


RESEARCH ARTICLE

Gender differences in disorders comorbid with posttraumatic stress disorder among U.S. Sailors and Marines

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Abstract

Psychological comorbidity, the co-occurrence of mental health disorders, is more often the rule than the exception among individuals with posttraumatic stress disorder (PTSD). Research shows that prevalence estimates for specific psychological disorders differ by gender; however, little is known about whether these patterns persist in the presence of a comorbid PTSD diagnosis. This study examined gender differences in prevalence estimates for conditions comorbid with PTSD using medical records for 523,626 active duty U.S. Sailors and Marines who entered the military over an 8-year period. Using chi-square tests of independence, we detected statistically significant gender differences for specific comorbid conditions in the subsample of 9,447 service members with a PTSD diagnosis. Women were more likely than men to have PTSD with comorbid adjustment, $OR = 1.35$; depressive, $OR = 1.71$; and generalized anxiety or other anxiety disorders, $OR = 1.16$, with the largest effects for eating, $OR = 12.60$, and personality disorders, $OR = 2.97$. In contrast, women were less likely than men to have a diagnosis of PTSD with comorbid alcohol use, $OR = 0.69$, and drug use disorders, $OR = 0.72$, with the largest effects for insomnia, $OR = 0.42$, and traumatic brain injury, $OR = 0.17$. No significant gender differences emerged for comorbid bipolar, obsessive-compulsive, panic/phobic, psychotic, or somatoform/dissociative disorders, $ps = .029-.314$. The results show gender differences in conditions comorbid with PTSD generally align with internalizing and externalizing dimensions. Differences in comorbidities with PTSD between women and men could have implications for treatment development and delivery.

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governing the protection of human subjects. Research data were derived from an approved Naval Health Research Center Institutional Review Board protocol number NHRC.2020.0002. The authors have no conflicts of interest to declare.

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Posttraumatic stress disorder (PTSD) is a condition that is exceedingly likely to be accompanied by additional psychiatric disorders (Koenen et al., 2008) in both military and civilian populations (Blakeley & Jansen, 2013; Brady et al., 2000; Crum-Cianflone et al., 2016; Kessler et al., 1995; Pietrzak et al., 2011; Rytwinski et al., 2013; Schmied et al., 2013; Seal et al., 2009; Walter et al., 2018). Psychological comorbidity, the co-occurrence of more than one mental health disorder, has been demonstrated in 80%–90% of civilians with PTSD (Kessler et al., 1995). A recent study in the U.S. military population showed comparable results; over an 8-year period, more than 80% of active duty Sailors and Marines diagnosed with PTSD were also diagnosed with a comorbid disorder (Walter et al., 2018). Additionally, the odds of diagnosis with each of the 14 disorders examined was significantly higher among individuals with PTSD than those without PTSD, with odds ratios ranging from 1.52 for psychosis to 29.63 for panic/phobic disorder.

Psychological comorbidity has been a growing issue among active duty U.S. service members. One study showed that incidence rates increased by 85% from 2000 to 2011 (Blakeley & Jansen, 2013). This increase is especially concerning because psychological comorbidity is associated with more severe outcomes relative to a single disorder alone. Individuals with PTSD and comorbid conditions typically exhibit higher degrees of clinical and functional impairment, poorer physical health outcomes, lower quality of life, reduced rates of recovery, and higher rates of suicidality than those with a single disorder (Gradus et al., 2010; Nichter et al., 2019; Straus et al., 2019). Identifying the comorbidities most commonly present with PTSD—and the demographic groups among which specific comorbidities are most common—can provide avenues for exploration in future research investigating the effects of comorbidity.

