Gender Differences of Postdeployment Post-Traumatic Stress Disorder Among Service Members and Veterans of the Iraq and Afghanistan Conflicts

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Despite the marked expansion of roles for women in the US military over the last decade, whether differences by gender exist in regard to the development of mental health conditions postdeployment is unclear. This comprehensive review of the literature (2001–2012) examined whether US servicewomen were more likely than men to experience post-traumatic stress disorder (PTSD) after returning from deployments to the Iraq and Afghanistan conflicts. Findings from 18 studies from 8 unique study populations were reviewed. Seven studies found that women had a higher risk for screening positive for PTSD compared with men, including prospectively designed studies that evaluated new-onset PTSD among members from all service branches. Although results from studies with Veterans Affairs samples found women at decreased risk in 4 analyses, these studies used the same source databases, were conducted in treatment-seeking populations, and were mostly unable to account for combat experience. Seven studies detected no differences by gender. In summary, women appeared to have a moderately higher risk for postdeployment PTSD, although there was a lack of consensus among the studies, and even those with the most rigorous methods were not designed specifically to evaluate potential gender differences. Given the limitations of the published literature, further research should use longitudinal study designs and comprehensive evaluations of deployment experiences while adjusting for predeployment factors to confirm that gender differences exist with regard to postdeployment PTSD.

INTRODUCTION

Women in the military

Women have experienced markedly expanding roles in military service over the past decade. They have swiftly transitioned from roles of “support” (e.g., nursing, food services, and clerical work) to those mirroring their male counterparts. During the first Gulf War in the early 1990s, women served as military police officers and pilots as well as on board combat ships (1). Although the Department of Defense policy until 2013 prohibited women from serving in “any unit below brigade level whose primary mission is to engage in direct ground combat” (2, p. 4) (3), hence barring service in combat infantry or special operations, the blurring of the front lines of war in Iraq and Afghanistan has led to a sizable number of women encountering combat situations.

Not only have the roles of women changed, but their numbers on active duty service have also markedly increased. Since 1973 when the United States ended conscription and established an all-volunteer force, the number of enlisted women has increased from 2% to 14%, with commissioned officers increasing from 4% to 16%. As of 2011, 214,098 women were serving on active duty, representing one-seventh (14.6%) of the active Armed Forces (Table 1) (4). In addition, 72,790 women serve in the Reserves and National Guards. The Army has the largest absolute number of women, while the Air Force has the highest proportion of female service members (Table 1).

The number of women deployers has also rapidly increased, representing approximately 10% of military personnel deployed in support of the conflicts in Iraq and Afghanistan, the largest percentage in the country’s history (5). Between October 1,
Table 1. Number of Women Serving on Military Active Duty, as of September 30, 2011*  

<table>
<thead>
<tr>
<th>Service Branch</th>
<th>Total Service Size, no.</th>
<th>Women No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army</td>
<td>565,463</td>
<td>76,694</td>
<td>13.6</td>
</tr>
<tr>
<td>Marine Corps</td>
<td>201,157</td>
<td>13,877</td>
<td>6.8</td>
</tr>
<tr>
<td>Navy</td>
<td>325,123</td>
<td>53,385</td>
<td>16.4</td>
</tr>
<tr>
<td>Air Force</td>
<td>333,370</td>
<td>63,552</td>
<td>19.1</td>
</tr>
<tr>
<td>Coast Guard</td>
<td>43,251</td>
<td>6,790</td>
<td>14.5</td>
</tr>
<tr>
<td>Total</td>
<td>1,468,364</td>
<td>214,098</td>
<td>14.6</td>
</tr>
</tbody>
</table>


2001, and December 31, 2010, a total of 154,548 women in the active component of the US military deployed to Iraq and Afghanistan, with 31% deploying 2 or more times and 7% deploying at least 3 times (6).

Women returning from the Iraq and Afghanistan conflicts have reported more exposure to traumatic events than during any past war, with data showing that 9% of Army women deployed witnessed a killing and 31% were exposed to death (7). In addition to women’s expanding role on the warfront, their roles in the military at large have grown: Over 92% of specialties are currently open to women, and nearly an identical proportion of women are officers compared with men (approximately 16%) (2). In short, never before in US military history have the roles of women in the Armed Forces been more similar to those of men.

With the expansion of the roles and numbers of women in the military, concern has arisen regarding the health of women, especially following deployment. Mental health disorders have become the “signature wounds” of the Iraq and Afghanistan conflicts, with markedly increased rates among returning service members (8–10). Although there has been a surge in concerns about mental disorders (e.g., post-traumatic stress disorder (PTSD)) among women veterans, few data have focused specifically on women deployers (11) or have compared mental health outcomes among women and men who recently deployed to the military operations in Iraq and Afghanistan. Given the large number of women service members and veterans, it is imperative to identify potential gender differences in post-deployment mental health outcomes. This paper summarizes the existing published data regarding the development of PTSD among women service members during the recent conflicts and discusses gaps in the existing literature.

