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Correlates and clinical associations of military sexual assault in Gulf War era U.S. veterans: Findings from a national sample

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Abstract

Military sexual assault (MSA) is a prevalent issue among military personnel that can have direct implications on postmilitary mental health. Gulf War era U.S. veterans represent the first cohort in which women veterans were integrated into most aspects of military service except for combat. The present study sought to build on prior studies by identifying characteristics associated with the occurrence of MSA, clinical correlates with MSA, and how these differ between men and women. This study analyzed cross-sectional survey data from a national sample of treatment-seeking Gulf War era veterans. Participants ($N = 1,153$) reported demographic information, clinical outcomes, military background, and history of MSA. MSA was more common among female veterans ($n = 100$, 41.3%) than male veterans ($n = 32$, 3.6%). The odds of experiencing MSA were approximately 19 times higher for female veterans relative to their male peers, $OR = 18.92$, $p <$

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We have no conflicts of interest to disclose.

OPEN PRACTICES STATEMENT

The present study was not preregistered. Neither the data nor materials are available on a permanent third-party archive. Requests for these materials may be sent to Nathan Kimbrel (Nathan.kimbrel@duke.edu)

.001. Moreover, as expected, MSA was robustly associated with probable current posttraumatic stress disorder, probable current depression, and past-year suicidal ideation in female veterans, whereas combat exposure was robustly associated with these sequelae in male veterans. The present findings confirm that a large proportion of female veterans from the Gulf War era experienced MSA and highlight the deleterious correlates of MSA on veterans' mental health. Sex differences of correlates of MSA and subsequent clinical associations are highlighted.

Military sexual trauma (MST) includes any sexual harassment or assault that occurs during military service (U.S. Government, 2014). Recent studies of veterans estimate that sexual assault in the U.S. military ranges from 3% to 38.4% in women and 0.2% to 6% in men (Haskell et al., 2010; Kang et al., 2005; Kimerling et al., 2007, 2010; Murdoch et al., 2014; Wilson et al., 2018). Similarly, among U.S. veterans, women endorse MST at higher rates than men (Haskell et al., 2010; Kimerling et al., 2007, 2010). For example, Haskell and colleagues (2010) analyzed cross-sectional data collected from 1,229 veterans deployed in support of recent military operations in Afghanistan and Iraq ($n = 1,032$ men, $n = 197$ women) and found that women veterans were more likely than men veterans to screen positive for MST (14% vs. 1%, $p < .001$).

In addition to being an adverse experience itself, MST can serve as a serious risk factor for a wide array of subsequent mental health problems, such as posttraumatic stress disorder (PTSD), major depressive disorder (MDD), suicidality, and anxiety (Bryan et al., 2015; Kimerling et al., 2010; Schry et al., 2015; Tannahill et al., 2020; K. L. White et al., 2018; Wilson et al., 2020). Given its strong association with mental health problems, risk factors and correlates of MST are worthy of additional study to examine how MST can be indirectly prevented by targeting predictors of MST.

The Gulf War collectively refers to the U.S. military operations within the Persian Gulf region that occurred between 1990 and 1991. MST is particularly important in understanding the experiences and health of Gulf War veterans, as this military conflict was the first in which female U.S. service members were integrated into almost every military unit except for combat units (Kang et al., 2005). Additionally, this was the first major conflict after the Selective Services were ended, leading to more volunteers and increased sociodemographic diversity, and, in relative terms, one of the shorter U.S. conflicts involving combat exposure. Given the unique context of the Gulf War and the differences of service members of this era compared to previous service eras, it is important for researchers to examine the prevalence and predictors of MST among Gulf War era veterans. To this end, Kang and colleagues (2005) investigated associations between MST and PTSD among respondents to a population-based health survey of 30,000 Gulf War era veterans and found that 24% of female troops experienced sexual harassment and 3.3% experienced sexual assault. MST was less common among male veterans; specifically, 0.6% of male service members experienced sexual harassment and 0.2% experienced sexual assault. The authors further found that female Gulf War era veterans with a history of MST were 5.41 times more like to have PTSD than those without an MST history, whereas male veterans who experienced MST were 6.21 times more likely to have PTSD than those who did not (Kang et al., 2005). Although this study helped call attention to the critical issue of MST among

Gulf War era veterans, its evaluation of mental health diagnoses was limited to PTSD, which was assessed according to now-outdated criteria in the third edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-III)* (American Psychiatric Association, 1987).

