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Predicting persistent posttraumatic stress disorder (PTSD) in UK military personnel who served in Iraq: A longitudinal study

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ABSTRACT

In a longitudinal study we assessed which baseline risk factors are associated with persistent and partially remitted PTSD in comparison to fully remitted PTSD. 6427 (68%) of a randomly selected sample of UK service personnel completed the PTSD checklist (PCL) between 2004 and 2006 (Phase 1) and between 2007 and 2009 (Phase 2). 230 (3.9%) had possible PTSD at baseline. 66% of those with possible PTSD at baseline remitted (PCL score <30) or partially remitted (PCL score 30–49) by phase 2 of the study. Associations of persistent PTSD with the fully remitted group for risk factors at phase 1 adjusted for confounders were having discharged from service (OR 2.97, 95% CI 1.26–6.99), higher educational qualification (OR 2.74, 95% 1.23–6.08), feeling unsupported on return from deployment (OR 10.97, 95% CI 3.13–38.45), deployed not with parent unit (OR 5.63, 95% CI 1.45–21.85), multiple physical symptoms (OR 3.36, 95% CI 1.44–7.82), perception of poor or fair health (OR 2.84, 95% CI 1.28–6.27), older age and perception of risk to self (increasing with the number of events reported, $p = 0.04$). Deploying but not with a parent unit and psychological distress were associated in the partially remitted PTSD when compared to the fully remitted group. The positive and negative likelihood ratios for the factors most highly associated with persistent PTSD indicated they were of marginal value to identify those whose presumed PTSD would be persistent. Many factors contribute to the persistence of PTSD but none alone is useful for clinical prediction.

1. Introduction

Many studies have assessed the risk factors for developing Posttraumatic Stress Disorder (PTSD) in civilian and military populations (Brewin et al., 2000; Fear et al., 2010; Hoge et al., 2004; Ozer et al., 2003; Rona et al., 2009a; Sundin et al., 2010), but only a minority use a longitudinal design and fewer compare persistent to non-persistent PTSD (Boscarino and Adams, 2009; Koenen et al., 2003; Peleg and Shalev, 2006; Solomon, 1989; Solomon et al., 1989). Some studies that have assessed persistent PTSD are not longitudinal (Bremner et al., 1996; Breslau and Davis, 1992; Green et al., 1990; Schnurr et al., 2004). None of the studies so far has assessed persistent PTSD in the Iraq and Afghanistan Wars.

Studies looking at PTSD trajectories have shown that many subjects with PTSD recover over time, but for some their level of PTSD symptoms is maintained or worsened (Blanchard et al., 1996a; Shalev et al., 1998; Shalev et al., 1996; Solomon et al., 1989). Therefore it is important to assess what factors contribute to PTSD persistence. Factors that have been found to be related to persistent PTSD include intensity of trauma (Green et al., 1990; Schnurr et al., 2004), severity of the initial episode (Blanchard et al., 1997; Schnurr et al., 2004), comorbidities such as alcohol misuse, depression and anger (Koenen et al., 2003; Schindel-Allon et al., 2010), social integration (Koenen et al., 2003; Schnurr et al., 2004; Solomon et al., 1989), subsequent traumatic events (Carlier et al., 1997), ethnicity (Boscarino and Adams, 2009; Schnurr et al., 2004), self-esteem (Boscarino and Adams, 2009) and gender (Kessler et al., 1995). Some of these studies were cross-sectional (Green et al., 1990; Kessler et al., 1995) and others reported only results unadjusted for confounders (Boscarino and Adams, 2009; Koenen et al., 2003; Solomon et al., 1989).

None of the studies have assessed whether risk factors predict persistent PTSD with any certainty, though some looked at predictors of PTSD using explained variation (Kleim et al., 2007).

We performed a large longitudinal study between 2004 and 2009, soon after the start of the 2003 Iraq War. A large proportion

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of this sample was deployed to Iraq. The purpose of this study is to assess which risk factors measured at baseline could distinguish between persistent, partially remitted, and remitted PTSD at follow up. We were especially interested to ascertain whether these risk factors would be powerful to predict persistence of PTSD, if used in a clinical setting.

