



## Longitudinal assessment of gender differences in the development of PTSD among US military personnel deployed in support of the operations in Iraq and Afghanistan



Isabel G. Jacobson <sup>a</sup>, Carrie J. Donoho <sup>a, b, \*</sup>, Nancy F. Crum-Cianflone <sup>a, c</sup>, Shira Maguen <sup>d, e</sup>

<sup>a</sup> Deployment Health Research Department, Naval Health Research Center, San Diego, CA, USA

<sup>b</sup> Department of Psychiatry, Uniformed Services University of the Health Sciences, Bethesda, MD, USA

<sup>c</sup> Naval Medical Center San Diego, CA, USA

<sup>d</sup> San Francisco VA Medical Center, CA, USA

<sup>e</sup> Department of Psychiatry, University of California, San Francisco, USA

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### ABSTRACT

Divergent findings from previous research examining gender differences in the development of post-traumatic stress disorder (PTSD) among US military members deployed to the operations in Iraq or Afghanistan (recent operations) prompted this study utilizing a matching approach to examine whether risk for new-onset PTSD and PTSD severity scores differed by gender. US military members from the Millennium Cohort Study deployed in support of the recent operations were followed for approximately 7 years from baseline through 2 follow-up periods between 2001 and 2008. Propensity score matching was used to match 1 male to each female using demographic, military, and behavioral factors including baseline sexual assault. Analyses were stratified by combat experience defined as reporting at least one of five exposures during follow-up. Outcome measures included a positive screen for PTSD and severity scores measured by the PTSD Patient Checklist–Civilian Version. Discrete-time survival analysis quantified the association between gender and incident PTSD. Among 4684 matched subjects (2342 women and men), 6.7% of women and 6.1% of men developed PTSD during follow-up. Results showed no significant gender differences for the likelihood of developing PTSD or for PTSD severity scores among women and men who reported combat experience and among those who did not. This study is the first of its kind to match a large population of male and female service members on important baseline characteristics including sexual assault. Findings suggest that while combat deployed personnel develop PTSD, women do not have a significantly different risk for developing PTSD than men after experiencing combat.

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Deployments in support of the recent operations in Iraq and Afghanistan have included more women than all other conflicts in US military history (Street et al., 2009). The adverse mental health outcomes suffered by some returning from deployment has largely impacted this important subgroup of the military and force readiness as a whole. While a plethora of previous research in the civilian population has found that women are more likely than men to develop posttraumatic stress disorder (PTSD) following

traumatic experiences (Breslau et al., 1998; Kessler et al., 1995), findings from military research are divergent, as highlighted by a recent review discussing conflicting evidence for gender differences in PTSD among studies of military personnel. This review concluded that women appeared to be at moderately higher risk for PTSD postdeployment compared with men, but noted future studies should leverage a longitudinal design and the ability to control for baseline characteristics and deployment exposures, especially sexual assault (Crum-Cianflone and Jacobson, 2013). Sexual assault is an important factor associated with the development of PTSD, and occurs 13 times more frequently among women than men, thus research accounting for the disproportionate exposure to sexual assault among men and women is critical (Kessler et al., 1995).

\* Corresponding author. Deployment Health Research Department, Naval Health Research Center, 140 Sylvester Road, San Diego, CA 92106-3521, USA. Tel.: +1 619 553 8447; fax: +1 619 553 7601.

E-mail address: [carrie.j.donoho@mail.mil](mailto:carrie.j.donoho@mail.mil) (C.J. Donoho).

Several important limitations of past research evaluating gender differences in postdeployment PTSD have included retrospective or cross-sectional designs, lack of predeployment baseline data, and inability to control for combat-related traumatic events and sexual assault, which is often the case in studies utilizing medical record data. Studies using survey research are imperfect because screening tools are used for assessments of PTSD, and such research is subject to recall and response bias. However, survey research as compared with medical record data may better capture the true burden of disease in a population where treatment seeking may negatively affect employment. Therefore, a survey-based longitudinal study following military personnel throughout their military career and their transition into the civilian population is critical. The present study used data from the Millennium Cohort Study, the largest longitudinal cohort study ever undertaken by the Department of Defense (DoD).

This study addressed limitations of past research with respect to gender differences and PTSD because of its longitudinal design, oversampling of women, and ability to match on baseline characteristics such as sexual assault. This large, longitudinal study utilized a matched sample of men and women who shared the same predeployment characteristics, including baseline history of sexual assault, and followed them over time to evaluate gender differences in developing postdeployment PTSD among those with and without combat experience.