Murdoch and colleagues (2014) examined MST and potential predictors of MST among a male-only sample of Gulf War era veterans who applied for Veterans Affairs (VA) service connection (i.e., disability benefits). Results showed that 1 in 5 participants experienced a completed or attempted sexual assault. For this sample, predictors of MST included having more crowded living quarters, working in units that were more tolerant of sexual harassment, being younger, reporting a sexual orientation other than “completely heterosexual,” and experiencing childhood maltreatment. However, the authors’ findings are limited to male veterans and do not reflect the experience of female veterans.

Taken together, research clearly demonstrates that MST is prevalent among U.S. veterans and is of considerable importance among those from the Gulf War era. Although some work has examined potential associations with MST, more research is needed to understand predictors of MST, especially among the unique population of Gulf War era veterans. Additionally, research understanding the epidemiology of MST in Gulf War era veterans and how it might differ between men and women has yet to be investigated. Understanding correlates of MST for these veterans may aid in clinician treatment planning.

In addition to elevated rates of PTSD and MDD, many Gulf War era veterans have been shown to report physical symptoms ranging from respiratory and gastrointestinal difficulties to fatigue and muscular pain (Dursa et al., 2020; Fukuda et al., 1998; Proctor et al., 1998; Unwin et al., 2002; R. F. White et al., 2016). Notably, this collection of physical symptoms overlaps with, but also deviates from, established medical conditions (e.g., chronic fatigue syndrome, fibromyalgia). As a result, this symptom cluster associated with the Gulf War theater formed a new condition known as “Gulf War illness” (GWI; Institute of Medicine, 2014).

One possible explanation for the emergence of GWI is the exposure to nuclear, biological, and chemical agents (NBCs) characteristic to the Gulf War theater. Veterans of the Gulf War were exposed to a variety of NBCs both in the context of the environment (e.g., pesticides and smoke from burning oil fields), warfare agents (e.g., nerve gas), and preventative measures to warfare agents (e.g., anti-nerve gas pills; Research Advisory Committee on Gulf War Veterans’ Illnesses, 2014; R. F. White et al., 2016). Notably, research has demonstrated associations between exposure to these NBCs and poor health outcomes, including GWI and PTSD symptoms, among Gulf War veterans (King et al., 2008; Proctor et al., 1998; Wolfe et al., 2002). Specifically for trauma-related symptoms, actual or perceived exposure to NBCs may act as an effect modifier that bolsters or dampens the effects of a traumatic experience on subjective distress or quality of life (King et al., 2008). Furthermore, the disproportionate rate of psychiatric disorders and presence of GWI among Gulf War veterans has also been linked to combat exposure. Specifically, combat exposure has been associated with both PTSD and MDD (Kimbrel et al., 2015; King et al., 2006; Luxton et al., 2010; Toomey et al., 2007) and has been shown to contribute to symptoms of GWI (Porter et al., 2019; Sheffler et al., 2016; R. F. White et al., 2016). Consequently,

combat exposure, NBCs, GWI, and PTSD are important considerations regarding the mental and physical well-being of Gulf War veterans.

Although sexual violence in the military historically has been categorized as MST (i.e., encompassing harassment and assault), the present study sought to observe sexual violence in the military through a more specific definition. Military sexual assault (MSA) includes any unwanted sexual activity that is the result of force, threat of harm, or manipulation while serving in the military (Skinner et al., 2000). To date, research has not yet examined the association between MSA and clinically relevant psychopathology, demographic characteristics, combat exposure, and GWI among male and female Gulf War era veterans. Additionally, women have been identified to be at higher risk of experiencing MSA, and although certain demographic factors have been identified, factors associated with Gulf War era veterans have not been fully investigated (i.e., epidemiologically and between male and female veterans; Castro et al., 2015; Turchik & Wilson, 2010). The present study sought to address this gap in the literature through an investigation of MSA in male and female veterans and clinical psychopathology utilizing a national sample of Gulf War era veterans.