2. Material and methods

2.1. Study design and participants

Participants in this cohort study were contacted between 2004 and 2006 (Phase 1) and again between 2007 and 2009 (Phase 2) (Fear et al., 2010; Hotopf et al., 2006). Phase 1 comprised a randomly chosen sample of service personnel who had been deployed to the Iraq War between January 18 and June 28 2003 together with another randomly chosen sample of those not deployed to Iraq at that time. Reservists were oversampled at a ratio of 2:1 and in total 10,272 participants responded (59% response rate). 9395 participants from phase 1 were available for follow-up at phase 2, including 37 participants who were late completers (Fear et al., 2010). Of the 914 unavailable 733 did not consent to follow-up, 29 died between the two phases of the study, 60 did not have a suitable contact address and 92 were removed from the cohort for security considerations. 6292 (67%) of the 9395 participants available for follow-up participated at phase 2 and completed the PTSD questions. Participation at phase 2 was associated with being older, female, an officer and a regular. Mental health status, including probable PTSD at phase 1 was not associated with participation at phase 2 (Fear et al., 2010). 169 participants who were not PTSD cases at phase 1 but who were cases at Phase 2 were excluded from this analysis after initial description of the sample because the main purpose of this study was to ascertain which Phase 1 factors contribute to the persistence of PTSD symptoms from Phase 1 to Phase 2. This was a heterogeneous group that included those with delayed onset PTSD or those whose PTSD was not related to Phase 1 deployment.

2.2. Measurements

PTSD was assessed at phases 1 and 2 using the PTSD Checklist – Civilian version (PCL-C); a 17-item questionnaire assessing five re-experiencing, seven avoidance and five hyper-arousal symptoms. Possible PTSD was defined as a score of 50 or above (PCL range score 17–85) (Blanchard et al., 1996b). We use the term possible PTSD as there was no clinical diagnosis. Remitted PTSD cases were those with a score of 50 or more at phase 1 but below 30 at phase 2, partially remitted PTSD were those with a score of 50 or more at phase 1 but between 30 and 49 at phase 2, persistent cases were those with a PCL score of 50 or more at phases 1 and 2, and resilient cases were those who had a score below 50 at both phases. Symptoms of psychological distress were measured by the General Health Questionnaire 12 (GHQ-12) (Goldberg et al., 1997), with cases defined as individuals with a score of 4 or above (range scores 0–12). General health status was assessed using one item from the SF-36 (Ware et al., 1993), cases were defined as individuals rating their health as 'poor' or 'fair'. Multiple physical symptoms (MPS) were assessed using a checklist of 53 symptoms, with cases defined as individuals reporting 18 or more symptoms (Hotopf et al., 2006). Alcohol use was measured by the 10-item World Health Organization (WHO) Alcohol Use Disorders Identification Test (AUDIT). A score of 16 or more was used to define alcohol misuse reflecting a high level of alcohol problems (scores ranged from zero to 40) (Babor et al., 2001). Functional impairment was assessed from the SF-36 item: physical or emotional problems interfering with normal social activities with family, friends, neighbors or groups (Ware et al., 1993); impaired were those who endorsed quite a bit or extremely from a five options response. We used this item of the SF-36 because we have demonstrated previously that it had the strongest association with both partial and full PTSD (Rona et al., 2009b). Two measures of childhood adversity were derived: i) childhood adversity relating to family relationships, and ii) childhood antisocial behavior (Iversen et al., 2007; MacManus et al., 2011). Four items of a scale that assessed the level of perceived support among service personnel on return from deployment were used to classify participants into two categories of support. In addition, role during deployment (combat, combat support, combat service support); time in a forward area; four categories of risk to self; four items of trauma involving others and thinking that one might be killed were used as proxy measures of trauma intensity. Other variables collected at phase 1 of the study were: sex, age, education level, marital status, service, rank, enlistment status (regular or reserve), deployed with parent unit (as opposed to deploying as an individual) and serving status (serving or discharged).

2.3. Analysis

Multinomial logistic regressions were performed to identify risk factors associated with persistent PTSD or partially remitted PTSD compared to remitted PTSD. The association of persistent PTSD or partially remitted PTSD was assessed with each phase 1 independent variable adjusted for sex, age, level of education, marital status, service, rank and enlistment status and for deployment between phases 1 and 2 (variables selected a priori as confounders based on previous published studies). We did not adjust for phase 1 health and functional impairment variables because of high collinearity between psychiatric conditions, functional impairment and perception of health status. Where PCL score and its domain scores were used as independent variables they were rescaled corresponding to the interquartile range of their score distributions as recommended (Babyak, 2009). Sample weights were created to account for the oversampling of reservists at phase 1, with regulars receiving a higher weighting, and to account for non response at phase 2. Participants with a lower probability of response to the questionnaire were assigned a higher weighting. All data analyses were conducted in STATA v11.2. Analyses presented here used survey commands, except for analysis in Table 4. Weighted percentages and odds ratios (OR) are presented in the tables with unweighted cell counts.

We chose risk factors that were associated with persistent PTSD in the logistic analysis to assess the sensitivity, specificity, and positive likelihood ratio (PLR) and negative likelihood ratio (NLR) of these factors to predict persistent PTSD (Deeks and Altman, 2004). We chose those variables with an OR of three or more as they were the variables most likely to have a predictive value.

