

Gender Differences in Combat-Related Stressors and Their Association With Postdeployment Mental Health in a Nationally Representative Sample of U.S. OEF/OIF Veterans

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Though the broader literature suggests that women may be more vulnerable to the effects of trauma exposure, most available studies on combat trauma have relied on samples in which women's combat exposure is limited and analyses that do not directly address gender differences in associations between combat exposure and postdeployment mental health. Female service members' increased exposure to combat in Afghanistan and Iraq provides a unique opportunity to evaluate gender differences in different dimensions of combat-related stress and associated consequence for postdeployment mental health. The current study addressed these research questions in a representative sample of female and male U.S. veterans who had returned from deployment to Afghanistan or Iraq within the previous year. As expected, women reported slightly less exposure than men to most combat-related stressors, but higher exposure to other stressors (i.e., prior life stress, deployment sexual harassment). No gender differences were observed in reports of perceived threat in the war zone. Though it was hypothesized that combat-related stressors would demonstrate stronger negative associations with postdeployment mental health for women, only one of 16 stressor \times gender interactions achieved statistical significance and an evaluation of the clinical significance of these interactions revealed that effects were trivial. Results suggest that female Operation Enduring Freedom/Operation Iraqi Freedom service members may be as resilient to combat-related stress as men. Future research is needed to evaluate gender differences in the longer-term effects of combat exposure.

Keywords: gender, veterans, military personnel, trauma exposure, mental health

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As a consequence of women's changing role in the war zone, as well as the evolving nature of modern warfare, female service members have experienced unprecedented levels of combat exposure in the U.S. wars in Afghanistan (Operation Enduring Freedom; OEF) and Iraq (Operation Iraqi Freedom; OIF). While

women are still officially barred from direct ground combat positions in the U.S. military, they serve in a variety of positions that put them at risk for combat exposure (Street, Vogt, & Dutra, 2009). Women's risk for combat is compounded by the enemy's increased use of guerilla warfare tactics in recent wars. As of 2009,

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more than 750 women had been wounded or killed in action during OEF/OIF (Department of Defense, 2009).

Although other countries have employed women in combat roles at different points throughout history (e.g., Russian Women's Battalions of Death during World War I), women's exposure to combat is a relatively new phenomenon in the U.S. As such, this topic has received a great deal of attention in the popular media. However, it has received surprisingly little empirical attention. Moreover, though the literature on the deployment experiences and postdeployment health of OEF/OIF veterans continues to grow, most studies include few women and do not report gender-based analyses. To our knowledge, no published study has yet examined gender differences in exposure to different dimensions of combat-related stress and their associated consequences for postdeployment mental health in a nationally representative sample of U.S. OEF/OIF veterans.

Although anecdotal accounts indicate that female OEF/OIF service members have experienced combat exposure at rates that are much higher than prior U.S. wars (La Bash, Vogt, King, & King, 2008), the extent to which the nature and severity of women's combat experiences parallel men's experiences is currently unknown. As one might expect due to women's exclusion from ground combat positions, studies that have reported relevant results generally reveal higher levels of combat exposure for men. However, these differences appear to be quite modest. For example, 45% of women and 50% of men in a national sample of U.S. OEF/OIF veterans reported experiencing some level of combat exposure (Jacobson et al., 2008). Another study that addressed gender differences in a sample of Iraq-deployed combat support troops (Hoge, Clark, & Castro, 2007) found that men were more likely to report being in firefights (47% versus 36%) and shooting at the enemy (15% versus 7%), but women were more likely to report handling human remains (38% and 29%). Though these studies suggest substantial levels of combat exposure for OEF/OIF deployed women, an in-depth evaluation of gender differences in the nature and severity of combat exposure in this cohort has not yet been conducted.

Women's increased exposure to combat also raises the question of whether there may be gender differences in the mental health consequences of combat exposure. Though the broader literature indicates that women are at higher risk for mental health problems following a variety of traumatic events (Tolin & Foa, 2006), most of this literature is based on noncombat traumas (e.g., motor vehicle accidents, assaults, etc). Moreover, although gender differences appear smaller when analyses are restricted to combat trauma samples (Tolin & Foa, 2006), the literature that is currently available is based on prior cohorts in which women's combat exposure was limited, and thus, may not allow for a robust test of this hypothesis. In addition, most prior studies on gender differences in combat trauma have relied on analyses that do not directly evaluate gender differences in associations between combat exposure and postdeployment mental health (Street et al., 2009). As a consequence, there is little evidence to inform conclusions regarding the extent to which women and men differ in their vulnerability to combat-related stressors.

Women's increased exposure to combat in OEF/OIF provides a unique opportunity to better understand gender differences in the mental health consequences of combat exposure. Though no published studies have examined differential associations for women

and men in an OEF/OIF sample, one study that took a slightly different approach to this research question produced several interesting findings. In a sample of infantry and combat support service members women were significantly more likely than men to screen positive for general mental health problems when exposure to combat was low (17% compared to 9%), but there was no difference under moderate levels of combat exposure (MHAT-IV, 2006). While this study provides some support for the possibility of gender differences in the impact of combat exposure on postdeployment mental health, it also suggests that this effect may be small.

