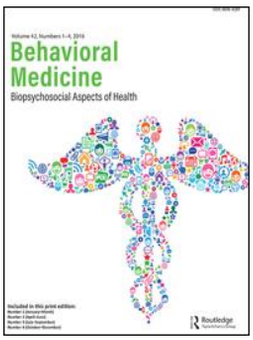

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Combat Experiences and their Relationship to Post-Traumatic Stress Disorder Symptom Clusters in UK Military Personnel Deployed to Afghanistan

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ABSTRACT

The association of post-traumatic stress disorder (PTSD) symptom clusters with combat and other operational experiences among United Kingdom Armed Forces (UK AF) personnel who deployed to Afghanistan in 2009 were examined. Previous studies suggest that the risk of developing PTSD rises as combat exposure levels increase. To date, no UK research has investigated how specific classes of combat and operational experiences relate to PTSD symptom clusters. The current study was a secondary analysis of data derived from a two-arm cluster, randomized-controlled trial of a postdeployment operational stress-reduction intervention in deployed UK AF personnel. 2510 UK AF personnel provided combat exposure data and completed the PTSD checklist (civilian version) immediately post-deployment while 1635 of the original cohort completed further followed-up measures four to six months later. A 14-item combat experience scale was explored using principle component analysis, which yielded three main categories of experience: (1) violent combat, (2) proximity to wounding or death and (3) encountering explosive devices. The association of combat experience classes to PTSD 5-factor "dysphoric arousal" model (re-experiencing, avoidance, numbing, dysphoric-arousal and anxious-arousal symptoms) was assessed. Greater exposure to violent combat was predictive of re-experiencing and numbing symptoms, while proximity to wounding or death experiences were predictive of re-experiencing and anxious-arousal symptoms. Explosive device exposure was predictive of anxious-arousal symptoms. The present study suggests that categories of combat experience differentially impact on PTSD symptom clusters and may have relevance for clinicians treating military personnel following deployment.

KEYWORDS

Afghanistan; combat exposure; military personnel; post-traumatic stress disorder; United Kingdom

Introduction

When untreated, post-traumatic stress disorder (PTSD) can be a chronic and disabling psychiatric condition that develops following exposure to events such as combat, interpersonal violence, accidents and/or natural disaster.[1,2] The fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV-TR*) details PTSD as 17 symptoms grouped in three clusters.[3] The clusters represent (1) re-experiencing of the traumatic event(s) (criterion B), including intrusive thoughts, recurrent nightmares, "flashbacks," emotional and physiological reactivity; (2) avoidance and emotional numbing (criterion C), including avoiding thoughts and/or reminders of trauma, inability to experience pleasure, feeling unresponsive to surroundings, feeling estranged from others, sense of foreshortened future and feeling detached from others; and (3) hyperarousal (criterion D), including sleep disturbance, irritability/anger, difficulty concentrating, hypervigilance and exaggerated startle responses.[3]

The structure of PTSD (criteria B, C and D) in *DSM-IV-TR* (and previous versions) was established through theoretical discussion among academics.[4] Over the past decade, researchers have raised concerns about whether the theoretical PTSD structure adequately represents the core constructs and dimensions of PTSD.[4–8] Several studies used confirmatory factor analysis to examine the underlying factor structure of PTSD and propose a 5-factor "dysphoric arousal" model which provides a better model fit than either 4-factor "dysphoria" or "numbing" models and the previous 3-factor *DSM-IV-TR* model.[5,7–9]

The 5-factor "dysphoric arousal" model comprises five first-order factors corresponding to re-experiencing (criterion B–5 symptoms), avoidance (criterion C–2 symptoms), numbing (criterion C–5 symptoms), dysphoric-arousal (criterion D–3 symptoms) and anxious-arousal (criterion D–2 symptoms).[5,6,8,9] This symptom categorization was derived from compelling evidence that avoidance and numbing symptoms (criterion C), relate to two competing mechanisms and psychological

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reactions that can occur in response to trauma. Avoidance appears to be regulated by efforts to escape stimuli, which are similar to or represent the initial trauma (symptoms C1–C2), whereas numbing occurs as an automatic response to hyperarousal (symptoms C3–C7).[6,9] Other studies suggest that hyperarousal (criterion D) represents two post-trauma reactions, representing firstly restlessness and agitation (symptoms D1–D3), and secondly fear-based, panic-like anxiety (symptoms D4–D5).[6,8–10]

A core requirement in the *DSM-IV-TR* diagnosis of PTSD is the emergence of a distinct constellation of symptoms occurring in response to a traumatic event (s).[3,11] Since 2001 and 2003, respectively, the United Kingdom Armed Forces (UK AF) have undertaken combat deployments in Afghanistan and Iraq where traumatic exposure frequently occurred.[12] Operations in Afghanistan involved counter-insurgency operations in both countryside and urban environments, which included ambushes, encountering improvised explosive devices (IEDs) and other forms of asymmetric threat such as suicide bomber attacks and snipers.[12–14] In the context of symptom development, studies suggest that the severity of PTSD symptoms is often proportional to the intensity and duration of traumatic experiences such as those encountered in Iraq and Afghanistan.[13,15,16]