Ethical approval for both phases of the study was granted by the Ministry of Defence (Navy) personnel research ethics committee and the King's College Hospital local research ethics committee.

3. Results

The PCL scores at phase 1 tended to decrease by phase 2 in those with a PCL score of 30 or more (Table 1). The decrease was substantial, 70 (32%) had fully remitted (PCL score <30) and 82 (36%) partially remitted (PCL score 30–49) in those with possible PTSD in phase 1. However, there was an increasing linear relationship between score at phase 1 and score at phase 2 for those with possible PTSD at phase 1 (regression coefficient = 0.013, 95% CI 0.010–0.015). The length of time between phase 1 and phase 2

Table 1
Cross-tabulation of PCL scores grouped in categories at phase 1 and phase 2 of the study.[a]

Phase 1 PCL score	Phase 2 PCL score				
	17–29 *N* (%)[a]	30–39 *N* (%)	40–49 *N* (%)	50 and over *N* (%)	Total
17–29	4663 (89.78%)	343 (6.99%)	93 (1.88%)	65 (1.35%)	5164
30–39	381 (58.51%)	146 (21.70%)	67 (10.41%)	59 (9.37%)	653
40–49	106 (42.66%)	57 (22.49%)	37 (15.62%)	45 (19.23%)	245
50 and over	70 (31.76%)	48 (20.63%)	34 (15.04%)	78 (32.56%)	230
Total	5220 (82.28%)	594 (9.72%)	231 (3.86%)	247 (4.14%)	6292

[a] Percentages are weighted.

assessments was 3.33 years (SD 0.62). The differences between assessments were 3.33 years in the resilient group, 3.30 years in the persistent group, 3.43 years in the partially remitted group and 3.47 years in the remitted group. Of 6123 subjects in the study, 1028 were deployed to Iraq, 656 were deployed to Afghanistan and 230 were deployed to both Iraq and Afghanistan.

Those with persistent PTSD were less likely to be in the Naval Services, but more likely to have experienced risk to self events, to have felt unsupported on return from deployment, and to have perceived their health to be poor or fair than the resilient group (Table 2). Persistent, partially remitted and remitted PTSD cases were less likely to be commissioned officers, but more likely to report higher levels of childhood adverse family relationship, childhood antisocial behavior and to have spent more time in a forward area. There was a higher prevalence of psychological distress, MPS and AUDIT score of 16 or more in the PTSD groups than in the resilient group. Those in the persistent and partially remitted PTSD groups were less likely to have deployed with a parent unit than the remitted PTSD group i.e. they deployed but as individuals. Those in the persistent PTSD group were more likely to have experienced more risk to self events and trauma involving others events than the partially remitted or fully remitted groups.

3.1. Comparison between persistent, partially remitted and remitted PTSD (multinomial analysis)

Those with persistent presumed PTSD were more likely to be older, have higher than General Certificates of Secondary Education (GCSE) qualifications, be discharged from service, have felt unsupported on return from deployment, to have deployed as individuals not with a parent unit, to report MPS and poorer health and have high hyper-arousal score, but were less likely to be in the Naval Services than the fully remitted cases (Table 3). The only measure of trauma exposure that was associated with the course of PTSD was risk to self events and then only just (p-value for trend = 0.04). Adjustment for a possible deployment effect between phase 1 and phase 2 did not change any of the associations already established (Table 3). The effect sizes of the significant associations were intermediate (OR between two and four for binary variables), except for deployed but not with a parent unit and feeling unsupported (effect size five or more). Partially remitted PTSD was only associated with being deployed but not with parent unit, more likely to deploy in phase 1 and to have psychological distress.

3.2. Predicting persistent possible PTSD

We assessed if the significant risk factors for persistent PTSD compared to remitted PTSD singly or cumulatively would have predicted those whose phase 1 presumed PTSD would persist at phase 2. The PLRs were low (below 2.5 and for most predictors below two) (Table 4). The NLR were moderately below one, though lower for feeling unsupported and being older than 25 years. These results were expected given the moderate sensitivities and specificities, or in the case of feeling unsupported and age (greater than 25 years), high sensitivity but low specificity.

The cumulative number of conditions only moderately increased the PLR, but at least four conditions increased the PLR to 7.6 (Table 4). The NLRs were substantially below one in those with two or three risk factors.