## 1. Materials and methods

### 1.1. Population and data sources

The Millennium Cohort Study (Ryan et al., 2007) was launched in 2001 with the primary goal of prospectively evaluating the long-term health of military service members, including the potential influence of deployment and other military experiences on health. The first panel of participants was a population-based sample randomly selected from all US military personnel on rosters as of October 1, 2000. Additional panels were enrolled in the Cohort in subsequent periods (2004, 2007, and 2011), but in order to provide the longest follow-up time to track the development of PTSD, only panel 1 participants were included in the present study.

Briefly, 77 047 of the 256 400 personnel included in the original sample provided informed, voluntary consent and were enrolled in the first panel of the study. Of the participants who completed a baseline survey (2001–2003), 55 021 (71%) completed a first follow-up survey (2004–2006), and 54 790 (71%) completed a second follow-up survey (2007–2008). A more detailed description of this study's methodology can be found elsewhere (Ryan et al., 2007). Inclusion criteria were screening negative for PTSD at baseline, deploying in support of the operations in Iraq or Afghanistan, completing both follow-up surveys, and having complete outcome and exposure information. This study was approved by the Institutional Review Board at the Naval Health Research Center (protocol NHRC.2000.0007).

### 1.2. Outcome

The outcome for this study was a positive screen for PTSD since baseline (new-onset PTSD). PTSD symptoms were measured using the PTSD Checklist–Civilian Version (PCL-C), a 17-item self-report measure of PTSD symptoms that asks respondents to rate the severity of each symptom during the past 30 days on a 5-point Likert scale ranging from not at all to extremely (Weathers et al., October 1993). Using criteria established in the *DSM-IV*, participants screened positive for PTSD if they reported a moderate or higher level of at least 1 intrusion symptom, 3 avoidance

symptoms, and 2 hyperarousal symptoms (American Psychiatric Association, 1994). In addition, PTSD severity scores were calculated among those screening positive by summing the number of points received for each item (range 33–85).

### 1.3. Main exposure of interest

Combat deployment was determined using electronic military data containing in and out of theater dates provided by the Defense Manpower Data Center in combination with survey data of self-reported combat experience. Combat experience was assessed at each follow-up using questions asking if participants had been personally exposed to the following: witnessing a person's death due to war, disaster, or tragic event; witnessing instances of physical abuse; dead or decomposing bodies; maimed soldiers or civilians; or prisoners of war or refugees (Jacobson et al., 2008; Smith et al., 2008a, 2008b). Combat experience (yes vs no) during each follow-up period was ascertained using any affirmative response to at least 1 of the above items. Further comments on the past performance of this measure and its limitations are included in the Discussion section.

### 1.4. Matched variables

Demographic and military data obtained from military electronic personnel files included gender, birth year, race/ethnicity, education level, marital status, service component, service branch, military pay grade, deployment experience in support of the operations in Iraq and Afghanistan, and military occupation where a combat specialist refers to individuals in occupations such as infantry, combat engineering, installation security, or aircrew (see Table 1 for categorizations). Behavioral and mental health variables were obtained from responses to the baseline Millennium Cohort questionnaire. Measures included history of life stress (items such as divorce, suffering a violent assault, or having a family member die) adapted from the Holmes and Rahe Social Readjustment Rating Scale (Holmes and Rahe, 1967) and categorized as having no stressful events, one, or more than one event; baseline positive screen for another mental disorder including depression, panic, or anxiety disorder, was assessed using the Patient Health Questionnaire (PHQ) screening tools (Spitzer et al., 1999); report of taking medication for anxiety, depression, or stress; alcohol misuse defined by endorsement of at least 1 of the 5 items on the PHQ (Spitzer et al., 2000; Spitzer et al., 1994); smoking status; physical component summary score evaluated using the lowest 15%, middle 70%, and highest 15% based on scoring algorithms for the Medical Outcomes Study Short-Form 36-Item Health Survey for Veterans (Ware and Kosinski, 2001); and a lifetime history of sexual assault measured at baseline. The aforementioned variables were selected *a priori* because they are known to be important in predicting PTSD, and they are also related to gender (i.e., confounders).

### 1.5. Post-matching adjustment variables

Additionally, residual confounding was adjusted for due to sexual assault that occurred since the baseline assessment. Sexual assault was captured by the question, "In the last 3 years, have you had any of the following life events happen to you? ... Suffered forced sexual relations or sexual assault" (yes vs no). Sexual assault reported during any follow-up period was added into the final combat experience-stratified models.

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