Prior research has revealed four categories of combat-related stress that may be especially important to consider in research in this area. These factors include: (a) combat exposure; (b) exposure to the aftermath of battle; (c) perceived threat; and (d) difficult living and working environment. Among these stressors, combat exposure has received the greatest attention in the literature. Studies based on OEF/OIF service members (e.g., Hoge, Auchterlonie, & Milliken, 2006; Hoge et al., 2004; Hotopf et al., 2006), as well as prior cohorts (King, King, Vogt, Knight, & Samper, 2006; Kulka et al., 1990), indicate that combat exposure, including experiences such as being fired upon and witnessing death, has significant implications for postdeployment mental health. Exposure to the aftermath of battle, such as handling human remains or caring for injured personnel, has received less direct research attention though several studies based on OEF/OIF service members indicate that these experiences are associated with poor postdeployment mental health (Fear et al., 2009; Rona et al., 2009). Of note, research has revealed different correlates and consequences of combat exposure and aftermath of battle (Renshaw, 2011), underscoring the importance of examining these dimensions separately.

Perceptions of threat in the war zone have also been implicated in the mental health of returning service members. In a study using data from the National Vietnam Veterans Readjustment Study (King, King, Foy, Keane, & Fairbank, 1999), perceived threat of bodily harm or death played a key role in accounting for the postdeployment mental health of returning veterans. Findings suggest that this factor may also be relevant for the OEF/OIF cohort. For example, in a study of predictors of PTSD among health care providers deployed to Afghanistan and Iraq, Kolkow and colleagues (2007) found a strong association between concerns about danger and probable PTSD. Similarly, Iversen et al. (2008) found that threat perceptions predicted PTSD in a sample of UK military personnel deployed to Iraq.

Another factor that may also be implicated in the postdeployment adjustment of returning OEF/OIF service members is ongoing exposure to the lower-level stress of living in a war zone. Aspects of the difficult living and working environment may include stressors such as long workdays and exposure to uncomfortable climates. Research based on both Vietnam veterans (King, King, Fairbank, Keane, & Adams, 1998) and Gulf War veterans (Vogt, Pless, King, & King, 2005) has documented the impact of this lower-level stressor on postdeployment health, though no studies on this topic were identified in the OEF/OIF veteran literature.

The goal of the present study was to examine gender differences in different dimensions of combat-related stress and their associated relationship with postdeployment mental health in a national

sample of female and male U.S. OEF/OIF veterans. This study builds on prior research in this area in a number of ways. First, this study focused on a sample in which there was ample dispersion in women's combat exposure to allow for gender comparisons across comparable levels of combat. Second, consistent with recent recommendations in the literature (Street et al., 2009; Zinzow, Grubaugh, Monnier, Suffoletta-Maierle, & Frueh, 2007), this study took a more fine-grained approach to conceptualizing combat-related stress than has been typical in the literature. Third, both sampling weights and nonresponse bias weights were applied to produce results that would be optimally representative of the larger population. Prior research has primarily relied on convenience samples and has not taken into consideration the impact of nonresponse bias on study findings.

Stemming from the recognition that warfare exposure has broad-ranging impacts on mental health (Tanielian & Jaycox, 2008), gender differences in associations between different dimensions of combat-related stress and posttraumatic stress symptomatology (PTSS), depression, substance abuse, and mental health functional status were examined in addition to evaluating mean gender differences on combat-related stressors. These analyses controlled for additional stressors—namely, prior life stress exposure and deployment sexual harassment—to isolate unique relationships between combat-related stressors and different aspects of postdeployment mental health. Based on the literature on gender differences in combat exposure among OEF/OIF service members, we hypothesized that men would report significantly more exposure to combat-related stressors than women, but that effect sizes associated with these differences would be small. Based on research indicating that women may be somewhat more vulnerable to the effects of combat exposure, we hypothesized that combat-related stressors would demonstrate a significantly stronger negative impact on postdeployment mental health for women than men, but that this effect would also be small.

Method

Sample

The larger study from which these data were drawn used an observational research design. A national stratified random sample of 2,000 OEF/OIF military personnel was randomly selected from the Defense Manpower Data Center (DMDC) roster (50% Active Duty component, 25% National Guard component, and 25% Reserve Forces), with 50% women in each subgroup. Only potential participants who were identified as having returned from deployment within the past year (between October 1, 2007 and July 31, 2008) were included in the sampling frame. The sampling frame was selected based on an evaluation of statistical power needed to address primary research questions. To be eligible for the survey, potential participants had to have an address in the United States and be physically located in the United States at the time of the initial mailing. Of the 2,000 names obtained, 1,833 were eligible for the survey. We received completed surveys from 595 OEF/OIF veterans, representing 57% of those for whom receipt of survey materials was confirmed. For the purpose of this study, three additional cases were eliminated from the sample because DMDC data were not available to classify them according to the stratified sampling plan, producing a final sample size of 340 women and

252 men. Unweighted demographic and deployment characteristics of the sample are available online as supplemental materials.