Gender differences in PTSD and comorbid disorders may be especially important in the military population,

as service members may face unique stressors that have been shown to differentially affect men and women. For instance, male service members have typically been more likely to be exposed to combat than female service members (Vogt et al., 2011), although this may be changing as women enter a broader range of military roles. In addition, at high levels of combat exposure, women may be more likely than men to screen positive for PTSD (Luxton et al., 2010; Skopp et al., 2011). A. Kline and colleagues (2013) did not find gender differences in combat exposure among National Guard personnel deployed to Iraq; however, prior to deployment, women scored higher on measures of post-traumatic stress symptoms and lower on measures of military preparedness and unit cohesion than men. Further, although male service members are more likely to experience combat trauma, female service members are more likely to experience military sexual trauma (MST; Allard et al., 2011; Maguen et al., 2011). Moreover, servicewomen who experience MST are markedly more likely than their male counterparts to develop PTSD (Kimerling et al., 2007, 2010; Maguen et al., 2012; Katz et al., 2012). Given evidence that the likelihood of exposure to specific traumatic experiences differs between women and men in the military, it is likely that gender differences in patterns of PTSD comorbidity also exist.

Studies involving service members with PTSD have revealed gender differences in comorbidity patterns, but there is little agreement on exactly which comorbidities are more common among either gender. For example, in a sample of Army National Guard soldiers, Calabrese and colleagues (2011) found a stronger association between generalized anxiety disorder (GAD) and PTSD for men than women, whereas Maguen and colleagues (2012) found that this association was stronger for women in a sample of veterans who served in Iraq or Afghanistan. Other studies of military and veteran samples have shown similar conflicting patterns of gender differences in

disorders comorbid with PTSD, including depression and substance use (Dedert et al., 2009; Hourani et al., 2016; Maguen et al., 2012). The variability in findings related to gender differences in comorbid disorders could be due to interactions among neurobiological, cognitive, trauma exposure, social, and cultural factors at play (e.g., Olf et al., 2007). Although inconsistencies are evident for gender differences in disorders comorbid with PTSD, research generally demonstrates that women with PTSD are more likely to have internalizing disorders, such as comorbid depression and anxiety disorders (Iverson et al., 2011; Maguen et al., 2012), whereas men are more likely to have externalizing disorders, such as comorbid substance use disorders (Dedert et al., 2009; Iverson et al., 2011; Maguen et al., 2012).

Traumatic brain injury (TBI) also warrants particular attention due to its frequent comorbidity with PTSD in the military population (Farmer et al., 2016; Hepner et al., 2016; Walter et al., 2018). Research demonstrates that rates of TBI are higher for men than women in both veteran (Morissette et al., 2011) and civilian populations (Bruns & Hauser, 2003; Frost et al., 2013; Mollaveva et al., 2018). Despite higher rates of TBI among men, women with deployment-related mild TBI typically report more neurobehavioral symptoms than men, such as higher levels of depressive symptom severity and suicidality (Amoroso & Iverson, 2017; Cogan et al., 2019; Epstein et al., 2019; Farace & Alves, 2000; Hoge et al., 2008; Iverson et al., 2011; Kim et al., 2018).

Improving understanding of gender differences in PTSD comorbidities within medical settings is critical given that such differences may moderate the outcomes of evidence-based PTSD treatment. A review by Straud and colleagues (2019) found no gender difference in outcomes of evidence-based PTSD treatment in military samples; however, prior reviews have shown that women experience larger symptom reductions than men (Wade et al., 2016; Watts et al., 2013). Regarding comorbidity, research has shown that evidence-based PTSD treatments can reduce a variety of comorbid symptoms (e.g., Back et al., 2019; Ronconi et al., 2015), but there are more limited data directly comparing outcomes among those with comorbid disorders (e.g., A. C. Kline et al., 2021). The existing research suggests that the impact of comorbidity on PTSD treatment outcomes may be nuanced. For example, meta-analytic results have indicated that higher continuous depression symptom severity scores predict smaller treatment effects, whereas depressive diagnoses do not (A. C. Kline et al., 2021). Similarly, substance use severity may result in reduced treatment effects (López-Castro, et al., 2015), whereas PTSD and depression outcomes following CPT have not been shown to differ based on whether veterans have PTSD alone or with a comorbid substance use disorder (Kaysen et al., 2014). In sum, evidence-based PTSD treatments can reduce

comorbid symptoms following treatment, and treatment outcomes may be moderated by gender and comorbidities, but additional research in these areas is needed to better inform care delivery.

