


# Military sexual trauma is associated with post-deployment eating disorders among Afghanistan and Iraq veterans

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## Abstract

**Objective:** Evaluate the association of military sexual trauma (MST) screen status with eating disorder diagnoses among veterans within 1- and 5-years after initiating Veterans Health Administration (VHA) care, and whether the association varied by sex.

**Method:** Retrospective cohort study of US Afghanistan/Iraq veterans who used VHA services between FY 2004 and 2014 ( $N = 595,525$ ). This study used VHA administrative data to assess the presence of eating disorder diagnoses in medical records within 1- and 5-years of initiating VHA care, and whether a positive screen for MST was associated with eating disorders.

**Results:** Three percent ( $n = 18,488$ ) screened positive for MST. At 1- and 5-year follow up, 0.1% ( $n = 513$ , 74% female), and 0.2% ( $n = 504$ , 71% female) were diagnosed with an eating disorder, respectively. In regression models adjusted for demographic variables, military service, and psychiatric comorbidities, the presence of an eating disorder diagnosis was nearly two times higher among those with a positive screen for MST in the 1-year (adjusted odds ratio [AOR] = 1.94, 95% confidence interval [CI] = 1.57–2.40) and 5-year (AOR = 1.86, 95%CI = 1.49–2.32) cohorts. The increased likelihood conferred by MST for an eating disorder diagnosis was differentially stronger among male veterans than female veterans in the 1-year cohort only (AOR = 2.13, 95%CI = 1.01–4.50).

**Discussion:** Veterans with a positive screen for MST, especially male veterans, had a nearly two-fold increased likelihood of having an eating disorder diagnosis. Screening for eating disorders may be important in both male and female veterans who report MST.

## KEYWORDS

Department of Veterans Affairs, eating disorders, Military Sexual Trauma, veterans

## 1 | INTRODUCTION

According to United States (U.S.) Department of Veterans Affairs (VA) screening data, 25% of female and 1% of male veterans report military sexual trauma (Department of Veterans Affairs, 2016). MST is defined as “psychological trauma, which in the judgment of a mental health professional employed by the Department, resulted 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” (Veterans Benefits, 2011). A recent non-VA study of MST in 494 partnered female service members/veterans revealed that 80% of females screened positive for MST. Of the 157 who reported a prior screening for MST, 26% of those indicated that they declined to disclose their true MST status during screening (Blais, Brignone, Galbreath, Fargo, & Gundlapalli, 2016). Similarly, Department of Defense (DoD) data shows that 15% of female and 30% of male service members did not disclose their sexual harassment/assault during military service (Morral et al., 2016), suggesting that MST is an even larger public health concern than initially considered.

Veterans who screen positive for MST are at differentially greater risk for adverse sequelae such as PTSD, depression, substance misuse and homelessness relative to veterans who screen negative for MST (Brignone et al., 2016; Haskell et al., 2010). Risk for distress secondary to MST varies between males and females. Indeed, a positive screen for MST in males is more strongly associated with suicidal intentions and plans, PTSD, poorer perceived physical health, and homelessness relative to females with a positive screen for MST (Brignone et al., 2016; Shipherd, Pineles, Gradus, & Resick, 2009).

The adverse sequelae of MST are also known correlates of eating disorders (Maguen et al., 2012a); however, studies of eating disorders in veteran samples are limited. A retrospective, cross-sectional analysis of national VA data on 593,739 veterans demonstrated that 0.007% of female and <0.001% of male veterans had a diagnosis of eating disorders, respectively (Maguen et al., 2012a). Such prevalence estimates of eating disorders are based on documented diagnoses within VA medical charts. Given the lack of routine screening for eating disorders among veterans, it is likely that such estimates under-represent this serious health concern. Though less frequently diagnosed relative to other mental health conditions in veterans, disordered eating prevalence estimates among service members and veterans are either comparable to or higher than those for the general population (Bartlett & Mitchell, 2015; Bodell, Forney, Keel, Gutierrez, & Joiner, 2014) or large college samples. Though the base rate of eating disorder diagnoses in VA-enrolled veterans is lower than the base rates of other psychiatric disorders such as PTSD, depression, or substance misuse, eating disorders pose a significant risk to veteran well-being. Eating disorders have high rates of mortality and morbidity as well as heightened risk for physical decline over time (Arce-lus, Mitchell, Wales, & Nielsen, 2011; Fichter & Quadflieg, 2016). Eating disorders are also difficult to treat and can be easily masked (Sullivan, 1995), resulting in increased distress and dysfunction over time.