Procedure

Prenotification letters were sent to all eligible service members to inform them about the study and let them know that the survey would be sent to them in two weeks. An "opt-out" postcard was included with each prenotification letter to give individuals the opportunity to decline participation. Anyone who returned the opt-out postcard was not contacted again. All potential participants were sent a cover letter, an information sheet that covered all elements of consent, the survey and a preaddressed, postage paid return envelope. A modified Dillman et al. (2009) method was used to enhance response rates. That is, if completed surveys were not returned within two weeks, a reminder letter was sent. Up to six reminder phone calls were also made to nonrespondents, followed by a repeat survey mailing to remaining nonrespondents. To further maximize response rates, an Internal Revenue Service (IRS) address search, available via a Department of Veterans Affairs Environmental Epidemiology Service interagency agreement with the IRS, was initiated to obtain updated addresses for individuals who could not be reached by mail or phone. Completion of the survey was considered implied consent. All those who returned a completed survey received a \$30 gift card. All procedures were approved by the Veterans Affairs (VA) Bedford Institutional Review Board.

We examined potential gender differences on a range of background and military characteristics, including age, education, race/ethnicity, marital status, parenting status, income, employment status, predeployment duty component, length of deployment, time since deployment, military rank, time in the military, deployment operation, branch of service, and current military status. There were no significant differences between women and men on the majority of these characteristics. However, female OEF/OIF veterans were, on average, about 3 years younger, $t(590) = 3.48, p = .001$, and more likely to belong to a racial/ethnic minority group, $\chi^2(1, N = 585) = 5.75, p = .017$, than male OEF/OIF veterans. Male OEF/OIF veterans were more likely to be married, $\chi^2(1, N = 592) = 79.8, p = .000$, and living with children, $\chi^2(1, N = 592) = 7.38, p = .02$, to have higher average incomes, $t(581) = 3.28, p = .001$, and to have served in the Marine Corps during their deployment, $\chi^2(1, N = 591) = 79.8, p = .000$.

Measures

All stressor measures were from the Deployment Risk and Resilience Inventory (DRRI; King, King, & Vogt, 2003). Scales from the DRRI have demonstrated strong reliability and validity based on samples of both OEF/OIF veterans (Vogt, Proctor, King, King, & Vasterling, 2008) and Gulf War veterans (King et al., 2006). Moreover, the application of a focus group methodology to inform both the conceptualization of these factors and the generation of items is a strength of the DRRI, contributing to the content validity of this suite of scales (Vogt, King, & King, 2004).

Combat experiences. Combat experiences, defined as exposure to typical warfare experiences such as firing a weapon, being fired on, and witnessing injury and death, were measured using a 15-item scale with a modified 5-point Likert response format (1 =

never; 2 = *few times over entire deployment*; 3 = *few times each month*; 4 = *few times each week*; 5 = *daily or almost daily*).

Aftermath of battle. Aftermath of battle is defined as exposure to the consequences of combat operations, including experiences such as observing or handling human remains and dealing with detainees. This 15-item scale also used a modified 5-point Likert response format (1 = *never*; 2 = *a few times over entire deployment*; 3 = *a few times each month*; 4 = *a few times each week*; 5 = *daily or almost daily*).

Perceived threat. Perceived threat is defined as fear for one's safety and well-being, especially as a response to combat exposure. This 15-item scale had a 5-point response format with anchors 1 = *Strongly disagree* to 5 = *Strongly agree*.

Difficult living and working environment. Difficult living and working environment is defined as exposure to events or circumstances representing repeated or day-to-day irritations and pressures related to life in the war zone. Participants responded to this 20-item scale using a 5-point response format with anchors 1 = *Almost none of the time* to 5 = *Almost all of the time*.

Prior stress exposure. Prior stress exposure, defined as exposure to highly stressful or traumatic events before deployment, such as domestic violence or sexual abuse, was measured using a 17-item scale and a dichotomous (*yes/no*) response format.

Deployment sexual harassment. Sexual harassment, defined as exposure to unwanted sexual contact, including sexual assault, or verbal conduct of a sexual nature from other unit members, commanding officers, or civilians in the war zone, was measured using a 7-item scale and a 4-point Likert response format (1 = *Never*; 4 = *Many times*).

Four mental health measures were used for this study.

Posttraumatic stress symptomatology (PTSS). The widely used and well-validated military version of the PTSD Checklist (e.g., Weathers, Litz, Herman, Huska, & Keane, 1993) was used to assess posttraumatic stress symptomatology. This measure contains 17 items corresponding to the symptom criteria for PTSD. Respondents rated each item on a 5-point response format (with anchors ranging from 1 = *Not at All* to 5 = *Extremely*). This scale has demonstrated high coefficient alphas and good test-retest reliability (Ruggiero, Del Ben, Scotti, & Rabalais, 2003), and is highly correlated with other measures of PTSD, including the Clinician-Administered PTSD Scale ($r = .93$; Blake et al., 1990). The PCL has also demonstrated acceptable levels of discriminant validity relative to other forms of psychopathology (e.g., Ruggiero et al., 2003; Weathers, Litz, Herman, Huska, & Keane, 1993).