We hypothesized that younger age, current service-connected disability, and race would be associated with MSA at the bivariate level for female veterans (Gibson et al., 2015). Additionally, we hypothesized that younger age, current service-connected disability, race, sexual minority status, combat exposure, and rank would be associated with MSA for male veterans (Murdoch et al., 2014). We further hypothesized that MSA history would be the strongest statistical predictor of lifetime suicide attempt history as well as a positive screen for current probable PTSD, current probable depression, and past-year suicidal ideation for female veterans, whereas combat exposure would be the strongest predictor of these outcomes in male veterans (Kang et al., 2005).

METHOD

Participants and procedure

The sample comprised 1,153 respondents who participated in the Gulf War Research & Individual Testimony study (Grant #1I01HX001682), a national survey of Gulf War era veterans' health care needs, utilization patterns, and associated costs. Study procedures were approved by the Institutional Review Boards of both the [Durham Veteran Affairs Health Care System] and the [Salt Lake City VA Health Care System]. Participants were eligible if they had served in an active duty capacity before May 1, 1990, and remained on active duty until after February 28, 1991, regardless of deployment status (for additional information of study procedures see Blakey et al., 2021). An initial pool of 1,098,991 Gulf War era veterans, including 133,461 women, were identified using the VA administrative database. Utilizing stratified random sampling, a subset of 6,000 veterans ($n = 750$ veterans from eight geographic regions of the United States) were identified to potentially contact for study participation. To maximize satisfactory representation, veterans who identified as women were oversampled (25%; i.e., 1,500 of 6,000).

Surveys were mailed to prospective participants between January 2019 and August 2020. To ensure a high response rate, a modified Dillman approach (Dillman et al., 2014) using multiple contacts and methods of contact was utilized. Initially, veterans were sent a letter on VA letterhead describing the study purpose, procedures, timeline of completion, and detailed instructions on how to opt out of the study. Veterans who did not opt out were sent a copy of the physical survey, an additional copy of the study information letter that highlighted the project as well as the components of informed consent, a token of appreciation (“challenge coin” with study name printed on it), and a prepaid return envelope. Veterans signified their consent to participate in the study by completing and returning the survey.

Of the initial 6,000 potential participants available to contact, surveys were mailed to 3,272 veterans. Of these 3,272 surveys, 548 surveys were returned due to an incorrect or outdated mailing address, resulting in 2,724 surveys that were sent to veterans with correct mailing addresses. A total of 32 veterans opted out of the study, and 1,153 veterans completed and returned the survey. Thus, the overall response rate for the study was 42.3% (i.e., 1,153 of 2,724), whereas the overall return rate was 35.2% (i.e., 1,153 of 3,272). The mean participant age was 58.9 years ($SD = 7.49$). For further characteristics of the sample, see Table 1.

Measures

Demographic characteristics—Veterans ($N = 1,153$) reported age, sex assigned at birth (male or female), sexual orientation (i.e., sexual majority being heterosexual or sexual minority encompassing gay/lesbian, bisexual, other), ethnicity (Hispanic/Latino or non-Hispanic/Latino), race (White, Black or African American, and other), and rank (enlisted soldier or officer). Age was self-reported at the time of survey completion.

Clinical characteristics—Clinical characteristics included self-reported lifetime diagnosis of GWI, past-year suicidal ideation, and lifetime suicide attempt. All variables were dichotomized as endorsed or not endorsed.

PTSD symptoms. Past-month PTSD symptoms were assessed using the Primary Care PTSD Screen for *DSM-5* (PC-PTSD-5; Prins et al., 2016). Respondents were asked whether they had experienced trauma-related symptoms over the past month, with 1 point assigned for each “yes” response. Scores of 4 or higher were coded as probable current PTSD. The PC-PTSD-5 has been shown to demonstrate good convergent validity with diagnostic interviews for PTSD (Prins et al., 2016). Internal consistency in the present sample was good (Cronbach’s $\alpha = .85$).

Depressive symptoms. Current depressive symptoms were assessed using the two-item Patient Health Questionnaire (PHQ-2; Kroenke et al., 2003). Respondents were asked to rate each item on a scale of 0 (*not at all*) to 3 (*nearly every day*), with scores of 3 or higher coded as probable current depression. The PHQ-2 has demonstrated good convergent and predictive validity in the past (Kroenke et al., 2003). Internal consistency in the present sample was excellent (Cronbach’s $\alpha = .91$).

