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Deployment-related injury and posttraumatic stress disorder in US military personnel

Andrew J. MacGregor *, Janet J. Tang, Amber L. Dougherty, Michael R. Galarneau

Department of Medical Modeling, Simulation and Mission Support, Naval Health Research Center, San Diego, CA, United States

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ABSTRACT

Background: The current military conflicts in Iraq and Afghanistan have resulted in the most US casualties since the Vietnam War. Previous research on the association between deployment-related injury and posttraumatic stress disorder (PTSD) has yielded mixed results.
Objectives: To examine the effect of battle injury (BI) relative to non-battle injury (NBI) on the manifestation of PTSD symptoms in military personnel and to assess the demographic, injury-specific, and pre-injury factors associated with PTSD following a BI.
Patients and methods: A total of 3403 personnel with deployment-related injury (1777 BI and 1626 NBI) were identified from the Expeditionary Medical Encounter Database. Records were electronically matched to Post-Deployment Health Assessment (PDHA) data completed 1–6 months post-injury. The PTSD screening outcome was identified using a four-item screening tool on the PDHA.
Results: Compared to those with NBI, personnel with BI had more severe injuries, reported higher levels of combat exposure, and had higher rates of positive PTSD screen. After adjusting for covariates, personnel with BI were twice as likely to screen positive for PTSD compared to those with NBI (odds ratio [OR], 2.10; 95% confidence interval [CI], 1.60–2.75). In multivariable analysis among battle-injured personnel only, moderate and serious-severe injury (OR, 1.49; 95% CI, 1.12–2.00 and OR, 1.64; 95% CI, 1.01–2.68, respectively), previous mental health diagnosis within 1 year of deployment (OR, 2.69; 95% CI, 1.50–4.81), and previous BI (OR, 1.96; 95% CI, 1.22–3.16) predicted a positive PTSD screen.
Conclusions: Military personnel with BI have increased odds of positive PTSD screen following combat deployment compared to those with NBI. Post-deployment health questionnaires may benefit from questions that specifically address whether service members experienced an injury during combat.
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Introduction

Posttraumatic stress disorder (PTSD), an anxiety disorder resulting from exposure to a traumatic event, is a frequent psychological consequence of current military operations.[1] Psychological morbidity in wartime has been documented for hundreds of years[2,3] and was described in detail following twentieth century conflicts,[2,4–6] with PTSD diagnosis formalized in the DSM-III after the Vietnam War.[7–9] More recently, elevated rates of PTSD have been found in personnel deployed to the 1990 Persian Gulf War,[10] as well as in those deployed in support of post-September 11, 2001 military conflicts, particularly Operation Iraqi Freedom (OIF). Hoge et al. found that 19% of returning US service members from OIF reported a mental health problem, compared with 11% from concurrent military operations in Afghanistan and 8% from other locations.[11] In this same study, nearly 10% reported PTSD-like symptoms. A later study on OIF and Operation Enduring Freedom (OEF) veterans by Seal et al. found that 25% of a US veteran population received a mental health diagnosis of any kind, and 13% were diagnosed with PTSD.[12]

The relationship between deployment-related injury and PTSD is of particular interest because of increased survivability from combat wounds,[13] but studies examining this relationship have yielded mixed results. Early studies from World Wars I and II suggested that injured soldiers may be less likely to suffer from psychological morbidity.[6,14] Further, an Israeli study found that injured soldiers showed minimal psychological disturbances.[15] Studies of PTSD among Vietnam veterans, however, have identified a two- to three-fold greater lifetime prevalence of PTSD symptoms in the injured compared with uninjured.[16,17] In another Israeli study, researchers examined PTSD risk among combat-injured soldiers after controlling for combat exposure and demonstrated more than eight-fold increased risk of PTSD among those with combat injury compared with those uninjured.[18]

* Corresponding author at: Naval Health Research Center, 140 Sylvester Road, San Diego, CA 92106, United States. Tel.: +1 619 459 9928; fax: +1 619 553 8378.
E-mail addresses: andrew.macgregor@med.navy.mil, macgregor1014@gmail.com (A.J. MacGregor).

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Two recent studies used clinical records of deployment-related injury and identified a positive association between risk of PTSD and injury severity, but these studies were limited by medical utilization data[19] and small sample size.[20] The effect of injury mechanism, battle injury (BI) or non-battle injury (NBI), independent of the physical injury is unclear, since previous studies either combined BI and NBI or failed to account for differences in injury severity and combat exposure.[19–21] Further, although some studies have suggested injury-specific predictors of PTSD, such as head wounds and objective injury severity,[19,20,22] a thorough multivariable analysis assessing potential predictors and confounders has not been conducted.

The continued military operations in Iraq and Afghanistan, coupled with significant injury rates from these conflicts, make the study of physical injury and PTSD of paramount importance. The identification of PTSD predictors following physical injury may be useful in targeting high-risk subgroups for screening and intervention. The purpose of the present study was to examine the association between deployment-related injury and PTSD in a large sample of injured OIF veterans. Specific objectives were to (1) identify the effect of BI versus NBI in the expression of PTSD; and (2) evaluate demographic, injury-specific, and pre-injury predictors of PTSD among personnel with BI. This study was approved by the Institutional Review Board at Naval Health Research Center (NHRC), San Diego, CA.