Depression and substance abuse. The 24-item Behavior and Symptom Identification Scale (BASIS-24) is a widely used, multidimensional mental health assessment instrument (Eisen, Norman, Belanger, Spiro, & Esch, 2004; Eisen, Gerena, Ranganathan, Esch, & Idiculla, 2006). Depression and substance abuse subscales were used in this study. Subscales from the BASIS-24 have been validated in a national sample of more than 5,800 recipients of mental health and/or substance abuse services, and have also been used in other mental health studies of veterans. Subscale reliabilities range from .77 to .91, with good concurrent and discriminant validity (Eisen et al., 2004; Eisen et al., 2006).

Mental health functioning. The Veterans RAND Short Form (VR-12) was used to assess postdeployment mental health functioning (Ware, Kosinski, & Keller, 1996). The 12-item

Short Form is a brief version of the Veterans RAND SF-36, which assesses both mental and physical health functioning. These instruments were adapted for use in veteran samples by increasing the number of response options, resulting in fewer floor and ceiling effects, increased reliability, and greater explanatory power (Kazis et al., 2004). They are among the most widely used functional status measures in the world and have been shown to be reliable and valid (Jones et al., 2001).

Weighting and Analyses

Along with women, National Guard and Reservist personnel were oversampled to allow for meaningful comparisons among subgroups. Weights were applied to adjust for oversampling, as well as nonresponse bias, so that results could be projected to the larger population. Sample design weights were based on population values provided by the DMDC and were set equal to the reciprocal of the stratum sampling probability. In addition, sample design weights were adjusted by a set of weights that accounted for nonresponse to the survey. This procedure was done by performing a logistic regression on the full sample of potential participants with "returned survey" (0/1) as the dependent variable and DMDC variables representing age, gender, race, and service component as independent variables. This analysis estimated the probability of returning the survey for each person in the sample. The reciprocal of this probability was the value of the 2nd weight. The product of an individual's sampling weight and the nonresponse weight allows for extrapolation from the sample of returned questionnaires to the overall population. As recommended, we also accounted for the stratified sampling design in all analyses (i.e., 6 strata defined by crossing gender with predeployment duty component). The application of sample design and nonresponse bias weights, combined with the recognition of stratification in the survey design, contributed to the computation of unbiased estimates and correct standard errors.

The STATA software package was employed to test all study hypotheses and weighted analyses were conducted using survey (svy) commands designed to handle the special requirements of complex survey data. Table 1 presents weighted correlations among all study variables. The first set of analyses involved computing weighted means for all deployment stressor measures and mental health measures separately for women and men. After that, independent samples *t*-tests were computed to provide information regarding gender differences in exposure to different dimensions of war-zone stress and postdeployment mental health. To evaluate gender differences in associations between deployment stressors and mental health, multiple regression analyses were conducted for each of the four outcomes. For ease of interpretation, the variables representing the main effects of deployment factors were centered prior to the calculation of the product terms (Cohen, Cohen, West, & Aiken, 2003). At the first step of each regression analysis, the set of stressor variables was entered to allow for the estimation of unique effects of each stressor on mental health. Prior life stress exposure and deployment sexual harassment were included in these regressions to isolate unique relationships between

Table 1
Weighted Correlations Among Study Variables

Variable	1	2	3	4	5	6	7	8	9	10
1. Prior stressors	—	.33*/-.01	.35*/.34*	.28*/.38*	.26*/.30*	.29*/.23*	.47*/.26*	.42*/.16	.27*/.09	.19*/.27*
2. Sexual harassment		—	.18*/.03	.17*/.01	.34*/.08	.27*/.12*	.49*/.06	.42*/.06	.27*/.20*	.25*/.01
3. Combat exposure			—	.63*/.72*	.49*/.56*	.50*/.49*	.49*/.54*	.36*/.35*	.23*/.18	.04/.30*
4. Aftermath of battle exposure				—	.44*/.54*	.37*/.44*	.42*/.54*	.24*/.33*	.17*/.22*	.03/.34*
5. Difficult living/working environment					—	.64*/.56*	.60*/.52*	.47*/.28*	.32*/.26*	.16*/.28*
6. Perceived threat						—	.61*/.57*	.45*/.35*	.34*/.16	.17*/.29*
7. PTSS							—	.78*/.79*	.55*/.52*	.34*/.48*
8. Depression								—	.67*/.65*	.33*/.34*
9. Mental health functioning									—	.29*/.24*
10. Substance abuse										—

Note. Values presented as women/men.

* $p < .05$.

combat-related stressors and postdeployment mental health.¹ At the second step, gender and combat-related stressor \times gender interactions or product terms were added to the model to evaluate gender as a moderator of these relationships.