Because the effectiveness of PTSD treatment could be impacted by gender and comorbidities, the identification of gender differences in comorbidities within a large sample of active duty service members with PTSD will provide a more comprehensive picture of how PTSD presents among female and male service members within the military health system. To expand upon previous findings and address the inconclusiveness in the literature regarding gender differences, the current study examined whether gender differences in the prevalence of PTSD comorbidities exist in a large population-based sample of U.S. active duty Sailors and Marines. Specifically, we explored gender differences in comorbidities with PTSD for 13 co-occurring mental health conditions (i.e., adjustment disorder, alcohol use disorder [AUD], bipolar disorder, depressive disorder, drug use disorder, eating disorder, GAD or other anxiety disorders aside from panic/phobic disorder, insomnia, obsessive compulsive disorder [OCD], panic/phobic disorder, personality disorder, psychotic disorder, and somatoform/dissociative disorder). We also examined gender differences in comorbid PTSD and TBI given the prevalence of this comorbidity in the military population. To provide descriptive data, we examined whether gender differences in disorders comorbid with PTSD differed as a function of demographic and service-related factors. Based on the existing literature, we generally expected that servicewomen would be more likely to have comorbidities with PTSD that are considered to be internalizing disorders, such as depressive and anxiety disorders, whereas servicemen would have a higher likelihood of comorbidities considered to be externalizing disorders, such as AUD and drug use disorders. Because the existing literature has yielded mixed findings regarding gender differences in some conditions comorbid with PTSD and others have yet to be investigated, these analyses should be considered exploratory.

METHOD

Participants

Sailors and Marines on active duty between 2006 and 2013 were included in the present sample. The study population was derived from the Career History Archival Medical and Personnel System (CHAMPS), a comprehensive administrative database detailing active duty service dates (Gundersen et al., 2005). Demographic and service-related information, including sex/gender, race/ethnicity,

age, rank upon entry into the military, and service branch were also obtained from this data source.

A total of 580,504 service members in the Navy and Marine Corps were on active duty between 2006 and 2013. Approximately 10% of these service members ($n = 56,878$) who did not have at least 6 months of service during the study period were excluded from analyses due to insufficient surveillance time. The final study population consisted of 523,626 service members, including 446,951 (85.4%) men and 76,675 (14.6%) women. Some analyses were based on the subsample of service members with PTSD diagnoses ($n = 9,447$; 1.8%). Birthdates and, therefore, age at accession were missing for 382 service members ($n = 49$ men, $n = 333$ women); there were no other missing data in this study.

Procedure

Medical records of eligible service members were retrieved from the Defense Health Agency's Military Health System Data Repository (MDR), which houses the records for all active duty service member medical visits reimbursed through TRICARE, the military medical insurance agency. The MDR contains both inpatient and outpatient records from visits to both military and civilian medical facilities. MDR and CHAMPS records were matched using social security numbers, birthdates, and sex/gender.

Measures

Both inpatient and outpatient medical records were scanned for *International Classification of Diseases, 9th Edition, Clinical Modification (ICD-9-CM*; World Health Organization & Practice Management Information Corporation, 1998) codes indicating PTSD and each of the 14 health conditions of interest. These included adjustment disorder, AUD, bipolar disorder, depressive disorder, drug use disorder, eating disorder, GAD or other anxiety disorder, insomnia, OCD, panic/phobic disorder, personality disorder, psychotic disorder, somatoform/dissociative disorder, and TBI. Some diagnostic categories were grouped together with related disorders due to low base rates. Specific ICD-9-CM codes for each condition are listed in Supplementary Table S1.

Consistent with existing research (Crum-Cianflone et al., 2016; Walter et al., 2018), a single inpatient record with a qualifying ICD-9-CM code was deemed sufficient to denote a formal diagnosis. For outpatient records, at least two qualifying codes within a 6-month period were required to distinguish between a positive screening assessment and a formal diagnosis for a given condition.