Numerous studies have examined the contribution of specific aspects of the warzone environment to psychiatric problems.[17–20] Four operational factors were found to be associated with PTSD in American Vietnam veterans; traditional combat, participating in atrocities and abusive violence, heightened subjective threat and experiencing a malevolent environment.[21] Fontana and Rosenheck provided a rationale for discriminating between various warzone stressors when assessing the differential contribution to PTSD symptoms.[22] These authors separated combat into five experiences: fighting, killing others, threat of death or injury to oneself, death or injury of others, and participating in atrocities; and contrasted the latter with noncombat factors such as experiencing a malevolent environment: physically harsh conditions and shortage of resources. Each factor was thought to make a discrete contribution to PTSD symptoms.[22]

During the past decade, additional efforts have been made to further develop the understanding of how the warzone environment may affect military personnel serving in Afghanistan and Iraq.[13,15,16,23–26] Military research conducted in the United States and Canada has assessed combat and operational experiences using up to 37 potential warzone experiences.[23–26] Factor analysis of the various combat exposure scales yielded central factors such as direct involvement in various forms of combat, witnessing trauma, exposure to death and injury, and more peripheral experiences.[23–26] Further studies examined the contribution of discrete combat experiences to PTSD caseness; however, combat experiences such as discharging a weapon or clearing homes/buildings tended to cluster producing a collective rather than individual contribution to PTSD symptoms.[26,27]

In this study, to further the understanding of the relationship between combat experiences and PTSD symptoms, we examined whether certain specific elements of combat and operational deployment would be associated with each of the symptom clusters in the 5-factor "dysphoric arousal" model (re-experiencing, avoidance, numbing, dysphoric-arousal, and anxious-arousal) at a later time.

Our first hypothesis (H1) was that violent combat would be associated with intense arousal represented by PTSD dysphoric-arousal and anxious-arousal symptoms. This hypothesis emerges from several military studies that found higher levels of combat exposure resulted in increased aggression, difficulty concentrating, hypervigilance, and exaggerated startle responses.[28–32]

The second hypothesis (H2) was that proximity to death and injury would give rise to feelings of horror and helplessness that could theoretically be associated with avoidance and numbing symptoms. This was suggested by studies of emergency medical teams experiencing high levels of trauma who use avoidance coping strategies to deal with fear and anxiety while at work.[33]

The third hypothesis (H3) states that exposure to landmine and/or IED attacks would give rise to horror and intense physical responsiveness immediately after the strike and subsequent anxious apprehension and hypervigilance while patrolling, while multiple exposure to IED events could result in a sense of helplessness. We therefore hypothesized that such complex reactions could be associated with symptoms in all five clusters. There is some research evidence that the indiscriminate wounding of IED attacks causes emotional damage.[34–36]

Methods

Participants

This study was a secondary analysis of a two-arm cluster, randomized-controlled trial (cRCT) of data comparing a UK version of US post-deployment BATTLEMIND training with a post-deployment stress and homecoming educational briefing. The participants were members of the three branches of the UK AF, predominantly Royal Marine Commandos and Army personnel, returning from an operational deployment in Afghanistan via a post-operational decompression facility in Cyprus. The

original study was conducted among personnel who had deployed to mainly forward-facing, high threat areas who had experienced generally high rates of exposure to traumatic and combat events; some personnel serving predominantly in main base areas were also included.[37]

Procedures

Sample

A total of 9000 UK AF personnel were deployed to Afghanistan during a 6-month period in 2009. From this group, a representative cohort of 2510 was sampled at baseline and provided data for the current study. The study participants were mainly combat personnel; of the baseline respondents, 1635 responded at follow-up. The cluster randomization in the original study was at company level (approximately 100 personnel per company). Study participants completed a survey during either 24-hour or a 36-hour period of structured rest that took place immediately before returning home. Sociodemographic, military, and clinical data were recorded prior to receiving a psycho-educational briefing; a follow-up survey took place around 4 to 6 months after returning home.[37]

Ethical approval

The cRCT study received approval from both the Ministry of Defence Research Ethics Committee and King's College Hospital Research Ethics Committee. All participants involved in the research gave written informed consent to participate in the cRCT and for their data to be used for research purposes.[37]

Measures

Sociodemographic characteristics included information regarding the age and sex of participants, while military characteristics comprised military service (Royal Navy, Royal Marine Commandos, Army, and Royal Air Force), engagement type (regular or reserve forces), rank, length of military service, and number of operational tours undertaken in the past 5 years.[37]