Few studies have examined whether those with a history of MST had a greater likelihood of being diagnosed with eating disorders and

whether this relationship varied by sex. The available research showed an association between female sex, eating disorders, and MST in a large sample of VA-enrolled veterans, but this sample was limited to female veterans with comorbid PTSD (Maguen et al., 2012b). Another study of female veterans found that those who screened positive for MST and PTSD were more likely to be diagnosed with an eating disorder relative to those who screened negative for MST or did not have PTSD (Forman-Hoffman, Mengeling, Booth, Torner, & Sadler, 2012). However, a third study examining the risk for eating disorders among males and females with a positive screen for MST demonstrated that risk for eating disorders was roughly equivalent for both male and female veterans (Kimerling, Gima, Smith, Street, & Frayne, 2007).

Male veterans with a history of MST may be at heightened risk for eating disorders due to stressors secondary to masculinity and rape myth stereotypes (O'Brien & Sher, 2013). Given that rates of non-disclosure of MST are higher in males relative to females (O'Brien & Sher, 2013) and distressed male veterans are less likely to seek or receive mental health treatment (Maguen et al., 2012a), it is critical to examine possible sex differences in the association of MST with eating disorders.

Using a large, representative cohort of male and female veterans of Operations Enduring Freedom and Iraqi Freedom (OEF/OIF) that utilize VHA care, we examined whether veterans with a history of MST had a greater likelihood of having an eating disorder diagnosis. In particular, we sought to understand whether the likelihood remained after adjusting for related psychiatric diagnoses and varied between male and female veterans.

## 2 | METHODS

The current dataset was generated by combining demographic and military service data from the 2011 OEF/OIF roster file with VHA clinical data. The roster contained the following variables: age, education, race, marital status, branch of service, rank, and component (Active Duty, Reserve, National Guard) from service members who separated from the military between fiscal years (FY) 2001–2011. VHA clinical data was extracted from the Corporate Data Warehouse (CDW) for FY 2004–2014, and included inpatient and outpatient service use, MST screening results, and mental health diagnoses.

Two analytic cohorts with fixed-lengths of 1- and 5-years were constructed. The 1-year follow-up cohort was comprised of the 595,525 veterans who had at least 1 year of available clinical follow-up in the administrative data. Of these, 265,806 had a full 5 years of clinical follow-up available, qualifying them for inclusion in the 5-year cohort. For both cohorts, administrative follow-up began on the date of each veteran's first VHA encounter following last deployment, and ended after the specified length of follow-up for the given cohort. This two-cohort approach addresses the issue of variability in available follow-up length due to individual differences in the timing of first VA encounter. This approach also allows insights into the association of MST with eating disorders both during the early reintegration period and over a longer-term follow-up, which allows additional time for

symptom manifestation and documentation. Clinical diagnoses for each cohort were extracted from records of inpatient and outpatient encounters that took place within the range of follow-up the given cohort. Also included in each cohort were MST screening results recorded at any point over the entire administrative follow-up period, and demographic and military service characteristics. Veterans were included in a given cohort if their initial VHA encounter following last deployment occurred during the range of clinical follow up, and if they contributed data for the duration of the follow-up period. This study was approved by the Institutional Review Board at the University of Utah and the Research Review Committee of the VA Salt Lake City Health Care System.

### 2.1 | Military sexual trauma classification

To determine MST status, the VHA MST screener (Kimerling, Gima, Smith, Street, & Frayne, 2007) was used. The screener consists of two questions: "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?*" Response options include "Yes," "No," or "Decline" to either item. A positive screen for MST is determined if a veteran responds in the affirmative to either item. MST screening results are recorded as a single variable in VA administrative data; thus, items cannot be analyzed separately (Brignone et al., 2016). Cases with a response of "Decline" (<0.2%) were not included in the current sample. Generally, veterans are only screened for MST once. However, if a veteran had more than one screen on file, the most recent screen result was used. Veterans may have more than one screen on file if they opted to "decline" responding during their initial screening. In such cases, veterans are re-screened 1 year later. A veteran may also have duplicate screens on file if the screen status was updated to reflect a later disclosure of MST.