4. Discussion

The main finding is that several risk factors were independently associated with persistent presumed PTSD compared to the fully remitted group: feeling unsupported, MPS, perception of poor or fair health, older age, education level above GCSE, being discharged from service, having deployed but not with a parent unit, and a perception of risk to self during deployment. Nevertheless, the factors with an odds ratio of three or more had only a marginal impact on predicting persistence of PTSD. Having deployed but not with a parent unit, having deployed at phase 1 and psychological distress were associated with partially remitted PTSD. The fully remitted group was compared to the partially remitted and the persistent group separately because those with a PCL score between 30 and 49 would suffer some functional impairment despite scoring below the cutoff for probable PTSD (Rona et al., 2009b).

The importance of distinguishing the cases that will remit from those that will not was clear in this study – two thirds of those with a PCL score of 50 or more at phase 1 had a score below 50 at follow up, and slightly less than half of those would have a PCL score of less than 30. Others have found that the recovery rates vary from 31% to 68% (Boscarino and Adams, 2009; Dohrenwend et al., 2006; Dunmore et al., 1999; Koenen et al., 2003; North et al., 1997; Schnurr et al., 2004; Solomon, 1989; Solomon et al., 1989; Wolfe et al., 1999). Blanchard et al. (1996a) in their study of road traffic accidents showed that the recovery rate of PTSD during the first year was more than 50%, but remained stable over the next 6 months. The recovery rate assessed at the two points in our study corresponds to their 18 months PTSD recovery rate.

4.1. PTSD recovery rates

Most studies agree that persistent PTSD is associated with the initial severity or initial PCL score (Blanchard et al., 1996a; Marshall and Schell, 2002). The association between PCL score at phase 1 and persistent PTSD did not reach statistical significance. We found that only hyper-arousal among the PCL criteria was associated with persistent PTSD. Two studies that have explored PTSD domains found that hyper-arousal is related to persistent PTSD (Blanchard et al., 1996a; Schell et al., 2004).

4.2. Characteristics of PTSD, comorbidities and quality of life

Comorbidities are important contributors in the maintenance of PTSD (Bremner et al., 1996; Koenen et al., 2007; Schindel-Allon et al., 2010). In our study MPS, and poor or fair health perception were associated with persistent possible PTSD. Neither of these associations has been studied before. Alcohol misuse was not associated with persistence in our study in contrast to others (Bremner et al., 1996; Koenen et al., 2003). Perhaps an AUDIT score of 16, although indicating high level of alcohol problems, is too common in the UK military. Likewise we could not find an association between persistent PTSD and GHQ-12 caseness, but others

Table 2
Demographic, service, childhood adversity, deployment experience, post deployment support and health variables by PTSD status ($N = 6123$).[a]