Reasons for potential gender differences in postdeployment PTSD

There are several factors that may impact the rates of PTSD among women serving in the military. Although women were not authorized to serve in combat infantry roles before 2013 (3) and men typically report more combat experiences during deployments, women nonetheless report a substantial level of combat-related events. For example, a study showed that firefighters were experienced by 36% of female deployers (vs. 47% of male deployers) and shooting the enemy among 7% (vs. 15%). This study also found that women were more likely to experience some traumatic events than men, such as handling human remains (38% vs. 29%) (9), likely because of the large proportion of women in health-care specialties.

There may be gender differences in trauma appraisals and perception (37), with lower levels of exposure creating similar perceived stress among women (38). For example, women are more likely to have a history of specific traumatic events (e.g., childhood sexual abuse and intimate partner violence), which may alter their perception and increase their vulnerability for PTSD after military-related events (18, 25, 35, 39–41). Further, information processing may differ by gender, with men being more likely to externalize stress (leading to higher rates of substance use issues), while women internalize stress, raising the possibility of mental health disorders (42).

In addition to combat-related experiences, women are at higher risk for sexual trauma during deployments (7, 18).
Studies have shown that approximately 15% of returning female deployers reported military-related sexual trauma (MST) compared with <1% of male deployers (43). MST increases the risk for PTSD among both men and women, with a stronger effect size among women; whether this is due to increased vulnerability in women or differences in MST intensity or number of events is currently unknown (43). Finally, because women remain the minority gender (approximate 85:15 ratio) in the military, they may have lower factual or perceived deployment preparedness and access to social support during and after deployments.

Although there are many hypothetical reasons that could impact a woman’s vulnerability to deployment and combat-related experiences, a review of the literature is needed to determine if gender differences in the development of PTSD exist among service members returning from the recent conflicts to inform veteran health care.

MATERIALS AND METHODS

We conducted a search of the published literature (including Medline, PubMed, Embase, and PsychInfo) using the terms “woman”, “women”, “female”, or “gender”; “deploy”, “military”, “military personnel”, or “armed forces”; and “PTSD”, “post-traumatic stress disorder”, or “posttraumatic stress disorder” for articles published in the English language between September 2001 and August 2012. We also utilized references of articles to identify additional studies. All studies that provided information on postdeployment PTSD stratified by gender during the recent conflicts in Iraq and Afghanistan were included. Studies that did not directly compare the outcome of PTSD by gender, unpublished data, and data collected prior to the initiation of the recent conflicts were not considered. Data collected from each study included the study design, deployment years, number of men and women service members evaluated, study location, measure utilized to define PTSD, rates of PTSD by gender, and assessment of predictors (specifically combat) of PTSD by gender. All papers were reviewed by 2 researchers (N. C.-C., I. J.). Although a meta-analysis was considered, the feasibility of this approach was limited given the large heterogeneity of the study designs and methodologies. Also, the outcome of PTSD was not measured consistently across studies, since different instruments were used and the way in which the outcome was examined (dichotomous vs. continuous) varied greatly. Therefore, a descriptive review of the literature was conducted. Results from studies with prospective designs that examined new-onset outcomes were given more consideration compared with smaller studies using retrospective or cross-sectional designs when making final conclusions from the review. Publications about prior conflicts, such as Vietnam or the first Gulf War, were not considered, as studies regarding gender differences during these conflicts were sparse (38, 44, 45).

RESULTS

Although a large number of articles on PTSD have been published in the last decade, few focused specifically on gender differences in postdeployment PTSD in association with the recent conflicts in Iraq and Afghanistan (Figure 1; Table 2) (1, 7, 16, 17, 19–22, 46–55). Studies were categorized by service branch and active duty versus veteran status, given the differences in military experiences by branch and various methods of data collection (e.g., active duty studies typically enrolled random military samples, whereas veteran studies mainly included those seeking Veterans Administration (VA) care). Further, articles using the same or similar data sources for their study populations were grouped together.

Studies have been most commonly conducted among Army personnel or at VA facilities examining PTSD rates among returning veterans. There were also studies that examined PTSD by gender across all US service branches including both active duty and Reserve/Guard (based on the Millennium Cohort Study), as well as a study of the US National Guard and 2 studies examining non-US military personnel using cohorts of military personnel from the United Kingdom who deployed to Iraq or Afghanistan. All studies in the literature utilized survey instruments or medical record codes for diagnosing PTSD, and none utilized clinical interviews.