### 2.2 | Eating disorders and other mental health diagnoses

All mental health disorders were identified using ICD-9-CM codes retrieved from clinical data. Mental health disorders were assigned by licensed clinicians providing care to veterans. Veterans were classified as having an eating disorder if the following diagnoses were included in their clinical data: 307.51 (bulimia nervosa), 307.1 (anorexia nervosa), and 307.50 (eating disorder, unspecified). Mental health diagnoses (i.e., depressive disorders, alcohol-related disorders, substance-related disorders) were based on ICD-9-CM codes as defined by the Healthcare Utilization and Costs Project Clinical Classification Software (HCUP-CCS) (Agency for Healthcare Research and Quality, 2009). The PTSD variable was created using ICD-9-CM code 309.81. No ICD-9 codes representing personal history of eating disorders or mental health disorders were included. Thus, all diagnoses correspond to disorders that were active in the post-deployment period. Veterans with one or more

diagnostic code in a given category were considered positive for that diagnosis.

### 2.3 | Data analysis

Descriptive statistics were computed for all study variables for both cohorts, stratified by eating disorder status. Eating disorder subtype frequencies by gender were also calculated. Because of small cell sizes for eating disorder subtypes, statistical models were based on a dichotomous eating disorder variable with levels "no eating disorder diagnosis" and "eating disorder diagnosis." For each cohort, a logistic regression analysis was conducted in three steps. First, models were computed with eating disorders as the dependent variable, and the following independent variables: demographic and military service covariates (sex, age, education [high school only/beyond high school], marital status [married/never married/divorced or other], race [White/Black/Hispanic/other/unknown], branch of service [Army/Marines/Navy or Coast Guard/Air Force], rank [enlisted/Officer or Warrant], and military component [active duty/reserve/guard]) as well as presence of specific mental health diagnoses (PTSD, depressive disorders, alcohol-related disorders, and substance-related disorders). Covariates inclusion was based on related prior studies (Brignone et al., 2016; Maguen et al., 2012a,b). Second, models were computed with the addition of an independent variable for MST screen status in order to determine whether variation in eating disorders could be further explained by MST. Last, in order to determine whether the association between MST and eating disorders varied between males and females, a term for the interaction between MST screen status and sex was added to the model. Dummy coding was used for categorical independent variables.

Adjusted odds ratios (AOR) and their 95% confidence intervals (CI) were calculated for all models. All analyses were conducted using the R environment for statistical computing through the VA's secure Informatics and Computing Infrastructure research workspace.

## 3 | RESULTS

Three percent ( $n = 18,488$ ) screened positive for MST. In the 1-year cohort, 513 out of 595,012 veterans (0.09%) had a diagnosis of eating disorder. In the 5-year cohort, 504 out of 265,302 veterans (0.19%) had a diagnosis of eating disorder. Among those with an eating disorder diagnosis in the 5-year cohort, the initial eating disorder diagnosis was made after the first year of clinical follow-up for 52.4% ( $n = 264$ ) of veterans (58.3% [ $n = 197$ ] with a negative MST screen and 40.4% [ $n = 67$ ] with a positive MST screen).

Table 1 presents a summary of the demographic, military service, and diagnostic characteristics of each follow-up cohort, stratified by eating disorder status. In both the 1- and 5-year cohorts, there were statistically significant differences between veterans with and without eating disorder diagnoses with regard to demographic and military service characteristics. For both the 1- and 5-year follow-up periods, female veterans, those with never-married marital status, younger age, non-Black race/ethnicity, active duty service, service in the Navy/Coast Guard and the Air Force, and a positive screen for MST were more

**TABLE 1** Demographic, military service, and mental health diagnoses of OEF/OIF/OND veterans with and without a VHA-documented eating disorder diagnosis within 1 and 5 years of first VHA encounter