Prior to conducting our final set of regression analyses we examined regression residuals to evaluate whether they were distributed normally, as this is a key assumption of linear regression. We identified deviations from normality for all four regressions and examined the mental health measures to evaluate whether problems with skewness might be accounting for the lack of normality. Variables were considered skewed if the variable's skewness statistic exceeded twice its standard error (Hopkins & Weeks, 1990). This was the case for all four measures. The PCL-M and BASIS – depression measures were positively skewed; therefore, a square-root transformation was used to increase the normality of these variables (Tabachnick & Fidell, 1996). The SF-12 measure of mental health functioning was negatively skewed; therefore, a square-root transformation was applied after reverse-scoring this measure. As a consequence, all results for this measure must be interpreted in the opposite direction. After further examination of the substance abuse variable, for which there was very little dispersion in scores above zero, it was determined that this variable would be best represented as a dichotomous variable scored "0" for anyone who did not endorse any items in this scale and "1" for anyone who endorsed any items in this scale. Reexamination of regression residuals confirmed that these transformations improved the normality of regression residuals. Weighted multiple regression analyses were conducted for the transformed PTSS, mental health functioning, and depression variables, and a weighted logistic regression was conducted for the dichotomous substance abuse variable.

A number of demographic and military characteristics were examined as possible covariates for both mean difference and regression analyses. The vast majority of these variables did not qualify as potential confounders, and results did not change after accounting for those variables that were associated with both the predictors and outcomes in study analyses.² Therefore, we determined that background differences could not account for observed associations and we did not control for these variables in our primary set of analyses.

Results

Differences Between Respondents and Nonrespondents

To identify characteristics associated with survey response versus nonresponse we compared the demographic and military characteristics of survey respondents with those of nonrespondents. Survey respondents were more likely than nonrespondents to be female ($\chi^2 = 15.8, p < .001$), older ($t = -8.48, p < .001$), National Guard or Other Reserve ($\chi^2 = 10.7, p = .005$) and from the Air Force or Navy ($\chi^2 = 16.9, p = .001$). There were no differences in response rate as a function of race or Hispanic ethnicity. Weighted analyses were conducted to adjust for the observed nonresponse bias.

Gender Differences in Exposure to Combat-Related Stressors

Table 2 presents weighted means and standard errors for the deployment stressor and postdeployment mental health variables for women and men separately, as well as differences between

¹ A supplemental set of separate regressions were conducted to assess whether associations differed for women and men when not controlling for other potentially co-occurring stressors (i.e., to evaluate the effects of combat-related stressors experienced in the context of other stressors). Specifically, each regression included a single combat-related stressor, gender, and stressor \times gender interaction. Consistent with results based on adjusted analyses, results did not support the hypothesis that associations would be stronger for women than men. Only three of the 16 interactions achieved conventional levels of statistical significance, and all corresponding effect sizes were trivial (Cohen et al., 2003).

² Minority racial/ethnic status was associated with both gender (women were more likely to be minorities) and perceived threat (minorities reported more threat). Marital status and parenting status was also associated with both gender (men were more likely to be married and to be living with children) and sexual harassment (unmarried service members and service members who were not living with children were more likely to report being harassed). Therefore, we reexamined: (a) the association between gender and perceived threat controlling for minority status; and (b) the association between gender and sexual harassment controlling for both marital status and parenting status. In each case, results did not change.

Table 2
Gender Differences in Combat-Related Stressors, Additional Stressors, and Postdeployment Mental Health

Study variables	Women		Men		Mean diff	CI diff	<i>t</i>	<i>r</i>	CI <i>r</i>
	Mean	<i>SE</i>	Mean	<i>SE</i>					
Combat-Related Stressors									
Combat Exposure	20.89	0.46	25.70	0.92	4.81	2.79–6.83	4.68*	.19	0.11–0.26
Exposure to Aftermath of Battle	22.57	0.68	25.92	0.95	3.35	1.05–5.65	2.86*	.12	0.04–0.19
Perceived Threat	39.97	0.87	41.52	0.94	1.55	–0.96–4.07	1.21	.05	–0.02–0.13
Difficult Living/Working Environment	45.24	0.78	50.91	1.05	5.66	3.08–8.24	4.31*	.18	0.10–0.25
Other Stressors									
Prior Life Stressors	2.97	0.21	2.30	0.22	–0.67	–1.26––0.8	–2.22*	.09	0.02–0.17
Sexual Harassment/Assault	8.95	0.23	7.34	0.12	–1.61	–2.12––1.09	–6.15*	.25	0.17–0.32
Postdeployment Mental Health									
Posttraumatic Stress Symptomatology	30.16	0.99	31.34	1.26	1.19	–1.96–4.33	0.74	.03	–0.05–0.11
Mental Health Functioning	40.58	0.65	40.68	0.68	0.10	–1.74–1.95	0.11	.00	–0.07–0.08
Depression	0.96	0.06	0.95	0.07	–0.01	–0.20–0.17	–0.13	.01	–0.07–0.08
Substance Abuse	0.25	0.03	0.47	0.06	0.22	0.09–0.35	3.35*	.14	0.06–0.21

* $p < .05$.

means and their associated confidence intervals (CIs). Also presented in this table are *t* statistics, as well as effect sizes (*rs*) and their associated CIs. Of 8 contrasts, there were 4 statistically significant differences. As expected, men reported significantly more exposure to combat, aftermath of battle, and difficult living and working environment, though differences were fairly modest. No gender differences were observed for perceived threat. With respect to additional stressors, findings revealed that women reported significantly more exposure to prior life stressors and deployment sexual harassment, though these differences were also quite modest.