Army

There were 3 published retrospective cohort studies among Army personnel that focused specifically on gender differences in postdeployment PTSD symptoms (1, 7, 19), all of which were conducted between 2006 and 2009, and drew their study samples from the same population of active duty soldiers on a large Army installation. The first study of 2,896 Army personnel (188 of whom were women) evaluated soldiers who completed their pre- and postdeployment screening visits between March 2006 and May 2008 (19). Combat experience was measured by using 4 yes/no questions regarding items such as being wounded or injured, and a sum score was created. Symptoms consistent with PTSD (using the 4-item Primary Care Post-Traumatic Stress Disorder screen with a cutoff of 2) were found to be nearly 2.5 times higher in women than in men in a model adjusted for combat. The study also found that decreases in perceived relationship strength increased the odds of PTSD at higher levels of combat exposure in women but not among men. In a follow-up study utilizing the same Army location and adding subjects to the prior study population by extending the follow-up time to July 2009, 6,943 personnel (including 516 women) were evaluated and found similar postdeployment rates of PTSD symptoms among women and men (15.3% vs. 15.7%) and similar PTSD scores (1). Combat experience was measured in the same way as mentioned in the first study. Of note, men had more combat exposures during deployment, and the study found a gender difference in regard to combat experience predicting a positive screen for PTSD, noting that higher levels of combat were more strongly associated with PTSD among women. The third study utilizing the same Army population from March 2006 to July 2009 examined 7,251 personnel (including 554 women) and found no significant differences in the prevalence of PTSD postdeployment (18% in both groups) (7). Combat exposure was measured in the same manner as in the previous 2 studies. Furthermore, there were no detectable differential effects of type of combat stressors by gender for mental health outcomes. The only reported gender difference was that injury was found to be more strongly associated with PTSD among women compared with men (7). Although the second and third studies
can be considered as updates to the first study, all 3 utilized samples from the same source population. Therefore, the findings from 3 analyses conducted on 1 unique study population of active duty Army personnel indicate that gender differences exist with higher levels of combat exposure, rather than type of combat exposure, with regard to screening positive for PTSD. Strengths of these studies include the relatively robust sample size and the ability to replicate results across 2 of the studies (1, 19). Limitations of these studies included the retrospective design and the inability to generalize the results to populations outside the active duty Army.

In addition to these 3 Army studies, data by gender were contained in a study among US Army soldiers (n = 4,089; 263 who were women) in 2005 after they returned from a 12-month deployment to Iraq or Afghanistan (16). PTSD was detected by using the Screen for Post-Traumatic Stress Symptoms among 30–31% of the soldiers, but gender was not associated with PTSD in the regression models. Combat experiences were not measured in this study. There are additional studies among Army personnel that examined mental health outcomes, but not specifically PTSD, by gender (8, 56). In addition to these studies that were based on postdeployment health surveys, a study evaluated hospital admissions after deployment to Operation Iraqi Freedom (OIF) or Operation Enduring Freedom (OEF) among Army personnel, and it found that women had a higher risk for admission for PTSD than did men (OIF: relative risk = 3.3, 95% CI: 2.05, 5.42; OEF: not calculated because of small numbers) (46).

**All service branches**

Two studies using data from the US Millennium Cohort Study provided a direct comparison of new-onset PTSD between men.
and women. The Millennium Cohort Study is the largest prospective military cohort study in US military history, and it includes participants from all service branches as well as the active and Reserve and National Guard components. The first study evaluated deployment and combat status among 50,128 participants (including 13,849 women) from all service branches (21). Combat exposure was indicated by 1 affirmative response to any of 5 items asking about personally witnessing any of the following events: death due to war, disaster, or tragic event; instances of physical abuse; dead or decomposing bodies; maimed soldiers or civilians; or prisoners of war or refugees. New-onset PTSD (based on specific criteria of the PCL-C) was noted among 3.8% of women and 2.4% of men at follow-up; of note, men in this study were more likely to deploy and experience combat. In the multivariable analysis adjusted for deployment experiences including combat, women had higher odds of new-onset PTSD compared with men in 3 of 4 service branches (Army: AOR = 1.70, Air Force: AOR = 2.00, and Navy/Coast Guard: AOR = 1.73; all P < 0.05).

A second study evaluated new-onset PTSD among a subset of the first Millennium Cohort population who were combat deployers (n = 5,410; 866 who were women) (50). Combat deployment was measured in the same way as in the previous study, and because the sample was restricted to combat deployers, a measure of combat severity (exposure to 1 item, 2 items, or 3 or more items) was included for adjustment. This study found that a larger proportion of women screened positive for new-onset PTSD (based on the specific criteria from the PCL-C) compared with men (13.2% vs. 6.2%, respectively). Additionally, in adjusted multivariable models including adjustment for combat severity, women were more than twice as likely to screen positive for new-onset PTSD compared with men, when using either the sensitive or the specific criteria to define a positive screen for PTSD.

Two cross-sectional studies also examined members from all service branches. These 2 studies utilized the same study population with nearly identical samples and included a random sample of 2,000 OIF/OEF deployed personnel; 30% completed surveys, and 57% of both samples were women (48, 49). One study compared mental health outcomes within a year of deployment and found no gender differences. PTSD scores by PCL-M (the military version of the PTSD Checklist) were an average of 31.17 (standard deviation, 14.04) among women and 29.97 (standard deviation, 13.54) among men (P = 0.30) (48). However, no measure of combat experience was included in this study, but rather deployment location (Iraq, Afghanistan, other) was examined. The second study was conducted with the specific objective to evaluate gender differences in combat-related stressors and their association with postdeployment mental health conditions including PTSD. Combat experience was measured by using a 15-item scale including experience such as “being fired on,” and items were scored 1–5 on the basis of responses to the frequency of the event reported on a 5-point Likert scale. This analysis noted no significant differences by gender, with the authors concluding that women and men are equally resilient to combat-related stress. Of note, the experiences of women and men differed in this study population as women had a higher history of life-related stressors, while men had more combat-related experiences (49). The findings from these 2 studies with 1 unique study population were in agreement that no gender differences were present with regard to reporting PTSD symptoms. Weaknesses of these studies included the relatively small sample sizes and cross-sectional designs.

