHQ-12. As the GHQ-12 is only a screening tool of psychological distress we cannot provide information as to the proportion of individuals in the group who have major depression (Goldberg et al., 1997; Marshall et al., 2001; North et al., 1999). On the other hand, our study is unambiguous in demonstrating that a severe alcohol problem does not seem to increase the level of impairment among PTSD subjects, a mechanism of co-morbidity previously suggested (Zatzick et al., 1997). The high percentage of subjects who have a severe alcohol problem in the PTSD group in comparison to the total sample could suggest that alcohol use is a maladaptive coping mechanism (Fear et al., 2007; North et al., 1999), but such a mechanism was not supported in a prospective study (Breslau et al., 2003).

#### 4.4. Strengths and weaknesses

This was a large study based on a representative sample of the UK Armed Forces, which only excluded special forces. Although the response rate was 61% we do not believe that this would have biased our results. It is possible that those with the most severe avoidance/numbing symptoms would have been more reluctant to complete a questionnaire but such a lack of response would have increased rather than decreased the level of association between PTSD symptoms and impairment. The cross-sectional design of this study is unlikely to have affected our results as we were measuring concurrent features of subjects in our study. Many items of the SF-36 were omitted due to the fact that we had to limit the number of items in the questionnaire. It is possible that some questions on psychological problems being the basis for functional impairment would have been more appropriate. This may have increased even further the strength of the association between PTSD and criteria scores, and impairment. However, we were able to demonstrate large effect sizes even when using physical health items from the SF-36.

#### 4.5. Implications

Our study provides strong clues that, in service personnel, PTSD symptoms cause noticeable impairment in the great majority who also have symptoms of psychological distress. Thus even sub-threshold scores on the PCL checklist are not inconsequential. We found that avoidance/numbing symptoms caused the largest impairment effect and there should be awareness that individuals who experience these symptoms may need support even if they do not manifest other symptoms recognized as part of PTSD; furthermore such symptoms might prevent appropriate help seeking behavior. The lack of a threshold of impairment for the PTSD score suggests that benefits could accrue from interventions which in-

crease self-reliance and mutual support within the usual network in the military rather than focusing only on those with a PTSD diagnosis (Gould et al., 2007). As our results suggest that intrusive symptoms may not cause impairment it would be worth undertaking a clinical reappraisal of the relative value of each of the PTSD domains.

Our study shows that impairment is widespread among those who have a high PCL score, in particular those endorsing numbing/avoidance symptoms or hyper-arousal symptoms. Whether this association is due solely to PTSD or co-morbidities deserves further attention. Impairment may also extend to those who do not fully conform to a PTSD diagnosis and some of these subjects may also need health care support.

#### Conflict of interest statement

Simon Wessely is Honorary Civilian Consultant Advisor in Psychiatry to the British Army (unpaid). Neil Greenberg is member of the Defence Medical Services. All other authors declare no competing conflict of interest.

#### Contributors

Roberto Rona was a principal investigator, planned and sought funding for the study, supervised aspects of data collection, designed the analysis and drafted the paper. Margaret Jones participated in the conduct of the research, carried out the analysis, and wrote the paper. Amy Iversen participated in the planning and conduct of the study; Lisa Hull participated in the conduct and planning of the study, Neil Greenberg participated in the planning of research and was involved with military liaison, Nicola Fear participated in the planning, conduct and analysis of the paper; Matthew Hotopf was a principal investigator, sought funding, planned and supervised aspects of data collection of the study, Simon Wessely was a principal investigator, sought funding, led the planning of the study and supervision of data collection. All authors revised critically each draft of the paper and approved the final version.

#### Role of funding source

The study was funded by the UK Ministry of Defence (MOD) Grant R and T/1/0078.

The MOD had no role in the study design, in the collection, analysis and interpretation of the results, and the decision to submit the paper for publication. The Defence Analytical Service Agency (MOD) provided the sampling frame and carried out the random selection of military personnel for this study following our instructions. We liaised with military personnel about the procedures to follow for contacting the subjects in the study.

#### Acknowledgements

We thank the UK Ministry of Defence for their cooperation; in particular the Defence Medical Services Department, the Defence Analytical Service Agency, the Armed Forces Personnel Administration Agency, the Armed Forces Personnel Administration Agency, and Veteran's Policy Unit. Matthew Hotopf and Simon Wessely are partially funded by the South London and Maudsley NHS Foundation Trust/Institute of Psychiatry NIHR (National Institute of Health Research) Biomedical Research Centre.

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