Suicidal ideation and suicide attempt.: Past-year suicidal ideation and lifetime suicide attempts were measured via the Suicidal Behaviors Questionnaire–Revised (SBQ-R; Osman et al., 2001). Response options differ by item, with total possible scores ranging from 3 to 18. For the purpose of the present study, we examined two distinct items on the SBQ-R to measure ideation and attempt separately. Participants were classified as having past-year suicidal ideation if they endorsed thinking about killing themselves at least once in the past year. Participants were classified as having a history of suicide attempt if they endorsed ever attempting to kill themselves.

GWL.: Lifetime GWI was separately assessed using a single item “yes” or “no” response format.

MSA—MSA was measured assessed with a single, “Did you ever experience unwanted sexual activity as a result of force, threat of harm, or manipulation during your time in the military?” Respondents answered “yes” or “no.”

Combat exposure—Combat exposure was measured using the seven-item Critical Warzone Experiences Scale (Kimbrel et al., 2014). Participants were asked to rate the frequency of various combat-related events they may have experienced on a scale from 0 (*never*) to 4 (*10 or more times*). Item scores were summed, with higher scores being indicative of higher degrees of combat exposure. The Critical Warzone Experiences Scale has demonstrated good internal consistency, good test–retest reliability, and convergent validity with other combat exposure scales (Kimbrel et al., 2014). The measure has also demonstrated associations with a broad array of postdeployment mental health concerns (Kimbrel et al., 2015). In the current sample, Cronbach’s alpha was .85.

NBC exposure—NBC exposure was assessed using the Deployment Risk and Resilience Inventory–2 (DRRI-2; Vogt et al., 2012) NBC Exposure subscale (Section F). Participants were asked to rate whether they believed they had been exposed to any of 13 various toxic substances, with response options of 0 (*no*), 1 (*not sure*), and 2 (*yes*). A total score was calculated by summing the responses to each item. Respondents with a score higher than 0 were coded as endorsing NBC exposure, whereas respondents with a score of 0 were coded as not endorsing NBC exposure. The measure has demonstrated strong internal consistency and criterion-related validity in previous work (Vogt et al., 2013). In the present sample, Cronbach’s alpha was .91.

Data analysis—All analyses were conducted in SPSS (Version 27). Given that risk factors and outcomes of MSA have been shown to vary by sex assigned at birth in military veterans (Kang et al., 2005; Kimerling et al., 2011; Skinner et al., 2000), all analyses were stratified by sex. Logistic regression was used to measure bivariate associations between MSA, demographic characteristics, combat exposure history, NBC exposure, and GWI for both male and female veterans. Multiple imputation using chained equations imputation was utilized to address missing data. Approximately 8% of the data were missing; thus, a total of eight iterations were selected for the multiple imputation analyses (I. R. White et al., 2011). Multivariate logistic regression models were conducted to identify categorical predictors of

mental health outcomes for both male and female veterans. Combat exposure, age, and race, as well as MSA, were included in the models.

RESULTS

Preliminary analyses

MSA was more common among female veterans (41.3%, $n=100$) than male veterans (3.6%, $n=32$) in our sample ($OR=18.92$, $p<0.001$). Nearly one fifth (19.8%, $n=228$) of the sample met the screening criteria for probable current PTSD, 21.5% ($n=248$) met the screening criteria for probable current depression, 18.1% ($n=209$) reported past-year suicidal ideation, 4.8% ($n=55$) reported a lifetime suicide attempt, 77.7% ($n=896$) reported NBC exposure during their Gulf War service, and 9.8% ($n=113$) self-reported they had received a diagnosis of GWI. Table 1 further illustrates the characteristics of the sample as well as missing data.