National Guard

A cross-sectional study involving 2 time points focused on National Guard members who deployed between 2005 and 2007 in support of the operations in Iraq and Afghanistan (51). Soldiers were surveyed at 3 (n = 2,539; 130 who were women) and 12 (n = 1,495; 88 who were women) months postdeployment, and combat exposure was measured by using the sum score from 28 items that measured traumatic experiences, while PTSD was measured by using the 17-item PTSD Checklist. Positive screens for PTSD were found in 18.0% of females and 14.5% of males 3 months postdeployment and in 17.9% of females and 25.1% of males 12 months postdeployment. Multivariable models including adjustment for combat exposure found that males had decreased odds of screening positive for PTSD compared with females 3 months postdeployment, but no gender difference was observed 12 months postdeployment.

Veterans Administration

Three studies used identical sources for medical record data from VA medical centers to examine mental health diagnoses or health-care utilization among OIF and OEF veterans separated from military service (17, 47, 52). Two studies were designed specifically to examine the relationship between gender and health-care visits for mental health diagnoses among deployers to the Iraq and Afghanistan conflicts (17, 47). VA medical records were examined in 329,049 (including 40,701 women) service members who deployed to OIF/OEF and then sought VA care for the first time between 2002 and 2008 (17). The study found that male veterans were more likely to have a health-care visit for PTSD using the International Classification of Diseases, Ninth Revision (ICD-9), compared with women (22% vs. 17%). Overall, 33% of both men and women had a visit for a mental health condition during the study period (17). Similarly, medical records from 163,812 (including 19,250 women) veterans who served in OIF/OEF between 2001 and 2007 were evaluated at a VA facility within the first year after deployment (47). Forty-two percent of women utilized mental health services compared with 43% of men, with a similar number of mean visits (4.0 vs. 3.6). In the adjusted analysis, women compared with men were less likely to have a health-care visit for PTSD. A subset of this larger VA population was examined cross-sectionally by the same lead author using records from the VA Connecticut Healthcare System (52). A total of 1,229 (16% women) veterans in this study were seen for care between 2001 and 2006. However, screening questions from the VA were utilized in this study to ascertain mental health outcomes rather than ICD-9 codes. Similar to the larger VA studies, the study found that women were at significantly lower odds for screening positive for PTSD compared with men (OR = 0.53, 95% CI: 0.35, 0.79).

