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A positive screen for military sexual trauma is associated with greater risk for substance use disorders in women Veterans

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Abstract

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Contributors: Simon B. Goldberg and Whitney S. Livingston wrote the first draft of the manuscript. Whitney S. Livingston conducted the statistical analyses. Whitney S. Livingston, Rebecca K. Blais, and Adi V. Gundlapalli conceptualized the study. All authors edited the manuscript and aided in interpretation of the results.

A portion of the current data set was used in a previous report (Gilmore, A. K., Brignone, E., Painter, J. M., Lehavot, K., Fargo, J., Suo, Y., … & Gundlapalli, A. V. (2016). Military sexual trauma and co-occurring posttraumatic stress disorder, depressive disorders, and substance use disorders among returning Afghanistan and Iraq veterans. *Women's Health Issues, 26*(5), 546-554.) The analyses included here have not been reported elsewhere.

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Military sexual trauma (MST) is a significant public health issue associated with adverse psychiatric outcomes, including heightened risk for suicide, PTSD, depression, and substance use disorders. Recently, research has begun exploring gender-linked disparities in mental health outcomes for individuals who experience MST. The current study assessed whether women who screened positive for MST were at disproportionately higher risk for diagnoses of alcohol-use disorder (AUD) or drug-use disorder (DUD) relative to men. Veterans Health Administration (VHA) clinical data were extracted for 435,690 military veterans who separated from the military between 2004 and 2011 and had at least five years of follow-up data after their initial VHA visit until the end of fiscal year 2014. Logistic regression models examined the main and interactive effects of gender and screening positively for MST as predictors of AUD and DUD. MST positive screens were associated with increased rates of both AUD and DUD across genders. Although rates of both AUD and DUD were higher among men, the increased rate of diagnosis associated with MST positive screens was proportionally higher for women than men (interaction adjusted odds ratios = 1.43 and 1.17, for AUD and DUD, respectively), indicating the presence of a gender-linked health risk disparity. This disparity was more pronounced for AUD than DUD ($p < .01$). The current study adds to previous literature documenting increased risk for women exposed to MST. These findings support efforts to reduce the occurrence of MST and continued use of MST screening measures within the VHA.

Keywords

military sexual trauma; alcohol use disorder; drug use disorder; veterans; health disparities

Military sexual trauma (MST) is defined as “psychological trauma…from a physical assault of a sexual nature, battery of a sexual nature, or sexual harassment which occurred while the veteran was serving on active duty or active duty for training” (U.S. Government, 2014, p. 285). The Veterans Health Administration (VHA) began providing outreach and counseling for veterans reporting sexual assault in 1992, with universal screening for MST implemented in 1999 (Kimerling, Gima, Smith, Street, & Frayne, 2007). Currently, each Veterans Affairs hospital has a designated MST coordinator charged with overseeing MST screening and treatment. In part informed by results of these screening efforts, there has been growing recognition of the high prevalence of MST among veterans and associated medical and psychiatric sequela (Kimerling et al., 2007; Kimerling et al., 2010; Kimerling et al., 2016; Surís & Lind, 2008; Yalch, Hebenstreit, & Maguen, 2018). A recent meta-analysis of 69 studies reported that 15.7% of military personnel and veterans report MST, with rates among women an order of magnitude higher than rates among men (38.4% vs. 3.9%, for women and men, respectively; Wilson, 2016). Exposure to MST is linked with numerous negative mental health outcomes, including increased risk for posttraumatic stress disorder (PTSD; Himmelfarb, Yaeger, & Mintz, 2006; Kimerling et al., 2007; Scott et al., 2014), depression (Gilmore et al., 2016; Kimerling et al., 2010), suicide mortality (Kimerling et al., 2014), anxiety (Klingensmith et al., 2014), sexual dysfunction (Blais, Geiser, & Cruz, 2018), and substance use disorders (Gilmore et al., 2016; Kimerling et al., 2010). Moreover, female service members and veterans who attributed their posttraumatic stress symptoms to MST relative to other sources of trauma (e.g., combat, deployment-related) report increased suicidal ideation (Blais & Monteith, 2018).