Though not central to our primary research questions for this study, it is interesting to note that few gender differences emerged in self-reports of postdeployment mental health. Specifically, similar levels of PTSS, mental health functioning, and depression were observed, though scores on substance abuse were higher for men than women.

Gender Differences in Associations Between Combat-Related Stressors and Postdeployment Mental Health

The Step 2 results included in Table 3 present interactions between combat-related stressors and gender in the prediction of postdeployment mental health measures.³ Unstandardized parameter estimates and their CIs, as well as partial correlation values and their associated CIs, are included in this table. Of the 16 interactions that were examined, only one of them achieved a conventional level of statistical significance and the direction of this interaction was not consistent with our hypothesis that associations would be slightly stronger for women than men.

As indicated in the table, there were no significant interactions between combat-related stressors and gender in the prediction of PTSS, mental health functioning, or depression. Moreover, all corresponding effect sizes for interactions were close to zero and well below Cohen et al.'s (2003) criterion for a small partial correlation effect (squared partial $r = .02$). In contrast, a significant interaction between aftermath of battle and gender emerged for substance abuse, suggesting that the increase in the odds of having a substance abuse problem associated with exposure to the

aftermath of battle was greater for men than women. However, an examination of the corresponding odds ratio for this interaction revealed that this effect was very small, and therefore, did not meet criteria for clinical significance.

Associations of Combat-Related Stressors and Mental Health for Both Women and Men

Though the primary focus of this study was on gender differences, it is interesting to note that different stressors demonstrated unique associations with different postdeployment mental health measures when the sample was considered as a whole (i.e., women and men combined), as indicated in the Step 1 results for each postdeployment mental health outcome in Table 3. Specifically, exposure to aftermath of battle and perceived threat were positively related to PTSS, difficult living and working environment and sexual harassment were positively related to mental health functioning, perceived threat and sexual harassment were positively related to depression, and aftermath of battle was positively related to substance abuse (though this main effect must be interpreted in the context of the observed interaction involving this variable).

Discussion

Study findings revealed a number of important findings with respect to gender differences in exposure to combat-related stressors and associated relationships with postdeployment mental health among U.S. OEF/OIF service members. As expected, men reported more exposure to the three more objective combat-related stressors examined in this study. The fact that these differences were relatively small, however, suggests that women's exposure to these stressors in OEF/OIF may be only slightly lower than men's exposure, on average. This finding is consistent with anecdotal reports suggesting high levels of combat exposure for female

³ Note that main effect results for Step 2 are not presented in Table 3 because they were not interpreted in the presence of the interaction results.

Table 3
Summary of Multiple Regression Analyses Predicting Postdeployment Mental Health

Variable	<i>B</i>	CI <i>B</i>	<i>SE B</i>	<i>r</i>	CI <i>r</i>
Posttraumatic Stress Symptomatology					
Step 1					
Combat Experiences	0.02	-0.02-0.06	0.02	0.11	0.03-0.20
Aftermath of Battle	0.03*	0.00-0.06	0.01	0.18	0.10-0.26
Perceived Threat	0.06**	0.03-0.08	0.01	0.37	0.29-0.44
Difficult Living/Working Environment	0.02	-0.00-0.04	0.02	0.13	0.05-0.22
Prior Life Stressors	0.01	-0.09-0.10	0.05	0.01	-0.08-0.10
Sexual Harassment/Assault	0.05	-0.05-0.15	0.05	0.06	-0.02-0.15
Step 2 [§]					
Gender	0.04	-0.31-0.38	0.17	0.01	-0.08-0.09
Combat Experiences × Gender	0.02	-0.04-0.07	0.03	0.02	-0.07-0.10
Aftermath of Battle × Gender	-0.02	-0.06-0.02	0.02	-0.04	-0.12-0.05
Perceived Threat × Gender	0.01	-0.03-0.04	0.02	0.01	-0.08-0.10
Difficult Living/Working Environment × Gender	0.01	-0.02-0.04	0.02	0.02	-0.06-0.11
SF-12 Mental Health Functioning[†]					
Step 1					
Combat Experiences	-0.01	-0.03-0.01	0.01	-0.07	-0.15-0.02
Aftermath of Battle	0.02	-0.00-0.03	0.01	0.13	0.05-0.22
Perceived Threat	-0.01	-0.02-0.01	0.01	-0.01	-0.09-0.08
Difficult Living/Working Environment	0.01**	0.00-0.03	0.01	0.16	0.08-0.25
Prior Life Stressors	-0.00	-0.05-0.05	0.02	-0.01	-0.09-0.08
Sexual Harassment/Assault	0.07**	0.02-0.12	0.03	0.13	0.05-0.22
Step 2 [§]					
Gender	-0.04	-0.25-0.17	0.11	-0.01	-0.10-0.07
Combat Experiences × Gender	0.02	-0.02-0.05	0.02	0.03	-0.05-0.12
Aftermath of Battle × Gender	-0.02	-0.05-0.01	0.01	-0.05	-0.14-0.03
Perceived Threat × Gender	0.02	-0.00-0.04	0.01	0.06	-0.03-0.15
Difficult Living/Working Environment × Gender	-0.01	-0.03-0.01	0.01	-0.02	-0.11-0.07
Depression					
Step 1					
Combat Experiences	0.00	-0.00-0.01	0.00	0.08	-0.01-0.17
Aftermath of Battle	0.00	-0.00-0.01	0.00	0.10	0.01-0.18
Perceived Threat	0.01**	0.00-0.01	0.00	0.19	0.10-0.27
Difficult Living/Working Environment	0.00	-0.00-0.00	0.00	0.03	-0.06-0.12
Prior Life Stressors	0.00	-0.02-0.02	0.01	0.01	-0.07-0.10
Sexual Harassment/Assault	0.02**	0.00-0.03	0.01	0.10	0.01-0.18
Step 2 [§]					
Gender	0.02	-0.04-0.08	0.03	0.02	-0.07-0.11
Combat Experiences × Gender	0.00	-0.01-0.01	0.01	0.02	-0.07-0.10
Aftermath of Battle × Gender	-0.01	-0.01-0.00	0.00	-0.04	-0.13-0.04
Perceived Threat × Gender	0.00	-0.01-0.01	0.00	0.00	-0.09-0.09
Difficult Living/Working Environment × Gender	0.01	-0.00-0.01	0.00	0.05	-0.03-0.14
Substance Abuse					
Step 1					
Combat Experiences	-0.01	-0.06-0.04	0.03	0.99	0.95-1.04
Aftermath of Battle	0.05**	-0.00-0.09	0.02	1.05	1.00-1.09
Perceived Threat	0.02	-0.02-0.06	0.02	1.02	0.98-1.06
Difficult Living/Working Environment	0.02	-0.02-0.06	0.02	1.02	0.98-1.06
Prior Life Stressors	0.10	-0.03-0.23	0.07	1.10	0.97-1.26
Sexual Harassment/Assault	0.01	-0.16-0.18	0.09	1.01	0.85-1.20
Step 2 [§]					
Gender	-0.56	-1.18-0.06	0.32	0.57	0.31-1.06
Combat Experiences × Gender	-0.01	-0.10-0.07	0.04	0.99	0.91-1.08
Aftermath of Battle × Gender	-0.08**	-0.14-0.01	0.03	0.93	0.87-0.99
Perceived Threat × Gender	-0.00	-0.06-0.06	0.03	1.00	0.94-1.06
Difficult Living/Working Environment × Gender	-0.00	-0.07-0.06	0.03	1.00	0.94-1.06