	Within 1 year (N = 595,525)		Within 5 years (N = 265,806)	
	No eating disorder; N = 595,012 (99.9%)	Eating disorder N = 513 (0.1%)	No eating disorder; N = 265,302 (99.8%)	Eating disorder; N = 504 (0.2%)
	N (%) or M (SD)			
MST	$\chi^2(1) = 1,843.1, p < .001$		$\chi^2(1) = 1,393.3, p < .001$	
No	576,709 (96.9%)	328 (63.9%)	256,764 (96.8%)	338 (67.1%)
Yes	18,303 (3.1%)	185 (36.1%)	8,538 (3.2%)	166 (32.9%)
Sex	$\chi^2(1) = 1,796.0, p < .001$		$\chi^2(1) = 1,490.0, p < .001$	
Female	72,973 (12.3%)	379 (73.9%)	33,986 (12.8%)	356 (70.6%)
Male	522,039 (87.7%)	134 (26.1%)	231,316 (87.2%)	148 (29.4%)
Race	$\chi^2(4) = 24.6, p < .001$		$\chi^2(4) = 21.6, p < .001$	
White	306,339 (51.5%)	283 (55.2%)	116,947 (44.1%)	225 (44.6%)
Black	67,683 (11.4%)	31 (6.0%)	28,671 (10.8%)	28 (5.6%)
Hispanic	64,252 (10.8%)	58 (11.3%)	29,471 (11.1%)	64 (12.7%)
Other	27,740 (4.7%)	39 (7.6%)	12,862 (4.8%)	38 (7.5%)
Unknown	128,998 (21.7%)	102 (19.9%)	77,351 (29.2%)	149 (29.6%)
Marital status	$\chi^2(2) = 40.0, p < .001$		$\chi^2(2) = 62.0, p < .001$	
Divorced/other	28,577 (4.8%)	22 (4.3%)	13,423 (5.1%)	19 (3.8%)
Married	254,115 (42.7%)	151 (29.4%)	116,716 (44.0%)	140 (27.8%)
Never married	312,320 (52.5%)	340 (66.3%)	135,163 (50.9%)	345 (68.5%)
Education	$\chi^2(1) = 0.3, p = .611$		$\chi^2(1) = 0.5, p = .476$	
High school	471,357 (80.2%)	411 (81.2%)	210,666 (80.4%)	409 (81.8%)
Beyond HS	116,187 (19.8%)	95 (18.8%)	51,244 (19.6%)	91 (18.2%)
Age	$t(513.7) = 11.6, p < .001$		$t(506.7) = 13.1, p < .001$	
	38.88 (9.5)	35.38 (6.8)	40.69 (9.5)	36.71 (6.9)
Component	$\chi^2(2) = 31.0, p < .001$		$\chi^2(2) = 48.9, p < .001$	
Active duty	340,914 (57.3%)	356 (69.4%)	152,865 (57.6%)	367 (72.8%)
Guard	162,266 (27.3%)	96 (18.7%)	69,731 (26.3%)	77 (15.3%)
Reserve	91,832 (15.4%)	61 (11.9%)	42,706 (16.1%)	60 (11.9%)
Branch of service	$\chi^2(3) = 65.5, p < .001$		$\chi^2(3) = 44.3, p < .001$	
Army	376,485 (63.3%)	270 (52.6%)	170,141 (64.1%)	282 (56.0%)
Navy/coast guard	75,831 (12.7%)	110 (21.4%)	32,002 (12.1%)	92 (18.3%)
Marines	84,048 (14.1%)	51 (9.9%)	38,055 (14.3%)	53 (10.5%)
Air force	58,648 (9.9%)	82 (16%)	25,104 (9.5%)	77 (15.3%)
Rank	$\chi^2(1) = 0.5, p = .475$		$\chi^2(1) = 0.0, p = 1.000$	
Enlisted	554,930 (93.3%)	483 (94.2%)	249,024 (93.9%)	473 (93.8%)
Officer/warrant	40,082 (6.7%)	30 (5.8%)	16,278 (6.1%)	31 (6.2%)
PTSD	$\chi^2(1) = 156.0, p < .001$		$\chi^2(1) = 120.2, p < .001$	
	158,219 (26.6%)	262 (51.1%)	114,472 (43.1%)	340 (67.5%)

(Continues)

TABLE 1 (Continued)

	Within 1 year (N = 595,525)		Within 5 years (N = 265,806)	
	No eating disorder; N = 595,012 (99.9%)	Eating disorder N = 513 (0.1%)	No eating disorder; N = 265,302 (99.8%)	Eating disorder; N = 504 (0.2%)
Depressive disorder	$\chi^2(1) = 890.2, p < .001$		$\chi^2(1) = 452.7, p < .001$	
	131,125 (22.0%)	394 (76.8%)	104,180 (39.3%)	432 (85.7%)
Alcohol-related disorder	$\chi^2(1) = 180.6, p < .001$		$\chi^2(1) = 77.4, p < .001$	
	56,149 (9.4%)	138 (26.9%)	46,875 (17.7%)	165 (32.7%)
Substance-related disorder	$\chi^2(1) = 111.7, p < .001$		$\chi^2(1) = 104.8, p < .001$	
	27,776 (4.7%)	75 (14.6%)	27,847 (10.5%)	124 (24.6%)