Combat exposure and operational deployment experiences were assessed at baseline with a 14-item measure derived from a US combat experience scale of 37 items designed to measure combat and operational events during deployment in Afghanistan and/or Iraq.[15,37] The significant reduction in the number of items in the UK version resulted from the exclusion of factors that were not relevant so that the modified scale better reflected the specific operational activities of UK personnel serving in Southern Afghanistan at the time of the original trial. The UK version of the questionnaire included combat and operational experiences such as coming under small arms fire, artillery fire, rocket attacks, seeing personnel being seriously wounded or killed, landmine and IED strikes, or encountering sniper fire.[13,37] The combat exposure scale scores ranged from one (never) to five (10 plus times), yielding total scores ranging from 14 to 70 with higher scores representing greater exposure to combat events. The inclusion of an intensity scale in the UK study allowed for frequency and intensity to be assessed. Similar combat exposure scales have been used in other UK military studies.[13,37] The internal consistency of the combat exposure scale is high (Cronbach's alpha = 0.90).

As in many other UK military studies,[13,38] PTSD symptoms were measured using the National Center for Posttraumatic Stress Disorder Checklist–Civilian Version (PCL-C).[39] Respondents are asked to rate how much they were troubled in the last month by 17 PTSD symptoms using a 5-point scale; "not at all" responses were scored one and "extremely" responses scored five.[39] The PCL-C assesses three hypothesized dimensions of PTSD.[3,39] In this study, we categorized symptoms using the 5-factor dysphoric arousal model proposed by Elhai and colleagues, which comprises first-order factors corresponding to re-experiencing, avoidance, numbing, dysphoric-arousal, and anxious-arousal symptom clusters.[7–9] Overall caseness was not evaluated, rather, scores relating to the five PTSD symptom clusters were assessed independently. In the current study, the internal consistency of the scale for re-experiencing, as measured by the Chronbach's alpha was 0.86 at baseline and 0.88 at follow-up, for avoidance it was 0.69 at baseline and 0.72 at follow-up, for numbing it was 0.81 at baseline and 0.86 at follow-up, for dysphoric-arousal it was0 .77 at baseline and 0.81 at follow-up, and for anxious-arousal it was 0.75 at baseline and 0.78 at follow-up.

As common mental disorder (CMD) symptoms and alcohol misuse are often comorbid with PTSD symptoms, the confounding effects of both factors were adjusted for in the analyses.[40] CMD symptoms were assessed using the 12-item General Health Questionnaire (GHQ-12). Symptoms were rated using a 4-point scale, with escalating intensity of responses being scored 0, 0, 1, or 1 respectively. The scores were then summed, to give scores ranging between 0 and 12. Those individuals who scored $\geq$ 4 were considered possible "clinical cases."[41,42] Hazardous and harmful patterns of alcohol consumption were measured with the 10-item World Health Organization's Alcohol Use Disorders Identification Test (AUDIT-10). The AUDIT is rated with a 5-point scale yielding scores ranging from 0 to 40. Participants in the study were considered to be hazardous drinkers when they scored $\geq$ 8 on the measure.[43]

Because military personnel are not allowed to drink alcohol during deployment, this measure was not administered at baseline, only at follow-up.

Statistical analysis

Analyses were performed using the IBM Statistical Software Package for Social Sciences (SPSS) version 21 for Mac OS X. Statistical significance was $p < 0.05$.[44] Frequencies and descriptive statistics were generated for demographic and military characteristics, combat experiences, and PTSD symptoms. Principle component analysis (PCA) was used to reduce the combat experiences scale to key constituents.[44,45] The PCA aimed to identify new meaningful underlying variables with minimal loss of information.[44] Three components with item coefficient scores > 0.40 were retained in the model: (1) violent combat experiences, (2) proximity to wounding and death experiences, and (3) landmine and IED experiences. Scores for the individual items comprising the 3 components of the combat experiences scale were summed and tertiles were generated to compare low, medium, and high levels of exposure to each of the three components.[44] Five PTSD symptom cluster scores were also compared by generating tertiles within each of the PCL-C symptom clusters. We merged the lower and middle tertile scores for combat exposure and PTSD symptom clusters to compare with scores above the upper tertile. Unadjusted and adjusted binary logistic regression analyses were used to calculate odd ratios (OR) with 95% confidence intervals (95% CI) for associations between different levels of combat experiences and PTSD symptom clusters while adjusting for alcohol use and CMD, sociodemographic and military factors. The Wald statistic was used to assess the strength of association between independent and dependent variables.[44]

Results

Demographic characteristics of UK military personnel deployed to Afghanistan

A total of 2510 UK AF personnel provided baseline data, of who 1635 responded at follow-up (65.1% response rate). Because we sought to evaluate the long-term mental health effects of combat experiences, we examined demographic and military characteristics at follow-up. The majority of respondents were male (98.2%) and 39.4% were younger than 25 years. Most of the sample were regular forces (96.8%), deployed in a combat role (47.5%) and were of junior rank (69.7%). A total of 58.4% of the sample were Army personnel while 39.1% were Royal Marine Commandos (Table 1).