Two other retrospective VA studies utilized data from first-time users of VA care among OIF/OEF veterans to examine the burden of mental health diagnoses (22, 53). The first
<table>
<thead>
<tr>
<th>First Author, Year (Reference No.)</th>
<th>Study Design</th>
<th>Years of Deployment</th>
<th>Study Population, no.</th>
<th>Setting</th>
<th>Outcome Measure</th>
<th>PTSD by Gender</th>
<th>Combat Experience, yes/no and measure</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skopp, 2011 (19)</td>
<td>Retrospective cohort</td>
<td>2006–2008</td>
<td>2,896</td>
<td>2,708</td>
<td>Army—large installation</td>
<td>Screening database with pre- (45–120 days) and post-(90–180 days) deployment surveys; PTSD by PC-PTSD screen</td>
<td>Increased odds of nearly 2.5 times among women</td>
<td>Yes. 4 yes or no questions about CE (e.g., becoming wounded or injured), summed for total score</td>
</tr>
<tr>
<td>Luxton, 2010 (1)</td>
<td>Retrospective cohort</td>
<td>2006–2009</td>
<td>6,943</td>
<td>6,427</td>
<td>Army—large installation</td>
<td>Screening database with pre- (45–120 days) and post-(90–180 days) deployment surveys; PTSD by PC-PTSD screen</td>
<td>Similar rates of PTSD symptoms and scores by gender. Higher levels of combat were more strongly associated with PTSD in women</td>
<td>Yes. 4 yes or no questions about CE (e.g., becoming wounded or injured), summed for total score</td>
</tr>
<tr>
<td>Maguen, 2012 (7)</td>
<td>Retrospective cohort</td>
<td>2006–2009</td>
<td>7,251</td>
<td>6,697</td>
<td>Army—large medical treatment facility</td>
<td>Pre- and post- (90–180 days) deployment surveys; PTSD by PC-PTSD screen</td>
<td>No gender differences</td>
<td>Yes. 4 yes or no questions about CE (e.g., becoming wounded or injured), summed for total score</td>
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<tr>
<td>Lapierre, 2007 (16)</td>
<td>Cross-sectional</td>
<td>2004–2005</td>
<td>4,089</td>
<td>3,826</td>
<td>Army reintegration training program</td>
<td>Survey after 12-month deployment to Iraq or Afghanistan; PTSD was detected by using the SPTSS</td>
<td>No gender differences</td>
<td>CE not measured</td>
</tr>
<tr>
<td>Wojcik, 2009 (46)</td>
<td>Retrospective study</td>
<td>2001–2004</td>
<td>473,964</td>
<td>419,358</td>
<td>Army personnel admitted by using data from the Standard Inpatient Data Record</td>
<td>Hospital-associated ICD-9 codes</td>
<td>Increased among women</td>
<td>CE not measured</td>
</tr>
<tr>
<td>First Author, Year (Reference No.)</td>
<td>Study Design</td>
<td>Years of Deployment</td>
<td>Study Population, no.</td>
<td>Setting</td>
<td>Outcome Measure</td>
<td>PTSD by Gender</td>
<td>Combat Experience, yes/no and measure</td>
<td>Limitations</td>
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<tr>
<td>Smith, 2008 (21)b</td>
<td>Prospective cohort</td>
<td>2001–2006</td>
<td>50,128</td>
<td>Millennium Cohort Survey</td>
<td>Increased among women with odds of 1.7–2.0</td>
<td>Yes. At least 1 affirmative response to any of 5 items (e.g., witnessing dead soldiers or civilians; dichotomous variable used</td>
<td>Combat experiences may not have occurred during deployment, no clinical confirmation of symptoms</td>
<td></td>
</tr>
<tr>
<td>LeardMann, 2009 (50)b</td>
<td>Prospective cohort</td>
<td>2001–2006</td>
<td>5,410</td>
<td>Millennium Cohort Survey</td>
<td>Increased among women with &gt;2-fold higher odds</td>
<td>Yes. Combat deployer population created using method from Smith paper (21). Combat severity measured as exposure to 1 item, 2 items, or 3 or more items</td>
<td>Combat experiences may not have occurred during deployment, no clinical confirmation of symptoms</td>
<td></td>
</tr>
<tr>
<td>Eisen, 2012 (48)c</td>
<td>Cross-sectional</td>
<td>2007–2008</td>
<td>596</td>
<td>All service branches</td>
<td>Survey within 1 year after return among veterans of all services; PTSD by military version of PTSD Checklist</td>
<td>No gender differences</td>
<td>CE not measured</td>
<td>Cross-sectional design, no adjustment for predeployment factors, small sample size, no clinical confirmation of symptoms</td>
</tr>
<tr>
<td>Vogt, 2011 (49)c</td>
<td>Cross-sectional</td>
<td>2007–2008</td>
<td>592 (random sample of 2,000 OIF/ OEF personnel; 592 completed survey)</td>
<td>All service branches</td>
<td>Survey within 1 year after return among veterans from all services; PTSD by military version of PTSD Checklist</td>
<td>No gender differences</td>
<td>Yes. 15-item scale used with a modified 5-point Likert scale response format. Sum score created</td>
<td>Cross-sectional design, small sample size, no clinical confirmation of symptoms</td>
</tr>
<tr>
<td>Riviere, 2011 (51)</td>
<td>Cross-sectional with 2 time points</td>
<td>2005–2007, 3 and 12 months after deployment</td>
<td>2,539 at 3 months 2,409</td>
<td>US National Guard soldiers from 2 brigades</td>
<td>PTSD assessed by PTSD Checklist (DSM-IV criteria plus 50 points)</td>
<td>Increased among females at 3 months, but no gender difference at 12 months</td>
<td>Yes. Sum of 28 CE items</td>
<td>Small sample, National Guard only. May not represent all military personnel. No predeployment baseline data available, no clinical confirmation of symptoms</td>
</tr>
</tbody>
</table>

Table continues
<table>
<thead>
<tr>
<th>First Author, Year (Reference No.)</th>
<th>Study Design</th>
<th>Years of Deployment</th>
<th>Study Population, no.</th>
<th>Setting</th>
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<th>PTSD by Gender</th>
<th>Combat Experience, yes/no and measure</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maguen, 2011 (17) d</td>
<td>Retrospective</td>
<td>2002–2008</td>
<td>329,049</td>
<td>VA</td>
<td>First health-care visit after deployment to a VA facility (2002–2008). Utilized ICD-9 codes</td>
<td>Decreased among women</td>
<td>CE not measured</td>
<td>Retrospective design, no adjustment for important behavioral factors because of record abstraction, limited generalizability to veterans not seeking VA care or currently serving personnel</td>
</tr>
<tr>
<td>Haskell, 2011 (47)d</td>
<td>Retrospective</td>
<td>2001–2007</td>
<td>163,812</td>
<td>VA</td>
<td>Health-care visit in first year and required 2 outpatient or inpatient visits with ICD-9 codes for a given condition</td>
<td>Decreased among women</td>
<td>CE not measured</td>
<td>Retrospective design, no adjustment for important behavioral factors because of record abstraction, limited generalizability to veterans not seeking VA care or currently serving personnel</td>
</tr>
<tr>
<td>Haskell, 2011 (52)d</td>
<td>Retrospective</td>
<td>2001–2006</td>
<td>1,229</td>
<td>VA Connecticut</td>
<td>Electronic medical records, including vital signs package and progress notes</td>
<td>Decreased among women</td>
<td>CE not measured</td>
<td>Small sample of users of the VA health-care system in Connecticut—may not be generalizable to personnel who are not seeking care</td>
</tr>
<tr>
<td>Seal, 2009 (22) d</td>
<td>Retrospective</td>
<td>2002–2008</td>
<td>289,328</td>
<td>VA</td>
<td>First health-care visit after deployment to a VA facility (2002–2008). Utilized ICD-9 codes</td>
<td>No gender differences</td>
<td>Proxies for CE were measured, including being of enlisted rank, in the Army, and being deployed more than once</td>
<td>Retrospective design, no adjustment for important behavioral factors because of record abstraction, limited generalizability to veterans not seeking VA care or currently serving personnel</td>
</tr>
<tr>
<td>Seal, 2007 (53)d</td>
<td>Retrospective</td>
<td>2001–2005</td>
<td>103,788</td>
<td>VA</td>
<td>Inpatient and outpatient mental health visits. Utilized ICD-9 codes</td>
<td>Decreased among females</td>
<td>CE not measured</td>
<td>Retrospective design, no adjustment for important behavioral factors because of record abstraction, limited generalizability to veterans not seeking VA care or currently serving personnel</td>
</tr>
<tr>
<td>Baker, 2009 (54) a</td>
<td>Cross-sectional</td>
<td>2006</td>
<td>339</td>
<td>VA</td>
<td>PTSD by the Davidson Trauma Scale (endorsement of trauma exposure and a score of at least 40)</td>
<td>No gender differences</td>
<td>Yes. Combat Exposure Scale</td>
<td>Small sample, not necessarily representative of all veterans. Treatment-seeking sample</td>
</tr>
</tbody>
</table>