Furthermore, comorbidity was determined as the diagnosis of another disorder of interest 6 months prior to or following a PTSD diagnosis (for additional information, please see Walter et al., 2018). As these are often longer-term conditions that most often appear on multiple records over time, the dates from all records with a qualifying code were used to assess comorbid status. Thus, two conditions could be considered comorbid even if their initial diagnosis dates were not within 6 months of one another.

Data analysis

First, prevalence estimates for each condition were computed, both in the study population as a whole and in the subsample of service members with PTSD. Diagnosis dates for each condition were then compared across conditions to assess comorbidity. As conditions are not mutually exclusive, study participants may have multiple comorbid diagnoses in their medical records. Gender differences in PTSD comorbidity status were compared across all conditions using chi-square tests of independence. Post hoc chi-square tests were computed for variables with more than two categories (i.e., age and race/ethnicity) to identify which group or groups drove statistically significant findings. Odds ratios (ORs) were computed using univariate logistic regression to assess the magnitude and direction of associations. Statistical significance was established at $p < .01$ due to the large sample size. All analyses were performed using SAS (Version 9.3; SAS Institute Inc., Cary, NC, USA). Study procedures were granted approval by the Naval Health Research Center Institutional Review Board.

RESULTS

Consistent with a previous report of these data by Walter and colleagues (2018), 1.8% of service members were diagnosed with PTSD ($n = 9,447$). Women ($n = 2,496$; 3.3%) were significantly more likely than men ($n = 6,951$; 1.6%) to receive a PTSD diagnosis, $\chi^2(1, N = 523,626) = 1,067.8$; $p < .001$. Overall, 83.3% of individuals with PTSD had at least one comorbid condition. The results from the current study showed that the likelihood of having any PTSD comorbidity versus PTSD alone did not significantly differ between women ($n = 2,104$; 84.3%) and men ($n = 5,762$; 82.9%), $\chi^2(1, N = 9,447) = 2.58$, $p = 0.11$. Demographic and military characteristics of service members as a function of both PTSD diagnosis and comorbidity status are provided for both women and men in Supplementary Tables S2 and S3, respectively. These tables include separate rows providing percentages for the full study population and for the subsample with diagnosed PTSD.

Comorbidity status among women

In the subsample of women with PTSD, those who were of enlisted rank upon entry into the military were not significantly more likely than officers to have a comorbid disorder versus PTSD alone (84.6% vs. 74.0%), $\chi^2(1, N = 2,496) = 6.33, p = .012$. Among female Marines, 87.1% of those with PTSD had a comorbid condition compared with 82.8% of Sailors, $\chi^2(1, N = 2,496) = 7.73, p = .005$. Neither race nor age demonstrated statistically significant associations with having a PTSD comorbidity versus PTSD alone.

Comorbidity status among men

In the subsample of men with PTSD, those of enlisted rank upon entry into the military were significantly more likely than officers to have a comorbidity versus PTSD alone (83.0% vs. 66.0%), $\chi^2(1, N = 6,951) = 10.70; p = .001$. Among male Marines, 84.5% of those with PTSD had a comorbid condition compared with 79.1% of Sailors, $\chi^2(1, N = 6,951) = 29.46, p < .001$. Comorbidity status did not significantly vary with age. However, male Marines who self-identified as “other” race/ethnicity had the lowest prevalence of a comorbidity (78.5%) compared with other race/ethnicities. Post hoc chi-square tests revealed significant differences between “other” race/ethnicity and both White (83.2%), $\chi^2(1, N = 5,380) = 7.06, p = .008$, and Latino self-identification (84.9%), $\chi^2(1, N = 1,367) = 8.93, p = .003$.