[†] Due to the transformation of the mental health functioning variable, all results should be interpreted in the opposite direction. [§] The main effects in Step 2 of each regression have been excluded from this table. * $p < .05$.

service members, and indicates that policies barring women from ground combat roles may be less meaningful in modern warfare, where combat exposure is often indirect and difficult to predict due to the enemy's use of guerilla warfare tactics. This finding is of particular significance given the recent call for the Pentagon to reverse its long-standing policy barring women from ground combat, which can limit women's career advancement in the military (Harding, 2011). This finding also highlights the need for increased attention to women's experiences of combat-related stress in the assessment and treatment of OEF/OIF veterans in both VA and DoD health-care settings.

Despite lower levels of combat exposure, women reported similar levels of subjective perceived threat in the war zone as men. It is possible that women's increased vulnerability to other stressors in the war zone, including sexual harassment, may have increased their perceptions of threat to levels that were comparable to that reported by men. In addition, given that all service members are at risk of combat exposure in these wars, it is perhaps not surprising that women report comparable levels of concern regarding their safety and well-being in the war zone. It may also be that the threshold for experiencing threat is lower for women than men, as suggested by a number of psychophysiological studies (e.g., Cornelius & Averill, 1983; Katkin & Hoffman, 1976).

Contrary to our hypothesis that associations between combat-related stressors and postdeployment mental health would be slightly stronger for women than men, only one of 16 interactions achieved a conventional level of statistical significance and this interaction suggested a stronger negative association for men rather than women. This finding is important because it appears to suggest fairly comparable levels of resilience to combat-related stressors for women and men, at least during the timeframe evaluated in this study. Though null results are difficult to interpret, the inclusion of confidence intervals and effect sizes allowed us to address the clinical significance of study findings in addition to their statistical significance. As noted by Cortina and Folger (1998), while null hypothesis significance test results do not allow for conclusions about the likelihood that the null hypothesis is true, the presentation of confidence intervals allows for an evaluation of the practical significance of study findings and the associated viability of the null hypothesis. In this regard, it is important to note that CIs for both mean differences and regression analyses were relatively small, increasing our confidence in the precision of results with respect to the larger population. In addition, effect sizes corresponding to all interactions were extremely small, indicating that the lack of significant differences was not due to a problem with power (a conclusion reinforced by the relatively large sample size of the study), and confidence intervals associated with these effect sizes did not include values that would be considered clinically significant.