While exposure to MST appears to negatively impact both women and men (Kimerling et al., 2007), studies have more recently begun to examine potential gender-linked disparities in mental health outcomes for individuals who experience MST. Initial evaluation of MST prevalence and correlates indicated higher rates of PTSD and substance use disorders (SUDs) among women screening positive for MST relative to men (adjusted odds ratios [ORs] for women and men, respectively = 8.83 vs. 3.00 for PTSD, 2.33 vs. 1.75 for alcohol-use disorder [AUD], 2.12 vs. 2.09 for drug-use disorder [DUD]; Kimerling et al., 2007). More recently, Gilmore et al. (2016) examined gender as a moderator of the link between a positive MST screen and PTSD, depression, and SUD in a large sample of veterans (n = 494,822) receiving Veterans Health Administration (VHA) services who had been deployed to Iraq and Afghanistan. Gilmore et al. found that the association between a positive MST screen and PTSD and SUD were stronger for women than men. This finding is consistent with previous work demonstrating a stronger link between exposure to trauma generally and adverse mental health outcomes for women than men (Luxton, Skopp, & Maguen, 2010; Polusny et al., 2014).

SUDs are one of the correlates of trauma exposure that exert the highest public health burden and may manifest differently for women and men (Sonne, Back, Zuniga, Randall, & Brady, 2003). While Gilmore et al. (2016) established that women may be at disproportionately high risk for SUDs following exposure to MST, they did not examine this relationship for AUD and DUD separately, nor did they compare the relative increase in risk for AUD versus DUD. Both AUD and DUD have been linked with adverse outcomes (Compton et al., 2007; Grant et al., 2015), although DUDs are often associated with greater social instability and more psychiatric comorbidities than AUD alone (Moss, Goldstein, Chen, & Yi, 2015). Thus, different treatment strategies may be needed to address each (Moss et al., 2015; Stinson et al., 2005). Further, increased risk for AUD or DUD may reflect gender-specific sequalae of MST and could inform future research investigating mechanisms and developmental processes underlying these risks (e.g., why might there be unique and disproportionate links to AUD or DUD specifically among women or men). In addition, highlighting AUD and DUD risk separately can inform secondary prevention efforts (e.g., screening, early intervention). It is currently unknown whether MST exposure puts women at greater risk for DUDs specifically compared to men, and whether this risk is similar in proportion or greater than the increased risk for AUDs.

The current study sought to extend the findings of Gilmore et al. (2016) to examine gender as a moderator of the link between exposure to MST and AUD and DUD separately and whether relative increases in risk are larger for AUD versus DUD. We employed a large sample of VHA users and examined data from a routinely administered MST screening tool and diagnoses of AUD and DUD made by VHA clinicians. We hypothesized that women would show a stronger link between MST positive screens and both AUD and DUD. We had no *a priori* hypothesis about increases in AUD versus DUD.

Methods

The current study included 435,690 VHA-enrolled veterans from the Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) conflicts (see Gilmore et al., 2016 for further

description). The 2011 OEF/OIF roster file captured demographic and military service data on veterans who deployed to post-9/11 conflicts and separated from the military between 2004–2011. Veterans listed in the roster file were matched with their VHA clinical records to create the current dataset. VHA clinical data were provided from the Corporate Data Warehouse. A five-year clinical follow-up period was applied to allow for symptom manifestation. Therefore, veterans were included in the current study if they had VHA administrative follow-up data from at least five years after their initial visit, up until the end of fiscal year 2014.

Approval for this study was provided from the Institutional Review Board of the University of Utah School of Medicine and Research and Development Committee for the Veterans Affairs (VA) Salt Lake City Health Care System.

Measures

Demographic variables shown to relate to AUD and DUD in previous research (e.g., Eisen et al., 2012; Seal et al., 2011) were included as covariates. All covariates were extracted from the roster file and included race (i.e., white, black, Hispanic, other, and unknown), branch of service, and combat exposure, where no combat exposure and combat exposure were scored as “0” and “1”, respectively, and age, which was included as a continuous variable and was mean centered in the regression analyses. Gender was also extracted from the roster file and was used as the moderator in the current study. Gender was coded as “0” for male and “1” for female.