Table 1. Sociodemographic and Military Characteristics of Military Personnel who Provided both Baseline and Follow-up Data.

Variable n(%)	Sample (n = 1635)
Sex	
Male	1606 (98.2)
Female	30 (1.8)
Age (years)	
18–24	645 (39.4)
25–29	463 (28.3)
30–34	227 (13.9)
35–39	197 (12.0)
40 +	103 (6.3)
Engagement type	
Regular	1076 (96.8)
Reserves	36 (3.2)
Combat role	
Combat	776 (47.5)
Combat support	493 (30.1)
Combat service support	365 (22.4)
Service	
Royal Navy	38 (2.3)
Army	955 (58.4)
Royal Air Force	3 (0.2)
Royal Marines	640 (39.1)
Rank	
Junior Rank	1139 (69.7)
Senior Non-Commissioned Officer	300 (18.3)
Commissioned Officer	196 (12.0)
Length of military service in months, *M* (*SD*)	4.43 (3.37)
Number of deployments in the past 5 years[a]	
One	678 (42.0)
Two	534 (33.1)
Three or more	402 (24.9)

[a]Including the current deployment

Frequency of combat experiences at baseline

The majority of military personnel (n = 2510) experienced multiple operational exposures during deployment ($M = 7$, $SD = 4$; range 0–14). The most frequently reported exposures were those related to violent combat experiences, particularly coming under mortar/artillery or rocket fire (84.7% of personnel exposed) or coming under small arms/rocket propelled grenade (RPG) fire (75.8% exposed). Encountering landmines and explosive devices was also relatively common with 53.9% of respondents reporting being near an exploding IED. The least frequently reported exposures were those related to proximity to wounding or death experiences, particularly having a colleague shot or hit nearby (28.5%), or handling human remains (27.1%) (Table 2).

Principal component analysis

The 14 combat and operational experiences scale items were entered into the PCA using an orthogonal Varimax rotation procedure to maximize the dispersion of factor loading.[44] Using Kaiser's criterion for factor extraction, all components with eigenvalues ≥ 1 and items with factors loading above 0.40 were retained in the model. Multicollinearity was not observed (determinant ≥

Table 2. Principle Component Analysis Results.

**Combat and Operational Experiences	Exposed *n* (%)	*Factor Loadings 1	2	3
Coming under small arms and/or RPG fire	1892 (75.8)	0.81		
Discharging a weapon in direct combat	1440 (57.7)	0.73		
Coming under mortar, artillery, or rocket attack	2113 (84.7)	0.70		
Clearing searching homes or buildings, caves, or bunkers	1312 (52.5)	0.69		
Encountering sniper fire	857 (34.3)	0.68		
Experiencing a threatening situation and being unable to respond due to rules of engagement	1010 (40.5)	0.52		
Experiencing hostility from civilians	1230 (49.3)	0.49		
Handling bodies	676 (27.1)		0.86	
Giving aid to wounded	886 (35.5)		0.82	
Seeing personnel seriously wounded or killed	1546 (61.9)		0.69	
Having a mate shot/hit who was near you	711 (28.5)		0.49	
See injured or sick women or children and being unable to help	801 (32.1)		0.44	
Experiencing a landmine strike	901 (36.1)			0.86
Experiencing an IED	1345 (53.9)			0.81

*Factor Loadings: (1) Violent Combat; (2) Proximity to Wounding or Death; (3) Encountering Explosive Devices.
**Data provided by baseline respondents ($n = 2510$).

0.00001) and the Kaiser-Meyer-Olkin measure of sampling adequacy was 0.91, indicating that patterns of correlations were relatively compact and yielded distinct and reliable factors.[44] Bartlett's test of sphericity indicated a significant relationship between all extracted factors ($p < 0.001$).[44] Three components were selected for retention, explaining 60.7% of the total model variance. All components comprised at least two items. Expert military opinion was sought to generate meaningful component labels. One factor explained 44.3% of the total model variance, which consisted of seven items representing violent combat experiences (eigenvalue = 6.2). Two additional factors explained 8.6% and 7.8% of total model variance respectively; the first consisted of 5 items characterized by proximity to wounding or death experiences (eigenvalue = 1.2) and the next of 2 items representing encounters with explosive devices (eigenvalue = 1.1). Items loading on the first factor (violent combat) were those representing exposure to small arms and RPG fire, discharging a weapon in a direct combat and coming under mortar, artillery or rocket attack. Items loading in the second factor (proximity to wounding or death) included experiences of handling bodies, giving aid to the wounded or seeing personnel seriously wounded or killed. The final component (encountering explosive devices) consisted of two items; encountering landmine strikes and exposure to IEDs (Table 2).