Phase 1 demographic, service and health characteristics	Resilient	Persistent	Partially remitted	Remitted
	N (%)	*N* (%)	*N* (%)	*N* (%)
	$N = 5893$ (96.0)	$N = 78$ (1.3)	$N = 82$ (1.4)	$N = 70$ (1.3)
Males	5234 (90.5%)	71 (91.5%)	75 (92.3%)	64 (92.4%)
Age band (years)				
<25	643 (14.5%)	7 (12.4%)	16 (26.6%)	21 (37.9%)
25–29	972 (18.7%)	14 (20.9%)	15 (20.5%)	7 (10.1%)
30–34	1361 (23.2%)	20 (24.6%)	20 (22.6%)	16 (22.3%)
35–39	1261 (20.2%)	20 (23.8%)	17 (17.7%)	11 (13.2%)
≥40	1656 (23.3%)	17 (18.3%)	14 (12.7%)	15 (16.5%)
Education level				
No qualification or GCSE	2281 (43.9%)	35 (46.3%)	41 (56.6%)	43 (66.7%)
Marital status				
In long term relationship	4677 (78.8%)	48 (59.7%)	59 (71.1%)	45 (62.9%)
Service				
Naval Services	982 (17.0%)	5 (5.9%)	15 (18.9%)	11 (17.1%)
Army	3666 (61.7%)	60 (76.2%)	58 (70.9%)	49 (70.2%)
RAF	1245 (21.3%)	13 (17.9%)	9 (10.3%)	10 (12.7%)
Rank: Commissioned Officer	1492 (21.2%)	8 (9.1%)	7 (7.1%)	5 (5.9%)
Enlistment status: Regular	4899 (91.3%)	62 (88.5%)	66 (90.2%)	61 (93.9%)
Serving status: Discharged	1752 (29.0%)	44 (58.7%)	37 (45.1%)	25 (35.6%)
Childhood adverse family relationship score				
0/1	3793 (65.9%)	33 (44.6%)	33 (41.9%)	37 (54.6%)
2/3	1115 (19.5%)	16 (17.3%)	19 (24.7%)	12 (18.6%)
≥4	837 (14.6%)	26 (38.2%)	25 (33.4%)	19 (26.8%)
Childhood antisocial behavior	846 (15.8%)	22 (28.0%)	24 (34.2%)	22 (33.3%)
Deployment at Phase 1	3963 (68.5%)	51 (63.9%)	65 (79.8%)	43 (59.7%)
Role on deployment[b]				
Combat	844 (23.6%)	14 (31.8%)	23 (38.4%)	15 (36.6%)
Combat support	429 (11.5%)	6 (12.9%)	7 (13.5%)	3 (7.6%)
Combat service support	2607 (64.9%)	30 (55.4%)	34 (48.1%)	25 (55.9%)
Deployed with parent unit[b]	2174 (60.6%)	21 (48.4%)	31 (50.7%)	32 (80.1%)
Time in a forward area[b]				
None	1969 (51.0%)	13 (25.4%)	15 (22.7%)	13 (29.0%)
Up to 1 week	429 (11.6%)	4 (8.1%)	10 (17.2%)	6 (14.6%)
More than 1 week	1392 (37.4%)	32 (66.5%)	39 (60.1%)	23 (56.4%)
Risk to self events[b]				
0	1286 (32.9%)	4 (9.6%)	14 (23.2%)	12 (24.2%)
1	1177 (30.2%)	9 (20.5%)	16 (23.2%)	12 (28.7%)
2	724 (18.8%)	9 (17.2%)	12 (20.2%)	5 (11.8%)
3 to 5	658 (18.1%)	24 (52.8%)	22 (33.4%)	14 (35.3%)
Trauma involving others[b]				
0	2138 (55.2%)	13 (26.9%)	20 (31.5%)	12 (28.7%)
1	584 (15.8%)	8 (15.9%)	14 (24.2%)	11 (26.6%)
2	460 (12.1%)	9 (16.0%)	10 (15.4%)	5 (11.2%)
3–9	692 (16.9%)	20 (41.2%)	20 (28.9%)	15 (33.5%)
Thought might be killed[b]	1918 (49.3%)	46 (92.2%)	49 (76.2%)	36 (80.7%)
Felt unsupported on return from deployment[b]	764 (21.2%)	39 (83.6%)	38 (59.7%)	17 (41.5%)
Health interfered with social activities: Quite a bit to extremely	357 (6.1%)	36 (46.6%)	42 (53.4%)	28 (40.1%)
GHQ case: score 4 or more	979 (16.7%)	68 (87.2%)	76 (94.7%)	57 (77.8%)
MPS: 18 or more symptoms	475 (8.3%)	64 (81.1%)	49 (57.9%)	43 (58.4%)
AUDIT: score 16 or more	692 (13.2%)	36 (49.1%)	38 (52.5%)	25 (38.9%)
Health perception: Fair or poor	587 (10.1%)	39 (51.5%)	27 (33.1%)	20 (27.2%)
Deployed between phases 1 & 2	1864 (34.1%)	15 (22.2%)	18 (23.9%)	19 (28.7%)

Numbers might not add up to totals because of missing data.
GCSE = General Certificates of Secondary Education (usually taken at school leaving age); RAF = Royal Air Force; GHQ = General Health Questionnaire; MPS = Multiple physical symptoms; AUDIT = Alcohol Use Disorders Identification Test.
[a] New PTSD cases have been excluded from this table as explained in the text.
[b] The denominator which applies to variables related to deployment is 4122 (68.5% weighted) of the total 6123.

have found an association between persistent PTSD and depression (Koenen et al., 2003; Schindel-Allon et al., 2010). The GHQ-12 assesses psychological distress rather than depression *per se*. The studies so far published indicate that comorbidities are important factors that will affect the persistence of PTSD, but it may be that the effect is non-specific so that any comorbidity may prevent individual recovery.

This study and another did not find an association between functional impairment, as a measure of quality of life, and persistence of PTSD (Schnurr et al., 2006).

4.3. Trauma intensity, homecoming support and other factors

A feeling of being unsupported was strongly associated with persistence of PTSD symptoms in our study and others have also reported this association (Koenen et al., 2003; Schnurr et al., 2004; Solomon et al., 1989), but not all studies have found such an association (Boscarino and Adams, 2009; Laffaye et al., 2008). This is an area of importance as the associations in our and another study (Schnurr et al., 2004) were substantial in the adjusted analysis which suggests that social support may modify the prognosis of PTSD.

Table 3
The association between PTSD status and phase 1 demographic, service, deployment, post deployment support and health variables,[b] comparing partially remitted or persistent PTSD to remitted PTSD ($N = 230$) (Multinomial logistic regression).