Bivariate logistic regression analyses

As hypothesized, service-connected disability, odds ratio (OR) = 4.19, 95% CI [1.54, 11.38], and age were associated with reports of MSA at the bivariate level for female veterans; however, race was not (see Table 2). Among female veterans, older age during Gulf War era military service was associated with lower odds of having experienced MSA, $OR = 0.95$, [0.91, 0.99]. For male veterans, being a sexual minority, $OR = 4.49$, [1.26, 16.04]; being a current VA service user, $OR = 4.36$, [1.31, 14.42]; reporting GWI, $OR = 2.55$, [1.07, 6.09]; and endorsing combat exposure, $OR = 1.10$, [1.04, 1.16], were associated with higher odds of reporting MSA. However, our hypothesis that race, service connection, and rank would be associated with increased odds of reporting MSA in male veterans was not supported. In fact, identifying as Black was associated with lower odds of reporting MSA, $OR = 0.35$, [0.14, 0.89], in this sample.

Additionally, we conducted a logistic regression model with sex as an interaction term for each characteristic to observe comparable differences between male and female veterans (see Table 1). The findings were consistent with the two individual models with respect to Black race and sexual minority status for men and service-connected disability for women.

Multivariate logistic regression analyses

Next, a series of logistic regression models were conducted to examine the association between MSA and relevant covariates (i.e., combat exposure, age, Black race, other race) with four separate mental health outcomes: current probable PTSD, current probable depression, past-year suicidal ideation, and lifetime suicide attempts for both male and female veterans (Table 3). As hypothesized, MSA history was uniquely associated with current probable PTSD, adjusted OR (aOR) = 9.39, 95% CI [4.04, 21.82]; current probable depression, $aOR = 3.57$, [1.72, 7.41]; and past-year suicidal ideation, $aOR = 3.08$, [1.57, 6.07], among female veterans. MSA was not significantly associated with lifetime suicide attempts, $aOR = 2.49$, [0.99, 6.25], among female veterans. Among men, in models accounting for age, race, and combat exposure, MSA was significantly related to PTSD, $aOR = 3.04$, [1.26, 7.29], but was not related to depression, past-year suicidal ideation,

and lifetime suicide attempts. Among men, combat exposure was associated with PTSD, depression, and past-year suicidal ideation but was unrelated to lifetime suicide attempts (see Table 3).

DISCUSSION

Sexual trauma during military service is unacceptably prevalent in U.S. military personnel. Previous work has suggested that MST and MSA increased during the Gulf War era in conjunction with the integration of women into military operations during that military conflict (Haskell et al., 2010; Kang et al., 2005; Kimerling et al., 2007, 2010; Murdoch et al., 2014). Additionally, these rates increased in men in conjunction with an increased number of volunteers, service members of color, and sexual minority service members (Balsam et al., 2011; Lofgreen et al., 2017). MST is associated with a wide array of adverse clinical outcomes and, therefore, warrants additional study regarding risk factors for MST and its impact on veterans' mental health (Tannahill et al., 2020). The current study aimed to build on prior studies by recruiting a national sample of Gulf War era veterans to examine sex differences associated with reporting MSA as well as differences in MSA-related mental health outcomes approximately 30 years after the Gulf War.

The finding that over 3% of male Gulf War era veterans and over 41% of female Gulf War era veterans reported MSA is consistent with prior studies and further emphasizes the critical importance of better addressing MSA among individuals who serve in the U.S. Armed Forces (Wilson, 2018). Notably, women are the fastest-growing active duty and veteran demographic, yet they are underrepresented in military health research and the VA Healthcare System (e.g., Brownley & Dunn, 2021; Marshall et al., 2021; U.S. Department of Veterans Affairs, 2015; Washington et al., 2006). Additionally, there continue to be barriers, such as stigma, that may lead to underreporting of MSA among male veterans (Campos, 2021). Our findings, therefore, carry meaningful implications for VA and non-VA clinicians, investigators, and policymakers alike. Specifically, our study highlights the need for additional research aimed at (a) identifying psychosocial and contextual risk factors for MSA, (b) implementing tailored MSA prevention programs, and (c) providing veterans who experienced MSA effective care for any deleterious effects on their health and well-being (e.g., PTSD, depression, and suicidal ideation). Although women are consistently shown to have the highest risk of experiencing MSA, it will be important to also deliver effective MSA prevention and intervention programs to men and non-gender-binary service members and veterans.