PTSD symptom clusters reported at baseline and follow-up

Compared to nonresponders, responders in the original study were significantly older, serving in the Army and less likely to be junior in rank; however, there were no significant differences between respondents and nonrespondents in measures of common mental disorder and PTSD symptoms.[37] In the current study, no significant differences were observed between baseline and follow-up rates of re-experiencing cluster PTSD symptoms (34.1% at both time points). The rate of reporting avoidance, numbing, and anxious-arousal was significantly higher at follow-up (26.0% versus 28.8%; 31.9% versus 41.2%; 32.0% versus 38.2%, respectively) while the rates of reporting dysphoric-arousal were significantly lower at follow-up (37.1% versus 35.4%) (Table 3).

Predictors of PTSD symptoms at follow-up

Univariate analyses suggested that more frequent exposure to violent combat and proximity to wounding and death experiences was significantly associated with higher levels of each of the five PTSD symptom clusters at follow-up. Encountering explosive devices was only significantly associated with re-experiencing, avoidance and anxious-arousal clusters at follow-up (Table 4). Re-experiencing symptoms, when adjusted for all observed confounders, were significantly associated with both violent combat experiences (Wald statistic = 4.02, $p < 0.05$), and with proximity to wounding or death experiences (Wald statistic = 12.03, $p < 0.001$). Numbing symptoms, when adjusted for all confounders, were significantly associated with violent combat experiences (Wald statistic = 8.53, $p < 0.01$). Anxious-arousal symptoms, when adjusted for all observed confounders, were significantly associated with both proximity to wounding or death experiences (Wald statistic = 8.75, $p < 0.01$)

Table 3. PTSD Symptom Cluster Scores at Baseline and Follow-up.

PTSD Symptom Cluster	Baseline Score* *n* (%) Sample ($n = 2510$)		Follow-up Score* *n* (%) Sample ($n = 1635$)	
Re-experiencing	≤ 6 1640 (65.9)	> 7 849 (34.1)	≤ 6 1067 (65.9)	> 7 551 (34.1)
Avoidance	≤ 2 1840 (74.0)	> 3 648 (26.0)	≤ 2 1152 (71.2)	> 3 465 (28.8)
Numbing	≤ 6 1692 (68.1)	> 7 793 (31.9)	≤ 5 951 (58.8)	> 6 666 (41.2)
Dysphoric-Arousal	≤ 4 1562 (62.9)	> 5 923 (37.1)	≤ 4 1045 (64.6)	> 5 572 (35.4)
Anxious-Arousal	≤ 3 1690 (68.0)	> 4 796 (32.0)	≤ 2 1000 (61.8)	> 3 617 (38.2)

*Lower cut-off scores relate to the lower and middle tertile; higher cut-off scores relate to the upper tertile.
Numbers may not sum to sample totals due to missing data.

and encountering explosive devices (Wald statistic = 4.55, $p < 0.05$). Avoidance and dysphoric arousal symptoms were not associated with any of the specific combat experiences components when adjusted for all observed confounders (Table 4).

Discussion

This study aimed to examine the association between three principle components of combat exposure and five PTSD symptom clusters within a group of UK AF personnel returning from combat deployment in Afghanistan. The PCA generated 3 main classes of combat experience; participation in violent combat, proximity to wounding or death, and encountering explosive devices. Following adjustment for a range of potentially confounding variables, greater exposure to violent combat was significantly associated with an increased risk of developing re-experiencing and numbing symptoms 6 months postdeployment. More frequent proximity to wounding or death experiences was significantly associated with a greater risk of developing re-experiencing and anxious-arousal symptoms, while frequently encountering explosive devices was significantly associated with a greater risk of developing anxious-arousal symptoms.

Our first hypothesis (H1) was that violent combat would produce intense arousal and would be significantly associated with PTSD dysphoric-arousal and anxious-arousal symptoms. This was not supported. Previous studies suggested that greater exposure to combat and other traumatic events was significantly associated with increased irritability, aggression, exaggerated startle responses, and hypervigilance in military personnel and veterans.[28–32] Violent combat was significantly associated with both re-experiencing and numbing symptoms at follow-up. It is likely, therefore, that exposure to violent combat events contributes to the development of intrusive memories, nightmares, distress, and physiological reactivity 6 months after completing an operational deployment. Re-experiencing symptoms are largely cognitive experiences with a sensory component and an accompanying emotional response provoked by current stimuli that resemble aspects of the index exposure (such as thoughts, emotions, shapes, colors, odors, sounds, and so forth) but lack a context and time perspective.[46,47] It is recommended that care provision for personnel presenting for treatment with a history of participation in violent combat should include a focus on anxiety reduction measures as part of an evidence-based package.