Variable obtained at phase 1	Partially remitted compared to remitted		Persistent compared to remitted	
	Unadjusted OR (95% CI)	Adjusted[a] OR (95% CI)	Unadjusted OR (95% CI)	Adjusted[a] OR (95% CI)
Sex				
Male	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Female	1.01 (0.31–3.29)	0.66 (0.15–2.86)	1.13 (0.34–3.70)	0.81 (0.24–2.77)
Age band				
<25	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
25–29	2.92 (0.94–9.07)	4.01 (1.02–15.77)	6.36 (1.78–22.75)	6.48 (1.73–24.27)
30–34	1.44 (0.56–3.71)	1.46 (0.55–3.89)	3.37 (1.12–10.12)	3.60 (1.19–10.94)
35–39	1.91 (0.68–5.34)	1.67 (0.54–5.11)	5.51 (1.74–17.46)	5.62 (1.46–21.65)
40 or over	1.10 (0.40–3.04)	0.73 (0.21–2.52)	3.40 (1.09–10.54)	2.04 (0.59–7.05)
Education level				
No qualifications or GCSE	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Higher than GCSE	1.54 (0.77–3.09)	1.40 (0.60–3.24)	2.33 (1.15–4.71)	2.74 (1.23–6.08)
Marital Status				
In relationship	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Single or ex relationship	0.69 (0.34–1.41)	0.55 (0.24–1.23)	1.14 (0.57–2.30)	1.39 (0.61–3.18)
Service				
Naval Services	1.09 (0.45–2.69)	1.01 (0.37–2.72)	0.32 (0.10–1.02)	0.19 (0.06–0.65)
Army	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
RAF	0.80 (0.29–2.20)	0.76 (0.24–2.40)	1.30 (0.51–3.33)	1.22 (0.43–3.45)
Rank				
Officer	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Other rank	0.82 (0.23–2.94)	0.55 (0.13–2.36)	0.62 (0.18–2.11)	0.63 (0.14–2.90)
Enlistment status				
Regular	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Reserve	1.67 (0.68–4.12)	1.49 (0.50–4.47)	1.99 (0.81–4.93)	1.30 (0.39–4.30)
Serving status				
Serving	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Discharged	1.49 (0.75–2.96)	1.59 (0.70–3.59)	2.57 (1.28–5.14)	2.97 (1.26–6.99)
Deployed phase 1	2.67 (1.25–5.68)	3.55 (1.49–8.46)	1.19 (0.59–2.39)	1.42 (0.65–3.10)
Deployed				
With parent unit	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Not with parent unit	3.91 (1.56–9.77)	5.32 (1.79–15.79)	4.29 (1.64–11.22)	5.63 (1.45–21.85)
Risk to self events during deployment				
0	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
1	0.84 (0.27–2.63)	0.84 (0.23–3.06)	1.80 (0.40–8.13)	1.68 (0.27–10.42)
2	1.78 (0.45–7.00)	2.41 (0.52–11.19)	3.66 (0.68–19.62)	2.45 (0.32–18.73)
3 to 5	0.99 (0.34–2.91)	1.21 (0.34–4.25)	3.77 (0.93–15.23)	5.03 (0.85–29.61)
Post deployment support				
Supported	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Unsupported	2.09 (0.88–4.97)	1.86 (0.71–4.91)	7.17 (2.47–20.81)	10.97 (3.13–38.45)
PCL score/8	1.11 (0.74–1.66)	1.11 (0.72–1.71)	1.65 (1.08–2.53)	1.50 (0.96–2.35)
Re-experiencing/3	1.03 (0.80–1.33)	1.06 (0.80–1.40)	1.03 (0.80–1.34)	0.99 (0.74–1.32)
Avoidance/3	0.93 (0.74–1.17)	0.92 (0.72–1.17)	1.29 (0.99–1.69)	1.27 (0.95–1.69)
Hyper-arousal/3	1.32 (0.93–1.86)	1.33 (0.93–1.91)	1.59 (1.12–2.24)	1.53 (1.03–2.27)
GHQ case: score≥4				
no	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
yes	5.14 (1.62–16.27)	5.40 (1.57–18.51)	1.93 (0.76–4.92)	1.35 (0.50–3.67)
MPS				
no	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
yes	0.98 (0.49–1.93)	0.99 (0.47–2.06)	3.06 (1.39–6.71)	3.36 (1.44–7.82)
Audit score 16 or more				
no	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
yes	1.74 (0.88–3.45)	2.05 (0.91–4.62)	1.52 (0.76–3.03)	1.78 (0.82–3.86)
Health perception				
good to excellent	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
fair or poor	1.32 (0.64–2.74)	1.71 (0.79–3.72)	2.84 (1.38–5.82)	2.84 (1.28–6.27)
Deployed between Phase 1 and Phase 2	0.78 (0.36–1.68)		0.71 (0.23–1.57)	

GCSE = General Certificates of Secondary Education (usually taken at school leaving age); RAF = Royal Air Force; GHQ = General Health Questionnaire; MPS = Multiple physical symptoms; AUDIT = Alcohol Use Disorders Identification Test; PCL = Posttraumatic stress disorder checklist.