Table continues
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</tr>
</thead>
<tbody>
<tr>
<td>Woodhead, 2012 (20)</td>
<td>Prospective cohort</td>
<td>2003–2007</td>
<td>4,986</td>
<td>4,554</td>
<td>432 United Kingdom</td>
<td>Survey of a representative sample of all 3 service branches; PTSD by PCL-C</td>
<td>Increased among women at lower levels of risk</td>
<td>Yes. 13-item scale to items on a 5-point scale. Responses summed and scored.</td>
</tr>
<tr>
<td>Rona, 2007 (55)</td>
<td>Cross-sectional</td>
<td>2003</td>
<td>2,539</td>
<td>1,593</td>
<td>946 United Kingdom</td>
<td>PTSD by PCL-C</td>
<td>No statistically significant gender differences</td>
<td>Yes. Combat role (combat, combat support, other) and 3 items on personal exposure (e.g., small-arms fire)</td>
</tr>
</tbody>
</table>


a Studies by Luxton (1), Maguen (7), and Skopp (19) used the same data source for their study populations. Reference 1 is a follow-up of reference 19.
b Study by LeardMann (50) used a subset of the population reported by Smith (21).
c Studies by Eisen (48) and Vogt (49) used nearly identical study populations.
d Studies by Maguen (17), Haskell (47), and Seal (22, 53) used the same data source for their study populations.
e Studies by Haskell (52) and Baker (54) used subsets of the VA populations cited in Maguen (17), Haskell (47), and Seal (22, 53).
study, published by Seal et al. in 2007 (53), evaluated diagnoses from 103,788 veterans (13% women) first seen from 2001 to 2005 and showed that men were significantly more likely than women to receive a PTSD diagnosis. A follow-up study by Seal et al. in 2009 (22), which included diagnoses from 289,328 veterans (12% women) returning from 2002 to 2008, noted that women were not more likely to be seen for PTSD compared with men. Of note, none of these VA studies using medical record data controlled for in-theater experiences such as combat or included predeployment assessments of mental health.

Another subset of these larger VA populations from San Diego, California, was examined for a 6-month period from April to October of 2006 (54). Unlike the aforementioned larger VA studies that utilized medical records or VA screening questions for diagnostic and demographic data, survey instruments were administered to a sample of 339 (11% female) veterans presenting for care. The questionnaires included information on demographics, combat experiences, traumatic events, and other health outcomes. The Davidson Trauma Scale was used to assess PTSD given the endorsement of a trauma and a score of at least 40 points. In multivariable model results adjusted for combat experience, no significant gender differences with regard to screening positive for PTSD were found.

The findings from these 6 VA studies with either nearly identical populations or subsets from the larger populations contribute results from 1 unique study population. Findings were consistent across VA studies showing that women were less likely to receive a diagnosis or to screen positive for PTSD compared with men. However, in all but 1 study, it should be noted that combat experience was not controlled for, and predeployment mental health was not controlled for in any of these studies. Moreover, these results were from either retrospective or cross-sectional studies from individuals presenting for care, and they may have included a larger proportion of men with greater combat experience than women.

Non-US military studies

An evaluation of a representative sample of United Kingdom Armed Forces examined the impact of in-theater exposures on postdeployment mental health outcomes by gender (20). Among 4,986 (including 432 women) service members, survey data were used to evaluate in-theater experiences and to assess PTSD symptoms (using the PCL-C). Combat exposure was measured by using 13 specific experiences that were grouped into 3 types of “risk to self,” “trauma to others,” and “appraisal of deployment.” Items were scored and summed, with higher scores indicating greater combat experience. The study found that women compared with men had higher PTSD Checklist scores at lower levels of perceived risk, but not at higher levels of risk, for each combat experience. The prevalence of PTSD was similar by gender (4.8% vs. 4.1%) (AOR = 1.48, 95% CI: 0.71, 3.11), and the impact of combat experiences on mental health outcomes by gender was similar, with only gender moderating the impact of exposure to “trauma to others” on PTSD symptoms. Overall, the authors concluded that the impact of exposure to war-time traumatic experiences on PTSD was similar among men and women. An earlier study examining this cohort from the United Kingdom also found no increased prevalence of PTSD by gender (although the number of women was limited) (57), and a follow-up study noted that gender was not associated with persistent versus remittent PTSD among United Kingdom Armed Forces personnel (58).