Specific comorbidities, by gender

Table 1 displays the prevalence estimates, chi-square values, odds ratios, and confidence intervals for the co-occurrence of specific disorders together with PTSD, stratified by gender. Among service members with PTSD, women were significantly more likely than men to have comorbid diagnoses of adjustment disorder, $OR = 1.35$; depressive disorder, $OR = 1.71$; and GAD or other anxiety disorders, $OR = 1.16$, although these effects were small (Chen et al., 2010); larger gender differences were observed for comorbid PTSD and both eating disorders, $OR = 12.60$, and personality disorders, $OR = 2.97$. Conversely, servicemen with PTSD were significantly more likely than their female counterparts to have comorbid chart diagnoses of AUD, $OR = 0.69$, and drug use, $OR = 0.72$, with larger effect sizes for comorbid insomnia, $OR = 0.42$, and TBI, $OR = 0.17$. Among service members with PTSD, no significant gender differences were observed in the likelihood of receiving a diagnosis of comorbid bipolar disorder, OCD, panic/phobic disorder, psychosis, or somatoform/dissociative disorder, $ps = .029-.314$.

For both genders, PTSD was most commonly comorbid with depressive disorder (58.9% for women, 45.5% for men), followed by adjustment disorder (42.2% for women, 35.1% for men), GAD or other anxiety disorder (38.7% for women, 35.2% for men), and AUD (21.7% for women, 28.8% for men). Of these comorbid disorders, only AUD was more common among men than women. The magnitude of gender differences in comorbidities with PTSD was largest for eating disorders such that women were almost 13 times more likely to receive this diagnosis than men. Women were also nearly 3 times more likely to be diagnosed with personality disorders than men. In contrast, TBI was almost 6 times more prevalent in men than women, and comorbid insomnia was over twice as common in men.

DISCUSSION

The current study examined gender differences in disorders comorbid with PTSD among active duty women and men in the U.S. Navy and Marine Corps over an 8-year period. The results showed that servicewomen (3.3%) were significantly more likely to have a chart diagnosis of PTSD than servicemen (1.6%), aligning with prior research (Crum-Cianflone & Jacobson, 2014; Kilpatrick et al., 2013; Kobayashi et al., 2019; Mitchell et al., 2012; Olff et al., 2007; Polusny et al., 2014; Tolin & Foa, 2006), but diverges from studies using samples of Army soldiers (Hourani et al., 2016) and veterans who served in Iraq or Afghanistan (Maugen et al., 2010). The findings also demonstrated that over 83% of service members with a diagnosis of PTSD in their medical record also had a comorbid diagnosis, which is consistent with literature showing PTSD comorbidity rates ranging from 80%–90% among civilians (Kessler et al., 1995). Across both genders, Marines were more likely than Sailors to have a comorbid condition with PTSD, which complements research indicating higher prevalence rates of psychological conditions among Marines compared to Sailors (Department of Defense, 2017). There were, however, no significant differences between servicewomen and servicemen in the overall likelihood of having a disorder comorbid with PTSD (84.3%, vs. 82.9%, respectively). These findings reveal that among both servicewomen and servicemen with a chart diagnosis of PTSD, a comorbid diagnosis is highly probable.

For both men and women, depressive disorder was the diagnosis most frequently comorbid with PTSD, followed by adjustment disorder, GAD or other anxiety disorders, and AUD, which supports prior research using medical chart data of service members (Crum-Cianflone et al., 2016; Hepner et al., 2016, 2018). Gender differences emerged, however, for specific disorders comorbid with

TABLE 1 Prevalence of specific comorbidities, by gender, in the full sample and posttraumatic stress disorder (PTSD) subsample