[a] Models adjusted for sex, age, level of education, marital status, service, rank, enlistment status and deployment between time 1 and time 2 assessments.

[b] The unadjusted and adjusted associations between persistent PTSD and each of the variables: Childhood adverse family relationship score, childhood antisocial behavior, role during deployment, time in a forward area, trauma involving others, thought might be killed, were statistically non-significant and were omitted from the table. Mental health comorbidities were left in the table even if not significant.

We found that persistent possible PTSD was related to having been discharged from service. It is known that in hospitalized personnel, mental disorders are the leading cause of separation from the military (Hoge et al., 2002, 2005). Contrary to expectations, it has not been reported that persistent in contrast to remitted PTSD is a risk factor for early separation. The number discharged for a mental disorder in the UK Armed Forces is small ($N = 164$ in total in 2009, 35 of them with PTSD)(DASA Health Information, 2011), although it is likely that this hides a larger number who are discharged under other labels such as service-related medical conditions, misconduct, unauthorized work absence, and unsatisfactory performance (Hoge et al., 2005).

Table 4
Multiple symptom caseness, feeling unsupported, age above 25 yrs, deploying but not with parent unit at phase 1 and having left service as predictors of persistent PTSD (vs. fully remitted PTSD) by phase 2 (with 95% confidence intervals).

Variables	*N* (%)	Positive likelihood ratio	Negative likelihood ratio	Sensitivity %	Specificity %
Multiple Symptoms ≥18	107/148 (72.3)	1.34 (1.08–1.65)	0.47 (0.27–0.81)	82.1 (71.7–89.8)	38.6 (27.2–51.0)
Feeling unsupported[a]	56/85 (65.9)	1.85 (1.27–2.70)	0.31 (0.15–0.62)	83.0 (69.2–92.4)	55.3 (38.3–71.4)
Age more than 25 years	120/148 (81.1)	1.3 (1.10–1.54)	0.30 (0.14–0.66)	91.0 (82.4–96.3)	30.0 (19.6–42.1)
Deployed but not with parent unit[a]	39/92 (42.4)	2.44 (1.35–4.40)	0.55 (0.38–0.80)	58.0 (43.2–71.8)	76.2 (60.5–87.9)
Left service	69/148 (46.6)	1.58 (1.09–2.29)	0.68 (0.50–0.92)	56.4 (44.7–67.6)	64.3 (51.9–75.4)
Cumulative measure of variables above					
At least 2 factors	76/84 (90.5)	1.14 (0.98–1.33)	0.26 (0.06–1.23)	95.7 (85.5–99.5)	16.2 (6.19–32.0)
At least 3 factors	61/84 (72.6)	1.74 (1.25–2.42)	0.22 (0.09–0.53)	89.4 (76.9–96.5)	48.6 (31.9–65.6)
At least 4 factors	32/84 (38.1)	7.61 (2.51–23.0)	0.42 (0.29–0.61)	61.7 (46.4–75.5)	91.9 (78.1–98.3)
At least 5 factors	14/84 (16.7)	[b]	0.70 (0.58–0.85)	29.8 (17.3–44.9)	100 (90.5–100)

[a] The items related to support and deploying but not with parent unit do not apply to those who had not deployed at phase 1 of the study.
[b] The positive likelihood ratio cannot be estimated because specificity is 100%.

Alternatively, veterans may feel freer to endorse PTSD symptoms once they are not part of the military and finally, the comradeship within the military and the feeling of belonging may have a beneficial effect on the course of PTSD.

We measured trauma intensity based on role during deployment, time spent in a forward area and potentially traumatic experiences involving danger to self or others. Only one (risk to self), was associated with persistent PTSD and then only marginally. Others have reported a stronger association between intensity of trauma and persistent PTSD (Boscarino and Adams, 2009; Schnurr et al., 2004). This type of construct may be better explored in a structured interview than using a self-administered questionnaire as in our study.

In contrast to the lack of association between combat experiences and persistent PTSD, having deployed but not with a parent unit was associated with both persistent PTSD and partially remitted PTSD. There are many reasons for deploying as an individual rather than with a parent unit. A possible explanation for this consistent finding may be a feeling of not belonging to the unit with which the service member deployed and possible alienation on reintegration with the parent unit. Another factor which may affect recovery is that those who deployed as "augmentees" may feel at greater risk of being deployed again with the next unit they are posted to. Unexpectedly, those aged 25 years or over were more likely to have persistent PTSD. We have not seen this reported elsewhere – in contrast another report showed that younger individuals are more likely to have persistent symptoms (Dunmore et al., 1999).