Exposure to violent combat also contributes to a restricted range of affect, including an inability to experience pleasure, feeling unresponsive to surroundings, and detached from others. Emotional numbing may result from cognitive and behavioral efforts to contain their re-experiencing symptoms to a point where subjects lose their capacity to experience a usual range of emotions.[48,49] This appeared to be a specific effect within the re-experiencing and numbing symptom clusters as the third cluster, hyperarousal (dysphoric-arousal and anxious-arousal), appeared to have no significant association with violent combat experiences.

Our second hypothesis (H2) predicted that UK military personnel with greater proximity to wounding and death experiences would report more avoidance and numbing symptoms; this too was not supported. Most studies evaluating the effects of seeing extreme physical trauma relate to emergency medical teams and suggest that these groups often use cognitive avoidance to suppress fear and anxiety.[33] In the present investigation, greater proximity to wounding and death experiences was associated with re-experiencing and anxious-arousal symptoms. This is consistent with this specific exposure, as dealing with human remains and physical injury can be extreme in the context of a war where the IED was used extensively by insurgents. Individuals may well have laid down memories that become salient and more impactful as their mental health deteriorated. The significant association of anxious-arousal symptoms (such as hypervigilance and exaggerated startle response) with wounding and injury at 6 months postdeployment might reflect an acquired persistent emotional response related to experiencing recurrent distressing memories associated with having provided medical aid and having dealt with human remains during deployment.[50]

The third hypothesis (H3) predicted that encountering explosive devices would generate all 5 symptom clusters. Among coalition forces, IEDs and landmine strikes are the leading cause of death and injury in Afghanistan.[51] Enemy forces use varying strategies to inflict maximum casualties, including the use of secondary devices against first responders and “daisy chain” IEDs.[51] Given the high incidence of such exposures and the potentially horrific consequences of contact with the IED, it was surprising to find an association with anxious-arousal symptoms alone. Nevertheless, it is likely that a reasonably detailed knowledge of the form of traumatic exposure might help to inform the therapist when designing interventions for military personnel.

The circumstances in which UK military personnel experienced IED or landmine strikes was not assessed in the original survey. In particular, proximity to an exploding IED/landmine strike was unknown. Additionally, it could be that the detonation was a controlled explosion, for instance, where bomb-disposal personnel identified

Table 4. Predictors of Reporting PTSD Re-experiencing, Avoidance, Numbing, Dysphoric Arousal, and Anxious Arousal Symptoms at Follow-up, Unadjusted (OR) and Adjusted Odds Ratios (AOR) with 95% Confidence Intervals (95% CI).