Comorbid condition	Gender				Overall ^b		$\chi^2(1, N = 9,447)$	OR ^c	95% CI
	Women (<i>n</i> = 76,675)		Men (<i>n</i> = 446,951)		Overall ^b (<i>N</i> = 523,626)				
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%			
Adjustment disorder	1,054		2,438		3,492				
Full population		1.4		0.6		0.7			
PTSD subsample		42.2		35.1		37.0	40.33**	1.35 [1.23, 1.49]	
Alcohol use disorder	541		1,999		2,540				
Full population		0.7		0.5		0.5			
PTSD subsample		21.7		28.8		26.9	46.88**	0.69 [0.62, 0.76]	
Bipolar disorder	190		487		677				
Full population		0.3		0.1		0.1			
PTSD subsample		7.6		7.0		7.2	1.01	1.09 [0.92, 1.30]	
Depressive disorder	1,469 ^a		3,163		4,632				
Full population		1.9		0.7		0.9			
PTSD subsample		58.9		45.5		49.0	130.97**	1.71 [1.56, 1.88]	
Drug use disorder	180		681		861				
Full population		0.2		0.2		0.2			
PTSD subsample		7.2		9.8		9.1	14.82**	0.72 [0.60, 0.85]	
Eating disorder	96		22		118				
Full population		0.1		0.0		0.0			
PTSD subsample		3.9		0.3		1.3	185.50**	12.60 [7.91, 20.06]	
GAD or other anxiety disorder ^d	966		2,449		3,415				
Full population		1.3		0.6		0.7			
PTSD subsample		38.7		35.2		36.2	9.58**	1.16 [1.06, 1.28]	
Insomnia	130		801		931				
Full population		0.2		0.2		0.2			
PTSD subsample		5.2		11.5		9.9	82.45**	0.42 [0.35, 0.51]	
OCD	34		70		104				
Full population		0.0		0.0		0.0			
PTSD subsample		1.4		1.0		1.1	2.12	1.36 [0.90, 2.05]	
Panic/phobic disorder	163		380		543				
Full population		0.2		0.1		0.1			
PTSD subsample		6.5		5.5		5.8	3.84	1.21 [1.00, 1.46]	
Personality disorder	527		574		1,101				
Full population		0.7		0.1		0.2			
PTSD subsample		21.1		8.3		11.7	294.80**	2.97 [2.61, 3.38]	
Psychotic disorder	55		212		267				
Full population		0.1		0.1		0.1			
PTSD subsample		2.2		3.1		2.8	4.79	0.72 [0.53, 0.97]	
Somatiform/dissociative disorder	82		189		271				
Full population		0.1		0.0		0.1			
PTSD subsample		3.3		2.7		2.9	2.11	1.26 [0.93, 1.58]	

(Continues)

TABLE 1 (Continued)

Comorbid condition	Gender				Overall ^b		$\chi^2(1, N = 9,447)$	OR ^c	95% CI
	Women		Men		(N = 523,626)				
	(n = 76,675)		(n = 446,951)		n	%			
TBI	92		1,251		1,343				
Full population		0.1		0.3		0.3			
PTSD subsample		3.7		18.0		14.2	308.45**	0.17	[0.14, 0.22]

Note: OR = odds ratio; GAD = generalized anxiety disorder; OCD = obsessive compulsive disorder; TBI = traumatic brain injury.

^aRefers to participants diagnosed with at least PTSD and possibly a comorbid condition. ^bPrevalence estimates for the full population are provided as context for comparison to estimates for women and men. ^cMen serve as the reference category for all reported ORs in Table 1. For conditions where odds are greater for men than for women, the reference category is reversed for values reported in the text of the Results section. ^dOther anxiety disorder other than panic or phobic disorders.

** $p < .01$.

PTSD. Among service members diagnosed with PTSD, servicewomen were more likely than servicemen to receive diagnoses with comorbid adjustment disorder, GAD or other anxiety disorders, and depressive disorders, with the strongest effects for eating and personality disorders. On the other hand, men diagnosed with PTSD were more likely than women to be diagnosed with comorbid AUD and drug use disorder, with the largest effect sizes for insomnia and TBI.