Mental health disorders were diagnosed by licensed VHA clinicians and recorded as International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). Documentation of mental health diagnoses through ICD-9-CM codes were categorized through the Healthcare Utilization and Costs Project Clinical Classification Software (HCUP-CCS; Agency for Healthcare Research and Quality, 2009). The presence of AUD and DUDs were based on HCUP-CCS codes 5.11 and 5.12, respectively, and formed the two outcomes in this study. A separate data set was then created for the analysis of each outcome (i.e., AUD, DUD). First, for AUD, all cases with diagnosed DUDs were removed in order to specifically identify those with only alcohol-related issues. Individuals with only AUD appear to be a unique sub-population who have less social and psychiatric impairment than those with comorbid drug-related disorders (Moss et al., 2015; Stinson et al., 2005; Whiteford et al., 2013). In contrast, for the DUD data set, cases with and without comorbid AUD were included, based on research indicating greater symptom and impairment burden associated with drug-related disorders regardless of comorbid AUD (Grant et al., 2016; Moss et al., 2015; Simpson, Rise, Browne, Lehavot, & Kaysen, in press; Stinson et al., 2005; Whiteford et al., 2013) and high prevalence of lifetime AUD among individuals with lifetime DUD (73.8 to 80.2%; Simpson et al., in press). Thus, two partially overlapping samples were used to examine the relationship between a positive MST screen and AUD (n = 390,833) and DUD (n = 435,690). Evidence of additional mental health diagnoses were included if they were documented during the five-year surveillance period.

Exposure to MST was assessed through the two-item VA MST Screener collected from the medical record. Veterans were asked, “While you were in the military: (a) Did you receive

uninvited and unwanted sexual attention, such as touching, cornering, pressure for sexual favors, or verbal remarks?; (b) Did someone ever use force or threat of force to have sexual contact with you against your will?" (Kimerling et al., 2007). A positive history of MST was documented following a response of "yes" to either or both questions. No history of MST was documented following a response of "no" to both questions. Veterans who declined to answer or who did not have data for the MST screener in addition to those who had missing data on their gender (n = 95,977) were not included in the current study.

Data Analysis

Descriptive statistics were computed for all study variables, stratified by AUD and DUD group membership, and further by gender and history of MST. Two separate logistic regression analyses were conducted to assess whether gender moderated the association between positive MST screen and the diagnosis of AUD or DUD. Each outcome was regressed on MST, gender, the interaction of MST and gender, along with covariates. A second set of regressions was also run to examine the interaction of MST and male gender by reverse coding gender so that females were the reference group. Finally, a linear hypothesis test was used to compare increased gender-linked risk for AUD and DUD associated with screening positive for MST using the 'linearHypothesis' function in the 'car' package (Fox & Weisberg, 2011). Specifically, models compared the interaction effect of gender by positive MST screen for AUD against a null hypothesized value set to the value of the coefficient for this interaction within the DUD model (and vice versa for testing the DUD effect vs. AUD effect). The R environment for statistical computing was used to conduct all analyses through the VHA's secure Informatics and Computing Infrastructure research workspace (R Core Team, 2018).

Results

Tables 1 and 2 provide descriptive statistics for demographic and outcome variables, stratified by gender and results of MST screening, for the AUD and DUD samples. Rates of positive MST screens were 1.0% and 1.1% for males within the AUD and DUD sample, respectively, and 21.8% and 23.0% for females within the AUD and DUD sample, respectively. The sample was predominantly white, Army veterans with an average age between 30.8 and 32.8 years. A substantial minority of the sample had combat exposure (37.0% to 41.0%).

Prevalence and predictors of AUD and DUD diagnoses

Prevalence of AUD diagnosis ranged from 4.7% (women screening negative for MST) to 18.2% (men screening positive for MST). Prevalence of DUD diagnosis followed the same pattern, with prevalence lowest for women screening negative for MST (4.5%) and highest for men screening positive for MST (20.9%). Among women veterans, prevalence of AUD was more than doubled among those screening positive for MST (10.2% vs. 4.7%, for women screening positive and negative for MST, respectively) as was prevalence of DUD (11.0% vs. 4.5%, for women screening positive and negative for MST, respectively). Although men who screened positive for MST also evidenced increased prevalence of AUD and DUD, the proportional increases were numerically smaller (see Tables 1 and 2).