	PTSD Re-experiencing Symptoms at Follow-up								
Exposure	OR(95% CI)	AOR(95% CI)[a]	AOR(95% CI)[b]	AOR(95% CI)[c]	AOR(95% CI)[d]	AOR(95% CI)[e]	AOR(95% CI)[f]	AOR(95% CI)[g]	AOR(95% CI)[h]
Violent Combat	2.43 (1.95–3.02)*	—	1.56 (1.21–2.01)*	2.04 (1.62–2.58)*	1.81 (1.43–2.29)*	2.63 (2.10–3.31)*	2.32 (1.85–2.89)*	2.36 (1.89–2.95)*	1.35 (1.01–1.81)†
Proximity to Wounding or Death	3.01 (2.42–3.74)*	2.42 (1.89–3.11)*	—	2.62 (2.08–3.31)*	2.02 (1.59–2.56)*	3.03 (2.42–3.80)*	2.94 (2.36–3.67)*	3.01 (2.41–3.75)*	1.67 (1.25–2.23)*
Encountering Explosive Devices	2.14 (1.71–2.67)*	1.66 (1.30–2.10)*	1.54 (1.21–1.95)*	—	1.70 (1.33–2.16)*	2.17 (1.72–2.73)*	2.01 (1.60–2.52)*	2.06 (1.65–2.59)*	1.26 (0.95–1.66)
	PTSD Avoidance Symptoms at Follow–up								
Violent Combat	1.80 (1.44–2.25)*	—	1.32 (1.01–1.72)†	1.59 (1.25–2.03)*	1.41 (1.10–1.80)‡	1.97 (1.55–2.50)*	1.67 (1.33–2.11)*	1.72 (1.36–2.17)*	1.22 (0.90–1.67)
Proximity to Wounding or Death	2.10 (1.68–2.63)*	1.83 (1.41–2.37)*	—	1.91 (1.51–2.42)*	1.46 (1.14–1.87)‡	2.07 (1.64–2.63)*	2.02 (1.61–2.54)*	2.07 (1.65–2.59)*	1.25 (0.92–1.70)
Encountering Explosive Devices	1.68 (1.33–2.11)*	1.41 (1.10–1.81)‡	1.33 (1.04–1.70)†	—	1.35 (1.05–1.74)†	1.69 (1.32–2.16)*	1.59 (1.25–2.00)*	1.61 (1.27–2.03)*	1.12 (0.84–1.51)
	PTSD Numbing Symptoms at Follow–up								
Violent Combat	1.59 (1.29–1.97)*	—	1.36 (1.06–1.74)†	1.57 (1.25–1.98)*	1.47 (1.17–1.85)*	1.78 (1.41–2.24)*	1.48 (1.19–1.84)*	1.57 (1.26–1.95)*	1.56 (1.16–2.11)‡
Proximity to Wounding or Death	1.59 (1.29–1.97)*	1.37 (1.07–1.75)‡	—	1.57 (1.26–1.97)*	1.27 (1.01–1.60)†	1.54 (1.23–1.94)*	1.52 (1.23–1.88)*	1.60 (1.30–1.99)*	1.05 (0.78–1.41)
Encountering Explosive Devices	1.23 (0.99–1.53)	1.04 (0.82–1.31)	1.04 (0.83–1.32)	—	1.05 (0.82–1.33)	1.20 (0.94–1.52)	1.14 (0.91–1.42)	1.21 (0.97–1.50)	0.83 (0.62–1.10)
	PTSD Dysphoric–Arousal Symptoms at Follow Up								
Violent Combat	1.33 (1.07–1.65)‡	—	1.08 (0.84–1.39)	1.27 (1.01–1.60)†	1.19 (0.94–1.51)	1.46 (1.14–1.86)‡	1.22 (0.98–1.53)	1.28 (1.03–1.60)†	1.07 (0.78–1.46)
Proximity to Wounding or Death	1.56 (1.26–1.93)*	1.50 (1.17–1.93)*	—	1.53 (1.21–1.92)*	1.34 (1.06–1.69)‡	1.50 (1.18–1.91)*	1.48 (1.19–1.85)*	1.54 (1.24–1.91)*	1.24 (0.92–1.69)
Encountering Explosive Devices	1.24 (0.99–1.55)	1.14 (0.89–1.44)	1.06 (0.84–1.35)	—	1.14 (0.90–1.45)	1.21 (0.94–1.55)	1.17 (0.93–1.47)	1.20 (0.96–1.51)	0.95 (0.71–1.28)
	PTSD Anxious–Arousal Symptoms at Follow Up								
Violent Combat	1.90 (1.53–2.35)*	—	1.28 (1.00–1.65)†	1.59 (1.26–2.00)*	1.43 (1.13–1.80)‡	2.01 (1.61–2.51)*	1.79 (1.44–2.23)*	1.80 (1.44–2.24)*	1.03 (0.77–1.38)
Proximity to Wounding or Death	2.45 (1.98–3.03)*	2.16 (1.69–2.77)*	—	2.14 (1.70–2.68)*	1.78 (1.42–2.24)*	2.42 (1.94–3.02)*	2.37 (1.91–2.94)*	2.38 (1.92–2.96)*	1.53 (1.15–2.02)‡
Encountering Explosive Devices	1.97 (1.59–2.46)*	1.67 (1.32–2.11)*	1.52 (1.20–1.92)*	—	1.62 (1.28–2.05)*	1.99 (1.59–2.50)*	1.89 (1.52–2.37)*	1.87 (1.50–2.34)*	1.34 (1.02–1.75)†

Lower/Middle Tertile Scores for Combat Experiences and PTSD Symptom Endorsement are the Reference Criteria.
[b]*Model 2* Adjusted for Proximity to Wounding or Death.
[c]*Model 3* Adjusted for Encountering Explosive Devices.
[d]*Model 4* Adjusted for PTSD Re-experiencing, Avoidance, Numbing, Dysphoric Arousal or Anxious Arousal Symptoms at Baseline.
[e]*Model 5* Adjusted for Psychological Distress Caseness.
[f]*Model 6* Adjusted for Hazardous and Harmful Alcohol Consumption.
[g]*Model 7* Junior Ranks vs. Senior/Officer Ranks, Male vs. Female, Regular vs. Reserves, 1 Deployment vs. 2 or more Deployments.
[h]*Model 8* Adjusted for Violent Combat, Proximity to Wounding or Death, Encountering Explosive Devices, PTSD Re-experiencing, Avoidance, Numbing, Dysphoric Arousal or Anxious Arousal Symptoms at Baseline, Psychological Distress, Hazardous and Harmful Alcohol Consumption, Junior Ranks vs. Senior/Officer Ranks, Male vs. Female, Regular vs. Reserves, 1 Deployment vs. 2 or more Deployments.
†$p \leq .05$;
‡$p \leq .01$;
*$p \leq .001$.
Predictors of reporting PTSD symptoms included the portion of the sample that completed the follow-up survey (n = 1635).

the explosive charge and purposely detonated it. During the campaign in Afghanistan, counter-IED procedures became increasingly effective through improved of ground-sign awareness, use of detectors, military search dogs and counter-IED protective equipment.[52] As a result, military personnel may well have experienced a degree of confidence and control which may have helped to insulate them against the worst psychological effects of potential IED exposure. However, it is possible that the persistent heightened awareness required to counter the IED threat may well have carried over into the post deployment period and could have had a kindling effect on anxious arousal symptoms.