In general, the comorbidities most frequently diagnosed with PTSD in both men and women fell, to a degree, along internalizing and externalizing dimensions. This is consistent with prior research on both single psychological disorders (American Psychiatric Association [APA], 2013; Curry et al., 2014; Kramer et al., 2008) and comorbid conditions (Dedert et al., 2009; Iverson et al., 2011; Maguen et al., 2012). The finding that comorbid personality disorders are more commonly diagnosed among servicewomen than servicemen with PTSD warrants further investigation, as this diagnostic category encompasses a diverse array of conditions that have often shown different patterns of gender differences (APA, 2013). Personality disorders commonly diagnosed in women (e.g., borderline personality disorder) may be more likely to lead patients to seek care or require continuing medical care and, thus, a formal diagnosis, whereas those common among men (e.g., antisocial personality disorder) may be less likely to lead to treatment-seeking or to require ongoing treatment. Adjustment disorder was also more frequently comorbid with PTSD among women, although it was a common comorbidity regardless of gender. An adjustment diagnosis may reflect true comorbidity with PTSD, but it may also be given in lieu of or prior to a PTSD diagnosis. Findings related to PTSD and adjustment disorder comorbidity should be interpreted with caution and underscore the need for further exploration of the clinical utility of adjustment disorder diagnoses within the military health system. Women and men with PTSD did not differ in their likelihood of being diagnosed with

comorbid bipolar disorder, OCD, panic/phobic disorder, psychosis, or somatoform/dissociative disorder; each of these had a low base rate in this population. These results collectively raise interesting clinical questions for future research, including whether existing PTSD treatments are the best approach to address conditions comorbid with PTSD, if modifications may be needed for optimal benefit, and the degree to which sex and/or gender influences treatment outcomes for individuals with PTSD and comorbid disorders. However, it is important to note that treatment plans should be based on an assessment of the individual patient's needs and pattern of symptoms and diagnoses rather than on their sex and/or gender.

Comorbid TBI showed a gender difference of large magnitude, as it was almost 6 times more prevalent in servicemen than servicewomen with PTSD. This is consistent with gender differences found in TBI diagnosis alone (Bruns & Hauser, 2003; Frost et al., 2013; Gupte et al., 2019; Mollayeva et al., 2018; Morissette et al., 2011). This disparity may be explained by the fact that combat exposure and accidents (e.g., military training exercises, motorcycle crashes), both of which increase the chances of TBI, are more commonly experienced by servicemen than their female counterparts (Bruns & Hauser, 2003; Gupte et al., 2019; Mollayeva et al., 2018; Morissette et al., 2011).

Sex differences in disorders comorbid with PTSD could reflect biologically based differences between servicewomen and servicemen (Blanco et al., 2018; Breslau, 2009; Epstein et al., 2019; Mollayeva et al., 2018). Alternatively, these findings could be the result of differences in how women and men present psychological symptoms consistent with socially constructed norms (e.g., internalizing vs. externalizing dimensions; Cogan et al., 2020; Crum-Cianflone et al., 2014; Farace & Alves, 2000; Hourani et al., 2016; A. Kline et al., 2013; Koenen et al., 2008; Kramer et al., 2008; Skopp et al., 2011; Straus et al., 2019). Another possibility is that physicians may be more inclined to diagnose some disorders in men and others in women based on known differences in base rates. An interesting

possibility is that gender-based variations in disorders comorbid with PTSD could result from gender differences in trauma exposure (Amoroso & Iverson, 2017; Crum-Cianflone & Jacobson, 2014; Cogan et al., 2020; Iverson et al., 2011; Katz et al., 2012; Kobayashi et al., 2019; Luxton et al., 2010; Olf et al., 2007; Polusny et al., 2014; Tolin & Foa, 2006). For example, servicewomen are more likely than servicemen to experience MST (Allard et al., 2011; Maguen et al., 2011), whereas servicemen are more likely to experience combat (Vogt et al., 2011). It is possible that among individuals with PTSD, those who experienced MST are more likely to have comorbid disorders such as GAD, depressive disorders, and eating disorders (e.g., Breland et al., 2017), whereas those who experience combat are more likely to have substance use disorders and TBI. Trauma and developmental history prior to military service may also affect disorders comorbid with PTSD. It is likely that biological, psychosocial, and trauma experiences interact to impact gender differences in the comorbid disorders diagnosed with PTSD. These possibilities are ripe for further investigation.