4.4. Predicting persistent PTSD

In spite of the intermediate or strong effect size of several variables associated with persistent presumed PTSD, the PLR and NLR of each factor separately demonstrated only a modest ability to predict persistent PTSD. We may have the ability to predict persistent PTSD in those with at least four of the risk factors present, but our estimate lacks precision because the 95% confidence interval was wide. Thus we have limited ability to predict persistence in an individual with PTSD. It is of course possible that a different set of variables would perform better in prediction. For example, we did not measure mental defeat or symptom appraisal, as suggested by Dunmore et al. (1999). However, we doubt that the list of variables proposed by Simon (Simon, 1999) would strongly predict persistent PTSD because many of his checklist variables were assessed in our and other studies without demonstrating a strong effect size (Boscarino and Adams, 2009; Laffaye et al., 2008; Schnurr et al., 2006, 2004).

4.5. Strengths and weaknesses

The strengths of this population study are its size and longitudinal design. The use of the same PCL measure in phases 1 and 2 is also a strength, with the added advantage that it allows comparisons with other studies. The response rate of 68% is satisfactory, in comparison to other military studies, particularly since we have demonstrated that response to follow up was unrelated to mental health status at phase 1. However, as in any study those who did not respond to the questionnaire would contribute to uncertainty in the findings.

Although the number of presumed PTSD cases at baseline ($N = 230$) is not large, we were able to find a large number of risk factors associated with our outcomes after adjustment for demographic and service factors. It is worth noting that with our design we do not know the proportion of those in the remitted group that may suffer relapses over time nor do we know if some of the persistent PTSD cases have suffered a relapse only at the time of assessment. We recognize that the PCL does not provide a clinical diagnosis of PTSD despite its solid psychometrics characteristics and its satisfactory validity against more comprehensive diagnostic instruments. Regression to the mean may have occurred in those with high PCL score, but should not have affected our results because the reference group, remitted PTSD, in this study had to decrease their PCL score by at least 20 points.

Follow up period should be a consideration when comparing studies. In our study the period between assessments was three years; other longitudinal studies have had shorter follow up, ranging from three to twelve months (Laffaye et al., 2008; Schell et al., 2004; Schindel-Allon et al., 2010; Solomon et al., 1989) or much longer, 14–26 years, between assessments (Koenen et al., 2003). Persistent PTSD with different periods of follow up may represent different durations of the condition and the strength of the association for any specific risk factor may vary by period between assessments, although a study found that the rate of PTSD remains stable after a year (Blanchard et al., 1996a).

4.6. Implications

Our study emphasizes the importance of addressing comorbidity as well as PTSD itself in the treatment of persistent PTSD. The perception of feeling unsupported, especially in those who have left the military, and a feeling of isolation in those who did not deploy with their parent unit are also important considerations to address as these factors may delay PTSD recovery.

Our study, as many others, has shown that for a large proportion of those with PTSD, their symptoms remit over time. We assume that a large proportion, if not most, have not received health care support as many studies have demonstrated that no more than 40% of military personnel access health services for their PTSD symptoms (Iversen et al., 2011; Sareen et al., 2007). The limited ability to predict those who will follow a protracted PTSD course has implications for the case for mental health screening within the military, particularly

given the relatively low prevalence that we have shown in the UK. However, only a randomized controlled trial (RCT) such as the one we are currently conducting will definitely address this question.

In conclusion our study demonstrates a large number of factors that may contribute to the persistence of PTSD, but they have only a modest value in predicting who is most likely to follow a protracted course.

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Contributors

Roberto Rona was a principal investigator, planned and sought funding for the study, designed the analysis and drafted the paper. Margaret Jones participated in the conduct of research, carried out the analysis, and wrote the paper. Joselin Sundin and Laura Goodwin participated in the planning of the study, and contributed to the analytical strategy of the paper. Lisa Hull participated in the conduct and planning of the study. Simon Wessely was a principal investigator, sought funding, planned and supervised aspects of data collection. Nicola Fear was a principal investigator, participated in the planning, conduct and analysis of the paper. All authors revised critically each draft of the paper and approved the final version.

Conflict of interest

Simon Wessely is Honorary Civilian Consultant Advisor in Psychiatry to the British Army and a Trustee of Combat Stress, a UK charity that provides services and support for veterans with mental health problems. All other authors declare no competing conflict of interest.

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