Another study examining United Kingdom personnel from phase 1 of the cohort study discussed above included 2,539 participants (37% women) who deployed to Iraq between January and April of 2003 and a comparison group of non-deployed personnel serving as of March 2003 (55). The PCL-C was used to measure the PTSD outcome for this Iraq war sample, and combat experiences were measured by combat role and questions about coming under small-arms fire, mortar or artillery fire, or seeing personnel seriously hurt. Females and males had similar odds of screening positive for PTSD in this study (odds ratio = 0.81, 95% CI: 0.45, 1.47).

Although data from these United Kingdom studies were from a cohort study, neither study controlled for baseline mental health disorders, nor did they examine new-onset PTSD. However, 1 study (20) included a relatively robust sample size and was prospective. Findings taken together representing 1 unique study population (20, 55, 57, 58) agreed that few differences exist with regard to gender, except at low levels of combat, where women have higher odds of screening positive for PTSD.

Summary of results

In summary, 18 studies from 8 unique study populations were included in this review. Findings from the Army studies (1, 7, 19) found that gender differences in PTSD exist with higher levels of combat exposure. Positive features of these studies included the ability to examine and adjust for combat exposure, while the retrospective design did not allow for assessment of new-onset PTSD. Additionally, an Army study found that hospitalizations for PTSD were higher among women (46), while a cross-sectional study among Army members returning from deployment found no gender differences (16). The 4 studies from all service branches, 2 from the Millennium Cohort Study (21, 50) and 2 that utilized a sample from Defense Manpower Data Center records (48, 49), had disparate findings. The Millennium Cohort data showed significantly increased odds for PTSD among women postdeployment compared with men (21, 50). The studies using Defense Manpower Data Center samples showed no gender differences with regard to PTSD (48, 49), and while 1 of these studies controlled for combat experiences (49), the retrospective design did not allow for control of predeployment mental health. The Millennium Cohort Study was the only study included in the review that examined new-onset PTSD, thereby removing individuals with PTSD at baseline (21, 50). This strength, coupled with its large sample size and ability to control for combat experience and other important behavioral factors (e.g., alcohol use), gives a great amount of credence to the findings from this study. Notable limitations include the fact that neither study from the Millennium Cohort included in this review was designed specifically to examine gender differences, the combat experience questions were not asked in relation to a recent deployment, and certain important factors like sexual assault were not accounted for in analyses.
Findings from the study on National Guard personnel showed that women were at increased odds of screening positive for PTSD, but this finding was significant only at 3 months postdeployment and not at 12 months postdeployment (51). Although combat experience was accounted for in this study, baseline mental health and other important behavioral factors were not included.

Four of the 6 studies using VA samples agreed that women were less likely to receive a PTSD diagnosis or to screen positive for PTSD compared with men (17, 22, 47, 52–54). All but 1 study utilized electronic medical records for outcome ascertainment and were able to control for combat experience. Results from these treatment-seeking samples should be interpreted with some caution, as men who seek care may have experienced higher levels of combat (hence may have more persistent symptoms that require treatment after service time) or have a greater need or desire for disability compensation, but this is unknown for these studies.

Finally, results from the non-US military cohort showed either no gender differences or that women were at higher risk at lower levels of combat (20, 55). The finding of women being at higher risk at lower levels of combat contrasts with the finding from the Army study by Luxton et al (1), where women were found to be at greater risk for PTSD at higher levels of combat. The studies from the United Kingdom cohort did not include new-onset outcomes and did not control for baseline mental health outcomes, but they were able to adjust specifically for combat experiences.

Taking all findings from the 8 unique study populations together, there is no complete consensus as to whether women are at higher risk than men for PTSD after deployment in support of the operations in Iraq and Afghanistan. On the basis of findings from the Millennium Cohort Study, a study on National Guard personnel, 3 of 5 Army studies, and a prospective cohort study from the United Kingdom, it would appear that women have a higher odds (ranging from 1.7 to 2.5) of screening positive for PTSD postdeployment compared with men. Findings from the VA dispute this, but results from treatment-seeking samples compared with a prospective cohort study cannot be given the same consideration. Therefore, these results indicate a pattern for a moderately higher likelihood for PTSD among women, but because of inconsistent results among studies, further research is needed to ascertain if there are gender differences in postdeployment PTSD among service personnel.

**DISCUSSION**

As the roles and responsibilities of women in the military have expanded, understanding unique health concerns among this group is essential for force protection and readiness. In this comprehensive review, women appeared to be at higher risk for postdeployment PTSD when accounting for combat exposure. However, there was no definitive consensus, and the available studies had notable limitations that should be considered, including the fact that prospective studies with large samples were not designed specifically to evaluate potential gender differences in postdeployment PTSD.