The results of bivariate analyses showed that age and service-connected disability were significantly associated with MSA for female veterans. Although our survey did not assess all possible sociodemographic and contextual risk factors, the findings do suggest that women who were younger during their military service may have been at a relatively higher risk of experiencing MSA, which is consistent with prior findings of MST and MSA in other military eras (Maguen et al., 2012). As the experience of MSA and its associated disabling physical or mental conditions are grounds for VA service-connection disability, it is not surprising that MSA was related to service-connected disability status in the present sample. Although we did not observe an association between MSA and combat in female

veterans, future research should seek to further observe this connection, as prior research has established the association between these two constructs in female veteran populations from more recent service eras (Barth et al., 2016). Future research on tailoring MSA prevention and assessment programs for women service members with these and other risk factors (e.g., prior experiences of sexual assault; Kelly et al., 2011) would be helpful.

For male veterans, the bivariate findings suggest that those who identified as a sexual minority (i.e., gay, bisexual, or other), were current VA service users, reported being diagnosed with GWI, and endorsed higher degrees of combat exposure may have been at higher risk of experiencing MSA. In particular, the associations between MSA and both sexual minority status and combat exposure are consistent with past findings of Gulf War veterans seeking PTSD disability benefits (Murdoch et al. 2014) and of veterans who identify as a sexual minority (Balsam et al., 2011). The presence of unique associations among male veterans, particularly regarding combat exposure, may be reflective of differing roles in the Gulf War, as female veterans were not integrated into combat units (Kang et al., 2005). Importantly, the present findings demonstrate that GWI was associated with MSA among male veterans in this sample. Due to the complex nature of GWI, the mechanisms explaining this association with MSA warrant further study. Regardless, these unique associations suggest that further MSA prevention and assessment programs may be beneficial.

Multivariate analyses adjusting for sociodemographic and military-related covariates also showed that for female veterans, MSA was associated with significantly higher odds of probable PTSD, probable depression, and suicidal ideation, even after adjusting for other known risk factors, such as age, race, and combat exposure. These findings align with previous research on adverse downstream consequences of MSA on mental health (e.g., Godfrey et al., 2015; Suris & Lind, 2008). It is important to note that despite not reaching statistical significance, the sizable effect size ($OR = 2.49$) of the association between MSA and suicide attempts is worth further investigation, as power may have been a limiting factor in the present study. For male veterans, MSA was only associated with significantly higher odds of probable PTSD, but the low endorsement of MSA among men may have been a limiting factor in detecting associations with depression and suicidal ideation and attempt. Conversely, combat exposure was significantly associated with probable PTSD, probable depression, and past-year suicidal ideation. Importantly, we found that MSA history was associated with nearly 3 times greater odds of current probable depression and past-year suicidal ideation for female veterans. Therefore, it will be important for future investigators and health care providers to thoroughly assess for depression and suicide risk in female service members and veterans who report MSA and for providers to address this during treatment, as clinically indicated.

The present study also had several limitations that should be addressed in future research. For example, MSA, combat exposure, and NBC exposure histories were gathered via retrospective self-report, which could have been affected by recall bias. Another barrier to self-report could be the stigma among male veterans surrounding reporting MSA (Campos, 2021). Additionally, because MSA was assessed using a single dichotomous variable, we do not have information on the specific nature of the assault or the number of

individual instances of MSA participants experienced. Similarly, race was assessed using an “other” category, which precludes the generalization of these associations to other minoritized veterans. Another limitation concerns our use of brief screening measures to assess diagnostic outcomes such as PTSD, depression, and suicidal thoughts and behaviors rather than more comprehensive measurements or interviews. Further, the generalizability of the presented study is limited due to our focus on veterans who sought care. Future studies should seek to replicate the present study’s findings in a more general Gulf War era sample. Finally, the data used were cross-sectional, which precludes drawing conclusions regarding the temporality or causality of our study variables. Future research incorporating a longitudinal design and multimethod assessment (e.g., self-report and clinician-administered interviews) would be particularly helpful.

Despite these limitations, the present study benefitted from several methodological strengths. We utilized a large national sample of Gulf War era veterans and built on previous findings (Kang et al., 2005) by oversampling women. Additionally, our survey battery assessed additional health outcomes not included in prior studies of MSA in Gulf War era veterans, such as combat exposure, depression, suicide risk factors, NBC exposure, and VA service use.