Results from logistic regression models predicting AUD or DUD diagnoses from MST positive screens and demographic variables are reported in Table 3. There were significant interactions between gender and MST screen when predicting both AUD and DUD (AORs = 1.43 and 1.17, for AUD and DUD, respectively). The significant interactions represent increased proportional risk for AUD and DUD diagnoses for women veterans screening positive for MST relative to men veterans. Examination of the simple slopes for the adjusted AUD model indicated that MST was associated with 1.63 higher odds of AUD for men, and 2.33 higher odds of AUD for women. Examination of the simple slopes for the adjusted DUD model indicated that MST was associated with 2.26 higher odds of DUD for men, and 2.65 higher odds of DUD for women. When gender was reverse coded with females as the reference group, the results of the logistic regressions showed the interactions for male gender and MST screen were 0.70 with AUD as the outcome, and 0.85 with DUD as the outcome. Consistent with the original logistic regressions, this shows increased proportional risk of AUD and DUD diagnoses among women veterans screening positive for MST. The linear hypothesis tests revealed that the increase in risk among women screening positive for MST was larger for AUD than DUD ($\chi^2[1] = 13.17$, $p < .001$ for AUD vs. DUD and $\chi^2[1] = 10.55$, $p = .001$ for DUD vs. AUD).

Discussion

The current study sought to extend previous research examining the psychiatric correlates of MST for men and women veterans. In keeping with previous studies showing disproportionate risk associated with MST exposure for women veterans (Gilmore et al., 2016; Kimerling et al., 2007), our results indicate that women who screen positive for MST are at increased risk for both AUD and DUD diagnoses. While overall prevalence rates of both AUD and DUD are higher among men, women show a greater increase in risk of diagnosis for each disorder when reporting MST. Importantly, this effect is present when controlling for other factors previously found to be correlated with AUD and DUD including age, combat exposure, and race/ethnicity.

These findings add to the growing literature documenting adverse outcomes associated with MST (e.g., Blais & Monteith, 2018; Kimerling et al., 2014; Klingensmith et al., 2014; Surís & Lind, 2008). To our knowledge, this is the first study to examine AUD and DUD separately, and to test the magnitude of gender-linked disparities for the two disorder categories. Importantly, our findings indicate that women screening positive for MST may be at increased risk of developing psychiatric conditions with substantial public health effects. From a clinical standpoint, our results highlight the elevated likelihood that women who experienced MST may have either AUD and/or DUD. Thus, clinicians are encouraged to assess for MST history and, particularly when women screen positive, to further assess for SUD-related symptoms. MST history should likewise be assessed when women report symptoms of AUD and/or DUD.

The relatively larger increase in risk for AUD versus DUD has not, to our knowledge, been reported previously and may inform treatment, screening and other secondary prevention efforts, as well as future research focused on the sequalae of MST and mechanisms of SUD risk. Examination of prevalence rates of AUD and DUD diagnoses within our sample for

men and women screening positive for MST indicates that this difference may be driven by a larger increase in risk for DUD among men screening positive for MST (10.8% vs. 20.9% for men screening negative and positive for MST, respectively). Increase in risk for AUD among men screening positive for MST (12.5% vs. 18.2% for men screening negative and positive for MST, respectively) was relatively smaller in magnitude. In contrast, increase risk for both AUD (4.7% vs. 10.2% for women screening negative and positive for MST, respectively) and DUD (4.5% vs. 11.0% for women screening negative and positive for MST, respectively) were of similar magnitude among women. Thus, one conclusion from the current study may also emphasize the substantial risk for DUD among men who screen positive for MST. Future research could investigate mechanisms underlying risk for DUD specifically among men screening positive for MST. Clinically, it may be important to provide clinician education on vulnerable subgroups and enhance outreach to male MST-survivors with respect to DUD treatment. Given low rates of SUD treatment engagement in the general population (19.8% and 24.6%, for individuals with lifetime diagnoses of AUD and DUD, respectively; Grant et al., 2015; Grant et al., 2016) as well as among veterans (Goldberg et al., in press; Maguen, Madden, Cohen, Bertenthal, & Seal, 2012; Vanneman et al., 2017), elevated SUD diagnosis risk associated with screening positive for MST among both men and women veterans highlights the need for ongoing efforts to engage veterans in SUD treatment. These findings also highlight the need for SUD treatment among veterans to be trauma-informed.