The study findings might have clinical implications for the future. Knowing how specific exposures experienced during deployment relate to PTSD symptom clusters may help clinicians to design and tailor clinical interventions according to the trauma-exposure.

Although evidence-based clinical interventions such as individual trauma-focused cognitive-behavioral therapy, eye-movement desensitization and reprocessing, and/or pharmacological therapy are widely available,[53] it might be helpful to design specific interventions for PTSD re-experiencing, numbing and anxious-arousal symptoms based on specific classes of exposure.

Military personnel in certain roles may be more susceptible to re-experiencing, numbing and anxious-arousal symptoms, including those with a combat and medical aid role. Accumulating evidence suggests that deployed UK combat forces have a small but significantly increased risk of developing PTSD symptoms when compared with non-combat troops. Approximately 7% of those deployed in a combat role develop symptoms of PTSD following return from deployment compared to around 4% of noncombat personnel.[12,13,38] The prevalence of probable PTSD amongst UK ex-Service personnel appears higher with rates of up to 13% having been reported using a bespoke measure of PTSD symptoms.[54] Studies of UK military medical personnel also suggests that forward located medics are at increased risk of PTSD (5%), when compared with rear located medics (3%) and all other military roles (4%).[55] Surprisingly, the few studies developed with counter-IED personnel do not seem to show an evidence of an increased PTSD risk, at least in the short-term.[34] Our proposition remains speculative as we were unable to differentiate between military personnel by role in the study.

The present study findings may have some relevance to a civilian emergency medicine context. Military personnel who endorsed experiences such as handling bodies, giving aid to the wounded, and seeing personnel seriously wounded or killed, exhibited more re-experiencing and anxious-arousal symptoms. In some respects the types of exposure assessed in the current study are congruent with aspects of the accident and emergency trauma care environment. Military personnel operating in a combat environment provide assistance with sometimes limited medical resources while their own life may be at risk. However, in both civilian and military settings, teams are regularly exposed to death and serious injury; it therefore follows that they may exhibit similar mental health outcomes. There is some evidence for this in a UK study showing that experiences of death, serious injury, acute severe pain, and/or acute hemorrhage were linked with higher levels of PTSD in UK surgical trainees.[56] Additionally, a US military study conducted among US Pararescuemen operators, a medical special forces role, suggested that medical stressors (such as taking care of injured or seeing severely wounded or disfigured military personnel) contributed more to PTSD than traditional combat stressors.[57]

Limitations

This study has a number of limitations that should be taken into account when interpreting the results. The study used questionnaires containing personally identifiable information which is known to influence levels of symptom reporting.[58] Second, the response rate in this study was 65.1% at follow-up, and though substantial, a significant number of individuals did not give consent to follow up or could not be contacted, introducing the possibility of bias. This is potentially important because several studies suggest that participants who decline to participate further in traumatic stress studies can report more mental health problems than those do.[59] Third, this study included a higher proportion of Royal Marine Commandos and Army personnel, so careful consideration should be taken when generalizing these findings to the entire UK military population.[37]

Conclusions

In this study of UK AF service personnel deployed to Afghanistan violent combat was linked with re-experiencing and numbing symptoms, experiences of proximal wounding or death were associated with re-experiencing and anxious-arousal symptoms, while encountering explosive devices were related with anxious-arousal symptoms. These findings may have clinical implications, particularly in designing and tailoring PTSD treatments to military personnel working in front-line roles.

Conflict of interest

C. O., N. J., and N. G. are based at the Academic Department of Military Mental Health, King's College London, when this

paper was written. S. W. is based at the King's Centre for Military Health Research, King's College London. Both Centres receive funding from the UK Ministry of Defence (MoD). N. J. is a full-time member of the UK Armed Forces, and although paid directly by the UK MoD, was not directed in any way by the MoD in relation to this publication. S. W. 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. E. J. is based at the Institute of Psychiatry, Psychology and Neuroscience and currently receives funding from Forces in Mind Trust. I. R. and N. G. are ex-serving full-time members of the UK Armed Forces, and are currently employed by King's College London. C. O. declares no conflicts of interest. The views expressed here are those of the authors and do not represent the official policy or position of the UK MoD.

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