Altogether, the present findings support the larger body of research demonstrating that women are at a significantly higher risk of experiencing MSA (i.e., almost 19 times greater) than men, but the findings uniquely demonstrate epidemiological differences of MSA in male and female veterans of the Gulf War era. This study also underscores the need to conduct additional research on the prospective role of MSA with regard to important clinical outcomes, such as PTSD, MDD, and suicidal ideation, in both female and male veterans. Additionally, the results emphasize the need to observe MSA in the context of combat exposure in veterans. These findings build upon prior research while signaling the need to address the present study’s limitations. Nonetheless, the study results signify the importance of evaluating and addressing the long-term effects of MSA.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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TABLE 1

Characteristics of Gulf War veteran sample

Characteristic	Male (n = 891)		Female (n = 249)		Missing data	
	n	%	n	%	n	%
Sex assigned at birth					13	1.1
Race					39	3.4
Black	175	19.6	64	25.7		
Other	106	11.9	29	11.6		
White	583	65.4	152	61.0		
Ethnicity					26	2.3
Hispanic	77	8.6	22	8.8		
Non-Hispanic	800	89.8	224	90.0		
Sexual minority status					17	1.4
Heterosexual	863	96.9	227	91.2		
Sexual minority	22	2.5	19	7.7		
Marital status					14	1.2
Married or living together	696	78.1	136	54.6		
Married but separated or divorced	130	14.6	82	32.9		
Widowed	19	2.1	5	2.0		
Single, never married	41	4.6	25	10.0		
Rank					158	13.7
Enlisted	628	70.5	173	69.5		
Officer	145	16.3	38	15.3		
Current service-connected disability	677	76.0	210	84.3	51	4.4
Current VA service user	621	69.7	181	72.7	14	1.2
Deployment status during Gulf War					25	21.7
Deployed	397	44.6	48	19.3		
Did not deploy	476	53.4	195	78.3		
NBC exposure	730	81.9	154	61.8	94	8.2
Military sexual assault	32	3.6	100	40.2	16	1.4

Characteristic	Male (n = 891)		Female (n = 249)		Missing data	
	n	%	n	%	n	%
	Gulf War illness	92	10.3	17	6.8	29
Mental health factors						
Probable current PTSD	177	19.9	48	19.3	82	7.1
Probable current depression	199	22.3	46	18.5	16	1.4
Past-year suicidal ideation	162	18.2	47	18.9	13	1.1
Lifetime suicide attempt	31	3.5	24	9.6	18	1.6

Note: N = 1,153. The denominator for all percentages is 1,153.

TABLE 2

Characteristics and unadjusted odds ratios (ORs) of Gulf War-era veterans and military sexual assault (MSA), stratified by sex assigned at birth

Characteristics	Female veterans				Male Veterans				Association with MSA	OR	95% CI
	MSA (n = 100)	No MSA (n = 142)	Association with MSA	OR	MSA (n = 32)	No MSA (n = 850)	Association with MSA	OR			
	n	%	n	%	n	%	n	%	n	%	
Age											0.96 [0.91, 1.02]
Race											
Black	28	28.0	35	24.6	11	34.4	159	18.7	0.35	[0.14, 0.89] *	
Other	15	15.0	13	9.2	7	21.9	99	11.6	0.98	[0.37, 2.61]	
White	56	56.0	91	64.1	14	43.8	565	66.5			
Ethnicity											
Hispanic	13	13.0	9	6.3	4	12.5	73	8.6	1.56	[0.53, 4.57]	
Non-Hispanic	86	86.0	131	92.3	27	84.4	766	90.1			
Sexual minority status											
Heterosexual	94	94.0	127	89.4	29	90.6	825	97.1	4.49	[1.26, 16.04] *	
Sexual minority	5	5.0	13	9.2	3	9.4	19	2.2			
Marital status											
Married or living together	48	48.0	84	59.1	22	68.7	670	78.8			
Married but separated or divorced	40	40.0	39	27.4	7	21.9	121	14.2	0.62	[0.14, 2.75]	
Widowed	3	3.0	2	1.4	1	3.1	17	2.0	1.10	[0.22, 5.52]	
Single, never married	8	8.0	17	12.0	2	6.3	38	4.5	1.12	[0.10, 13.18]	
Rank											
Enlisted	74	74.0	92	64.8	24	75.0	598	70.4	1.41	[0.48, 4.11]	
Officer	26	26.0	50	35.2	8	25.0	252	29.6			
Current service-connected disability	93	93.0	111	78.2	4.19	[1.54, 11.38] **	25	78.1	1.59	[0.55, 4.64]	
Current VA service user	77	77.0	102	71.8	1.31	[0.73, 2.37]	29	90.6	4.36	[1.31, 14.42] *	
Deployment status during Gulf war											
Deployed	22	22.0	26	18.3	1.19	[0.63, 2.26]	14	43.8	0.97	[0.47, 2.00]	
Did not deploy	78	78.0	110	80.9	17	53.1	451	53.1			