While highlighting a mental health disparity worthy of further investigation, the current study has several notable limitations. Although exposure to MST may function as a causal mechanism leading to the development of SUDs, the current design is correlational in nature and therefore insufficient for demonstrating this relationship. It may be that individuals who have existing AUD or DUDs are more likely to experience MST (i.e., reverse causality). Future longitudinal studies are warranted to examine the temporal ordering of SUDs and exposure to trauma among military personnel and the general population. In addition, the current study included only VHA users, who may demonstrate higher rates of psychiatric and medical conditions than the general veteran population. Our study was also limited in its assessment of MST, relying on the VHA-administered two-item screening, rather than a more nuanced assessment of MST experiences, including distinguishing harassment from assault MST (e.g., Blais et al., 2018). Similarly, information regarding the severity of AUD and DUD symptoms was not available, which may have allowed a richer understanding of the magnitude of clinical differences between veterans with and without MST exposure.

These limitations notwithstanding, this study highlights an important health disparity among women and men veterans. Given the high prevalence of MST exposure and increasing representation of women within the military and among VHA-users (Yano et al., 2010), continued research seeking to understand and address the link between MST and SUD is needed.

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Table 1.

Demographic and Mental Health Characteristics of Male and Female U.S. Veterans With and Without Positive Screen for MST Used in Sample Assessing Alcohol-Use Diagnosis as an Outcome (N = 390,833)

	Male		Female	
	Negative MST n = 337,022	Positive MST n = 3,339	Negative MST n = 39,465	Positive MST n = 11,007
Characteristic	**No. (%) or M (SD)**	**No. (%) or M (SD)**	**No. (%) or M (SD)**	**No. (%) or M (SD)**
Race				
White	227,592 (67.5%)	2,083 (62.4%)	20,213 (51.2%)	6,142 (55.8%)
Black	50,847 (15.1%)	631 (18.9%)	12,221 (31.0%)	2,959 (26.9%)
Hispanic	36,924 (11.0%)	404 (12.1%)	4,270 (10.8%)	1,177 (10.7%)
Other	11,427 (3.4%)	111 (3.3%)	1,559 (4.0%)	408 (3.7%)
Unknown	10,232 (3.0%)	110 (3.3%)	1,202 (3.0%)	321 (2.9%)
Age	32.5 (9.5)	32.8 (9.4)	31.1 (8.7)	31.0 (8.5)
Branch				
Navy/Coast Guard	42,388 (12.6%)	666 (20.0%)	6,386 (16.2%)	1,980 (18.0%)
Marines	53,656 (15.9%)	379 (11.4%)	1,576 (4.0%)	531 (4.8%)
Air Force	32,813 (9.7%)	325 (9.7%)	6,459 (16.4%)	1,593 (14.5%)
Army	208,163 (61.8%)	1,968 (59.0%)	25,043 (63.5%)	6,903 (62.7%)
Combat Exposure				
Yes	124,707 (37.0%)	1,345 (40.3%)	14,862 (37.7%)	4,226 (38.4%)
No	212,315 (63.0%)	1,994 (59.7%)	24,603 (62.3%)	6,781 (61.6%)
Alcohol-Use Diagnosis				
Yes	42,194 (12.5%)	608 (18.2%)	1,836 (4.7%)	1,128 (10.2%)
No	294,828 (87.5%)	2,731 (81.8%)	37,629 (95.3%)	9,879 (89.8%)

Abbreviation: MST, military sexual trauma.

Table 2.