Confidence in study results is further underscored by the observation that many of the factors that typically contribute to Type II error were not an issue in the current study. Specifically, it has been suggested that factors such as inadequate power, use of an inappropriate sample, and invalid measurement can all contribute to Type II error (Cook & Campbell, 1979; Frick, 1995; Greenwald, Keren, & Lewis, 1993). Given the aforementioned large sample and small effect sizes, it is unlikely that a lack of power can explain our observed findings. In addition, exploratory analyses revealed sufficient dispersion in combat exposure for both women and men, underscoring the

fact that this sample was large enough to allow for an examination of gender differences in associations between combat-related stressors and postdeployment mental health.⁴ Finally, invalid measurement is not likely to be a problem given that we used scales that had well-documented reliability and validity.

The conclusion that gender differences in the impact of combat-related stressors on mental health are minimal is consistent with comments offered by Hoge, Clark, and Castro (2007) in their recent commentary on women in combat. These authors suggested that combat duty may be a great equalizer of risk due to its persistent level of threat. The lack of clinically significant gender differences may also, to some extent, reflect improved training of female service members in recent years. This interpretation is consistent with the finding that perceptions of preparedness for deployment did not differ for men and women in this sample. Regardless of the cause, these findings have substantial implications for military policy, as they call into question the commonly held belief that women may be more vulnerable to the negative effects of combat exposure than men.

Although not a primary focus of the study, it was interesting to note that different combat-related stressors were implicated in different dimensions of postdeployment mental health. Particularly noteworthy was the finding that combat exposure was not uniquely associated with any of the four mental health dimensions assessed in this study in regressions, though it was associated with mental health measures in bivariate correlations. This finding suggests that the relationship observed between objective combat circumstances and postdeployment mental health in studies that do not assess other combat-related stressors may be explained, at least in part, by combat's association with other aspects of the war-zone experience. Consistent with this perspective, perceived threat has been identified as a key mediator of the impact of combat exposure on PTSS in different cohorts (King, King, Gudanowski, & Vreven, 1995; Vogt & Tanner, 2007). These findings underscore the importance of measuring a wide range of combat-related stressors in research on deployment stress and highlight the need for clinicians to attend to a broad range of combat-related stressors in both assessment and treatment.

One limitation of this study was the cross-sectional nature of the study design, which involved reports of both deployment experiences and postdeployment mental health at a single timepoint following return from deployment. Though this assessment occurred much closer to the deployment experience than is typical of many prior deployment health studies, the cross-sectional nature of these data raises potential concerns regarding retrospective reporting bias and calls into question the directionality of the association between deployment stressors and postdeployment mental health. Longitudinal data are needed to provide more definitive results

⁴ The group who reported no combat exposure included 77 women and 37 men. The group who reported experiencing combat, on average, between never and a few times during deployment included 230 women and 156 men. The group who experienced combat, on average, between a few times during deployment and a few times a month included 21 women and 41 men. The group who experienced combat, on average, between a few times a month and a few times a week included 5 women and 8 men. No women or men reported exposure to combat on a daily basis. These findings suggest that women experienced sufficient levels of combat to allow for a comparison across different levels of combat intensity.

regarding the directionality of these relationships. In addition, postdeployment mental health was assessed with self-report measures in this study. One potential threat to the validity of self-reports for this study purpose is that men may underreport mental health symptoms more than women (Tolin & Foa, 2006). Therefore, another direction for future research will be to replicate these findings using clinician-administered measures of mental health.

In addition, it is important to note that the conclusions from the current study are restricted to a year following return from deployment. Given prior research indicating that risk factors for shorter- and longer-term postdeployment adjustment may differ (Koenen, Stellman, Stellman, & Sommer, 2003; Schnurr, Lunney, & Sengupta, 2004), as well as the recognition that postdeployment symptomatology may increase over time (Fear et al., 2010; Milliken, Auchterlonie, & Hoge, 2007), an important direction for future research will be to examine whether the lack of clinically significant differential associations holds in studies that assess longer-term health outcomes. More generally, it is important to recognize that there are numerous differences in women's and men's experiences before, during, and after deployment, and the results of this study should not be interpreted to suggest that gender differences are not important to consider in future studies. For example, a recent examination of separate models of risk for PTSS for female and male OEF/OIF veterans suggested a number of differences in the potential mechanisms of risk for women and men (Vogt et al., in press). In addition, this study was restricted to a sample of U.S. OEF/OIF veterans who had returned from deployment between 2007 and 2008. Though it seems unlikely that gender differences would vary across different phases of the war, future studies that include service members deployed at different phases of these wars are needed to evaluate the generalizability of study findings. Finally, it should be noted that the association between PTSS and depression was very strong in this study ($r = .78$ for women; $r = .79$ for men). While this raises some concern regarding their discriminant validity, results revealed differences between them that supported treating them separately. Specifically, not only were bivariate associations between deployment stressors and PTSS generally stronger than analogous associations for depression, but regression analyses revealed differences in associations between these measures and combat-related stressors.

In conclusion, study findings suggest that both exposure to combat-related stressors and their associated impact on postdeployment mental health in the year following return from deployment may be more similar than different for female and male U.S. service members. This finding is striking given that it contrasts with the widely accepted view that women are more vulnerable to the negative impact of trauma exposure than men. Future research is needed to promote a better understanding of the factors that may contribute to similar levels of resilience to combat trauma among female and male U.S. service members deployed in support of OEF/OIF, as well as the limits of this phenomenon.

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