Characteristics	Female veterans						Male Veterans					
	MSA (n = 100)			No MSA (n = 142)			MSA (n = 32)			No MSA (n = 850)		
	n	%	OR	n	%	95% CI	n	%	OR	n	%	95% CI
Gulf War illness	10	10.0	2.12	89	62.7	[0.78, 5.77]	7	21.9	2.55	85	10.0	[1.07, 6.09] *
NBC exposure	68	68.0	1.12	86	60.6	[0.61, 2.07]	26	81.3	0.92	701	82.5	[0.31, 2.69]
Combat exposure			1.08			[0.99, 1.18]			1.10			[1.04, 1.16] ***

Note: The remaining percentages in each cell are missing data. Odds ratios are considered statistically significant if the confidence interval does not contain 1.0.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Summary of pooled logistic regression models predicting mental health outcomes, stratified by sex

TABLE 3

Variable	Female veterans			Male veterans		
	aOR	95% CI	p	aOR	95% CI	p
<i>Model 1: Predicting current PTSD</i>						
Military sexual assault	9.39	[4.04, 21.82]	<.001	3.04	[1.26, 7.29]	.013
Combat exposure	1.17	[1.04, 1.32]	.009	1.21	[1.17, 1.25]	<.001
Age	0.97	[0.91, 1.03]	.280	0.92	[0.89, 0.95]	<.001
Black race	0.33	[0.11, 0.99]	.048	0.67	[0.36, 1.22]	.189
Other race	0.87	[0.26, 2.93]	.821	1.17	[0.61, 2.23]	.641
<i>Model 2: Predicting Current Depression</i>						
Military sexual assault	3.57	[1.72, 7.41]	<.001	1.56	[0.71, 3.45]	.269
Combat exposure	1.09	[0.98, 1.21]	.102	1.10	[1.07, 1.13]	<.001
Age	0.92	[0.87, 0.98]	.010	0.93	[0.91, 0.96]	<.001
Black race	0.57	[0.21, 1.57]	.276	0.85	[0.50, 1.47]	.568
Other race	0.90	[0.31, 2.66]	.853	1.25	[0.70, 2.24]	.451
<i>Model 3: Predicting past-year suicidal ideation</i>						
Military sexual assault	3.08	[1.57, 6.07]	<.001	1.83	[0.81, 4.15]	.146
Combat exposure	1.00	[0.87, 1.15]	.950	1.05	[1.02, 1.08]	.003
Age	0.95	[0.89, 1.00]	.054	0.96	[0.94, 0.99]	.006
Black race	1.39	[0.37, 5.22]	.623	1.12	[0.62, 2.02]	.699
Other race	1.54	[0.39, 6.02]	.532	0.95	[0.49, 1.84]	.876
<i>Model 4: Predicting lifetime suicide attempts</i>						
Military sexual assault	2.49	[0.99, 6.25]	.052	0.72	[0.09, 5.66]	.751
Combat exposure	0.82	[0.88, 1.18]	.815	1.04	[0.97, 1.11]	.281
Age	0.93	[0.86, 1.00]	.053	0.99	[0.94, 1.04]	.578
Black race	0.52	[0.15, 1.80]	.299	1.02	[0.36, 2.90]	.973
Other race	0.36	[0.09, 1.53]	.166	0.48	[0.12, 1.94]	.301

Note: aOR = adjusted odds ratio. Odds ratios are considered statistically significant if the confidence interval does not contain 1.0.

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