Patients and methods

Study sample

The Expeditionary Medical Encounter Database (EMED, formerly the Navy-Marine Corps Combat Trauma Registry) was queried for all personnel injured during OIF who completed a Post-Deployment Health Assessment (PDHA). The EMED is a deployment health database maintained by NHRC and consists of documented clinical encounters of deployed military personnel.[23] Clinical EMED records are completed by medical providers as casualties move through the medical chain of military evacuation. Unique aspects of the EMED include detailed information regarding the injury incident, which is collected at or near the point of injury, as well as the inclusion of persons with otherwise mild injuries who are subsequently returned to duty. Clinical records are provided to NHRC and professional coders review the records and assign Abbreviated Injury Scale (AIS), Injury Severity Score (ISS), and *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM) codes.[24–26] The AIS ranges from 1 (minor) to 6 (unsurvivable) and is assigned to nine body regions. The ISS is a composite score based on the AIS and ranges from 1 to 75.

Eligible personnel for the present study were service members who sustained a deployment-related physical injury during OIF between 2004 and 2008, and who completed a PDHA between 30 and 180 days post-injury. The PDHA is a self-administered screening questionnaire developed by the US Department of Defense (DoD) to identify personnel in need of medical referral for a variety of health reasons spanning from mental health to physical complaints.[27] The PDHA has been used in previous research to identify population-level mental health screening rates.[28,29] For personnel with multiple injury episodes recorded in the EMED, only the most recent episode was included. Episodes indicating BI were given priority; i.e., if an individual sustained both a BI and NBI, only the BI record was included in the analysis. There were 8956 injured personnel in the EMED at the time of the analysis. Of these, 4802 had record of a PDHA, and 3412 completed a PDHA 1–6 months post-injury. An additional 9 individuals were excluded who failed to complete the PTSD screening instrument, leaving a final study sample of 3403 injured personnel.

Measures

Covariates. Demographic variables included in the analysis were age, military rank, and branch of service at the time of injury and were identified by the Defense Manpower Data Center (DMDC), which maintains electronic administrative records for all military personnel. Military rank was categorized as junior enlisted (E1–E4), mid-level enlisted (E5–E6), and senior enlisted/officer (E7 and above). Branch of service was categorized into Marine Corps, Army, and Navy/Air Force. Age at the time of injured deployment (18–24 years, 25 years and older), marital status (married, not married), education level (some college, no college), and service component (active duty, Reserve/National Guard) were identified from electronic DMDC deployment records.

Injury-specific variables were abstracted from the EMED clinical record. Injury group was classified as BI or NBI, with BI resulting from hostile action. Injury mechanism for BI was categorized into blast and non-blast following review of incident-specific information present on the EMED clinical record. ISS was categorized into mild, moderate, and serious-severe corresponding to a score of 1–3, 4–8, and 9 or greater, respectively, due to small numbers of serious-severe injuries among NBI. Presence of a head or neck injury was identified based on an AIS code assigned to the head or neck region.

Pre-injury variables of interest included previous deployment experience, previous mental health diagnosis, and previous BI. Personnel with a prior deployment were identified by presence of an electronic DMDC deployment record prior to their present deployment under study. Standard inpatient and outpatient medical databases were queried to identify presence of mental health diagnosis before injury, indicated by an ICD-9-CM code between 290 and 319 (excluding 305.1, tobacco addiction). This variable was further classified into mental health diagnosis occurring before the current injury and up to 1 year before deployment, and mental health diagnosis occurring outside of 1 year before deployment. Previous BI was identified from the EMED as any person with a documented BI prior to the injury of interest in the present study.

The PDHA contains questions that ask whether the service member was exposed to dead bodies, discharged his or her weapon, or had a perceived threat to life. The specific questions are shown in Table 1. For analyses including personnel with BI and NBI, numbers of "yes" responses were summed to create a "combat exposure" variable that ranged from zero to three positive responses. For analyses including only personnel with BI, those who endorsed zero or one combat exposures were combined due to small numbers. In order to further control for combat exposure, a variable indicating "infantry" or "noninfantry" occupation was created using the DoD standardized occupational codes from DMDC electronic records.

Main outcome measures. A positive screen for PTSD was ascertained from the PDHA, which contains a validated four-item PTSD screening instrument shown in Table 1. This four-item screening instrument is based on the Primary Care PTSD screen, and endorsing any three of the four symptoms indicated a positive screen for PTSD.[30] This PTSD screening instrument was recently validated against the more widely used 17-item PTSD Checklist.[31]

Statistical analysis

All statistical analyses were performed using SAS software, version 9.2 (SAS Institute Inc., Cary, NC). Covariates were described for the study sample stratified by BI and NBI. Chi-square and

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