This study was not without limitations. It should be noted that relying on medical reimbursement records alone for population prevalence estimates presents threats to accuracy. Diagnoses are unlikely to have been based on clinician-administered, gold-standard diagnostic measures that require time and resources. Rather, diagnoses may have been informed by the service member's report of symptoms and the provider's knowledge and experience with particular disorders, both of which can be subject to bias. Some clinicians may opt not to diagnose certain mental health disorders for the perceived benefit of the service member (e.g., to avoid potentially adverse career consequences). Further, prevalence estimates based on medical reimbursement records tend to underestimate the true prevalence of mental health disorders because data are collected only from those who utilize health care services. This could mean that if women are more likely than men to seek health care services, the magnitude of gender differences in PTSD comorbidities that are more common among women may be smaller than what we observed. Conversely, the magnitude of gender differences in comorbidities more common among men may be underestimated. Moreover, fluctuations in the severity of an individual's symptoms may impact whether they meet the criteria for a specific diagnosis over time. As such, individuals diagnosed with PTSD may be more likely to receive a comorbid diagnosis merely because they are receiving care and, thus, have more opportunities to be evaluated for other presenting conditions. The period of study observation was approximately eight years and allowed for time to detect diagnoses, which is important given that symptoms can fluctuate over time. Variables such as deployment and combat exposure could

differently affect comorbidities with PTSD; however, this information is not standardized in the databases from which we drew our data and is, therefore, not reflected in the present analyses. Additionally, the study focused on patterns of comorbidity rather than predictors. Sex/gender was categorized as a binary, self-identified variable, and was not assessed across the biological or gender spectrum. Future research should determine if prevalence estimates of comorbidities differ, and the extent to which they differ, if they are evaluated based on sex or gender, which would also inform the contribution of biological and psychosocial factors. Finally, the current study examined U.S. Navy Sailors and Marines, which may limit generalizability to other service branches or to civilians.

The greatest strength of the current study was its large sample size and long observation period. The study population included all qualifying active duty Sailors and Marines who entered service over an 8-year timeframe. In and of themselves, these components are key strengths for the current study because the existing literature on gender differences among service members with PTSD comorbidities has been largely inconclusive, potentially due to biased sampling (e.g., more men than women available in a combat veteran sample) or small sample sizes. All diagnoses for the current study were assigned by health care providers, which may allow for increased specificity of presenting symptoms during a provider-driven assessment as opposed to reliance on self-report measures alone. The requirement of at least one inpatient visit or two outpatient diagnoses within 6 months of each other likely improved classification accuracy for the disorders considered. Similarly, requiring that diagnoses with PTSD and a comorbid disorder occurred within 6 months of each other enhances the likelihood that the conditions were comorbid. Using this definition provides more precise prevalence estimates of comorbidities to guide future research among service members with PTSD and specific comorbidities.

The current study explored gender differences in the prevalence estimates of disorders comorbid with PTSD using population-level medical data from U.S. Sailors and Marines. Comorbid diagnoses were evident for most active duty service members with PTSD. Although the likelihood of having any comorbid condition did not differ by gender, distinct patterns emerged regarding specific disorders most likely to be comorbid with PTSD in servicewomen and servicemen. Women were more likely to have comorbid internalizing disorders, whereas men had a higher likelihood of externalizing disorder diagnoses. Given that comorbidity is the norm rather than the exception for individuals with PTSD and that many comorbidities differ by gender, these findings underscore the importance of comprehensive assessment in trauma populations. Future research should explore whether and how treatment

outcomes differ based on comorbid disorders, sex or gender identification, and their interaction to inform whether existing treatments are sufficient or if modifications or adjunctive interventions are needed to optimally treat service members with PTSD.

OPEN PRACTICES STATEMENT

The study reported in this article was not formally preregistered. The datasets generated and/or analyzed during the current study are not publicly available due to security protocols and privacy regulations, but they may be made available on reasonable request by the Naval Health Research Center Institutional Review Board at +1-619-553-8400.

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SUPPORTING INFORMATION

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