Demographic and Mental Health Characteristics of Male and Female U.S. Veterans With and Without Positive Screen for MST Used in Sample Assessing Drug-Use Diagnosis as an Outcome (N = 435,690)

	Male		Female	
	Negative MST n = 377,799	Positive MST n = 4,222	Negative MST n = 41,307	Positive MST n = 12,362
Characteristic	**No. (%) or M (SD)**	**No. (%) or M (SD)**	**No. (%) or M (SD)**	**No. (%) or M (SD)**
Race				
White	256,462 (67.9%)	2,644 (62.6%)	21,228 (51.4%)	6,937 (56.1%)
Black	57,080 (15.1%)	809 (19.2%)	12,777 (30.9%)	3,330 (26.9%)
Hispanic	41,070 (10.9%)	499 (11.8%)	4,473 (10.8%)	1,305 (10.6%)
Other	12,292 (3.3%)	143 (3.4%)	1,594 (3.9%)	447 (3.6%)
Unknown	10,895 (2.9%)	127 (3.0%)	1,235 (3.0%)	343 (2.8%)
Age	32.2 (9.4)	32.1 (9.1)	31.0 (8.7)	30.8 (8.4)
Branch				
Navy/Coast Guard	45,987 (12.2%)	829 (19.6%)	6,625 (16.0%)	2,217 (17.9%)
Marines	60,546 (16.0%)	484 (11.5%)	1,654 (4.0%)	581 (4.7%)
Air Force	34,765 (9.2%)	389 (9.2%)	6,701 (16.2%)	1,727 (14.0%)
Army	236,499 (62.6%)	2,519 (59.7%)	26,326 (63.7%)	7,837 (63.4%)
Combat Exposure				
Yes	141,179 (37.4%)	1,732 (41.0%)	15,570 (37.7%)	4,824 (39.0%)
No	236,620 (62.6%)	2,490 (59.0%)	25,737 (62.3%)	7,538 (61.0%)
Drug-Use Diagnosis				
Yes	40,777 (10.8%)	883 (20.9%)	1,842 (4.5%)	1,355 (11.0%)
No	337,022 (89.2%)	3,339 (79.1%)	39,465 (95.5%)	11,007 (89.0%)

Abbreviation: MST, military sexual trauma.

Table 3.

Logistic regression models predicting diagnosed alcohol-use and drug-use disorders among OEF/OIF veterans

	Alcohol-Use Diagnosis n = 390,833		Drug-Use Diagnosis n = 435,690	
Characteristic	**AOR (95% CI)**	***p*-value**	**AOR (95% CI)**	***p*-value**
Intercept	0.15 (0.15–0.16)	< .001	0.13 (0.13–0.13)	< .001
Military Sexual Trauma (Ref = No)	1.63 (1.49–1.79)	< .001	2.26 (2.09–2.43)	< .001
Gender (Ref = Male)	0.36 (0.34–0.38)	< .001	0.37 (0.35–0.38)	< .001
Race/Ethnicity (Ref=White)				
Black	0.93 (0.91–0.96)	< .001	1.08 (1.05–1.11)	< .001
Hispanic	1.02 (0.99–1.05)	.29	0.88 (0.85–0.91)	< .001
Other	0.96 (0.90–1.01)	.12	0.65 (0.60–0.69)	< .001
Unknown	0.69 (0.65–0.74)	< .001	0.58 (0.53–0.62)	< .001
Age	0.98 (0.98–0.98)	< .001	0.95 (0.95–0.96)	< .001
Branch of Service (Ref = Army)				
Navy/Coast Guard	0.67 (0.65–0.70)	< .001	0.67 (0.65–0.70)	< .001
Marines	1.16 (1.13–1.19)	< .001	0.76 (0.74–0.78)	< .001
Air Force	0.53 (0.51–0.55)	< .001	0.56 (0.53–0.58)	< .001
Combat Exposure (Ref = No)	1.02 (1.00–1.04)	.04	1.12 (1.10–1.14)	< .001
Interaction	1.43 (1.27–1.61)	< .001	1.17 (1.06–1.31)	.003

Note: MST = military sexual trauma; OEF = Operation Enduring Freedom; OIF = Operation Iraqi Freedom; AOR = adjusted odds ratio; CI = confidence interval; Ref = reference group. Both models included the interaction of military sexual trauma (Ref = No) and gender (Ref = male). Age was mean centered; the intercept reflects the value when age is 32.4 for the AUD model and 32.0 for the DUD model.