Although not all studies agreed that women were at higher risk for postdeployment PTSD compared with men, those with the most rigorous study designs, including prospective studies that adjusted for combat experience, showed this finding. There are several hypothesized reasons why women may be at higher risk compared with men. Women may possess higher levels of vulnerability to combat experience or combat-related trauma than men, leading to higher risk for PTSD. Also, the type of traumatic events experienced by women may be different from those experienced by men (e.g., events experienced in health-care roles). In addition, experiences like sexual trauma (specifically military-related sexual trauma that may occur during deployment) and intimate partner violence are more often experienced by women, which may cause a higher predisposition for PTSD among these women (43). Also, as the minority gender in the military, there may be factors associated with lower levels of social or unit support experienced by women placing them at higher risk for PTSD compared with men.

Given the diversity of findings from this review, it is important to consider the etiology of the divergent findings among studies, which may be severalfold. For an understanding of the risk for PTSD, complete information on the 3 primary categories of risk factors for its development is required: 1) type(s) and severity of trauma(s); 2) personal characteristics (e.g., age, education, psychiatric history, prior trauma exposures); and 3) environmental factors (e.g., social support and life stressors) (59). A clear limitation of the existing literature is the lack of comprehensive assessment of these factors, which may explain the various study results.

Specifically, an important issue for studies is the adequate evaluation of combat experiences, because men more often have these types of traumatic events (20, 60, 61). Studies examining whether gender moderates the relationship between combat experiences and PTSD symptoms following deployment have been performed, but with various results (1, 20). In an Army study that accounted for in-theater experiences, higher levels of combat were more strongly associated with PTSD among women (1). However, a study from the United Kingdom found that women compared with men had higher PTSD Checklist scores at lower levels of perceived risk, but not at higher levels of risk, for each combat experience (20). Limitations include that these studies did not examine other deployment-related factors beyond combat, such as deployment length, dwell time, occupation, and in-theater job assignments. Further, the various types and severity of combat experiences were often not assessed; however, it is known that an increasing number of traumatic factors during a specific event is associated with a higher likelihood of PTSD (59, 62).

Regarding other published data in the civilian literature on the impact of gender and combat on PTSD, a quantitative review of the general population found that females had a greater vulnerability to developing PTSD after certain traumatic events (i.e., refugee situations, terrorism events, accidents, witnessing death, and illness/injury) but not after combat or sexual trauma (14), the 2 most recognized stressors during the Iraq and Afghanistan conflicts (8, 43). Overall, the current published literature provides some evidence that gender moderates the impact of combat on postdeployment PTSD in the setting of the Iraq and Afghanistan conflicts.

There are other limitations of the current published literature to consider, including the lack of consistent assessments for other known risk factors for PTSD, which may differ by gender.
among military personnel. For instance, few studies in our review adjusted for prior psychiatric illness. The only study that collected and controlled for predeployment PTSD symptoms and then assessed new-onset postdeployment PTSD was the Millennium Cohort Study. Another notable limitation is that the diagnosis of PTSD in all of the current studies relied on survey instruments and medical record codes, rather than on clinical interviews. It should be noted that there are numerous motivators for service members and veterans to over- and under-report symptoms, and that women are typically more likely to seek health care (63, 64). Additional considerations include port symptoms, and that women are typically more likely to participate in surveys (1, 7, 17, 19, 22, 46, 47, 52, 53) in design, and those with a retrospective cohort had follow-up times of less than a year (1, 7, 19). The short follow-up limits assessment of the longer term effects of deployment, as the onset of PTSD varies by time since return from deployment (10, 65). Further, studies had important methodological differences (e.g., operational samples vs. population-based studies; the specific service branch/component evaluated; anonymity of reporting; time since return from deployment to assessment; and response rates) and varied in the collection of substantive factors (e.g., level of combat and other deployment-related factors, prior mental health and sexual history, MST, and concurrent life stressors). Future studies on gender and mental health outcomes should include adequate numbers of women and collect predeployment baseline data (e.g., psychiatric assessment, prior history of adverse childhood and sexual experiences), detailed deployment data (types and severity of in-theater stressors including combat and MST, unit support), and postdeployment assessments (social support) using survey instruments and clinical interviews (when feasible) for the diagnosis of PTSD with longitudinal follow-up.

In summary, the erased battle lines of the recent conflicts in Iraq and Afghanistan have meant that female service members are no longer shielded from combat-related experiences. Providing care for this new generation of female service members and veterans is of utmost importance. This includes the assessment of gender-specific risks for health outcomes including postdeployment PTSD, a chronic and potentially debilitating disorder associated with impairment in both physical and social functioning. The current literature demonstrates that the most rigorous studies suggest that women deployers are at higher risk for postdeployment PTSD compared with men, but findings were not always consistent among studies. Our review shows that women have a notable risk of developing postdeployment PTSD and, therefore, should not be forgotten in terms of veteran-related mental health care. Further, with the expanding roles of women including the opportunity to engage in direct ground combat roles, continued research is advocated. These data should be utilized by the Department of Defense and VA to design mental health care programs and to perform additional studies among service members and veterans of the Iraq and Afghanistan conflicts to more thoroughly assess potential gender differences in postdeployment outcomes. If women are confirmed to be at higher risk for postdeployment PTSD compared with men as the findings from this review suggest, then follow-on studies should examine modifiable factors that could reduce the risk of PTSD and increase the effectiveness of interventions among female service members.

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