Note. Cases in the 5-year cohort are also represented in the 1-year cohort. VHA = Veterans Health Administration; OEF/OIF/OND = Operations Enduring Freedom, Iraqi Freedom, and New Dawn; MST = Military Sexual Trauma; HS = High School; PTSD = Post-traumatic Stress Disorder.

likely to have an eating disorder diagnosis. Similarly, those with significantly higher rates of PTSD, depressive disorders, alcohol-related disorders, and substance-related disorders were more likely to be diagnosed with eating disorders. Table 2 presents the breakdown of eating disorder diagnosis subtypes stratified by MST status and sex. In both follow-up periods, male and female veterans with a positive screen for MST had higher rates of co-occurring eating disorder diagnoses.

Table 3 presents the results of all logistic regression analyses. Likelihood ratio tests revealed that the addition of MST screen status in step two models resulted in significantly better fit as compared to step one models for both the 1- and 5-year cohorts [1-year:  $\chi^2(1) = 42.2, p < .001$ ; 5-years:  $\chi^2(1) = 32.5, p < .001$ ]. While there was a statistically significant interaction between MST screen status and sex in the 1-year cohort, the addition of an interaction term in step three models did not result in significantly better overall model fit for either cohort as compared to step two models [1-year:  $\chi^2(1) = 3.27, p = .071$ ; 5-years:  $\chi^2(1) = 0.76, p = .382$ ]. Figure 1 illustrates the effect of MST screen status between males and females.

In the best-fitting step two models, those with a positive screen for MST had approximately double the adjusted odds for eating disorder diagnoses (1-year: AOR = 2.03, 95% CI = 1.64–2.50; 5-years: AOR = 1.90, 95% CI = 1.53–2.36). Those with depressive disorders

were 5.3 to 6.9 times more likely to have eating disorder diagnoses (1-year: AOR = 6.93, 95% CI = 5.52–8.70; 5-years: AOR = 5.34, 95% CI = 4.06–7.02). Those with remaining mental health diagnoses characteristics were at 1.3 to 2.2 times higher odds for being diagnosed with eating disorders: PTSD (1-year: AOR = 1.33, 95% CI = 1.09–1.62; 5-y: AOR = 1.51, 95% CI = 1.21–1.88); alcohol-related disorders (1-year: AOR = 2.24, 95% CI = 1.78–2.83; 5-years: AOR = 1.55, 95% CI = 1.24–1.95); and substance-related disorders (1-year: AOR = 1.57, 95% CI = 1.18–2.08; 5-years: AOR = 1.66, 95% CI = 1.31–2.12).

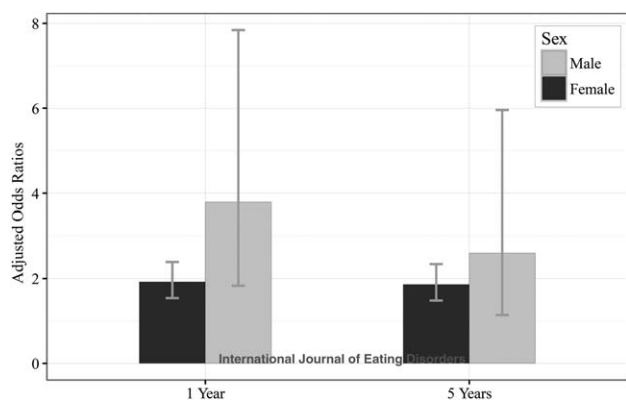
#### 4 | DISCUSSION

Military sexual trauma (MST) and eating disorders among veterans are understudied public health concerns and share many of the same psychiatric distress correlates including PTSD, depression, substance misuse, and homelessness (Brignone et al., 2016; Haskell et al., 2010; Hoerster et al., 2015; Maguen et al., 2012a). To our knowledge, this is the first study to examine whether those with a positive history of MST had a greater likelihood of eating disorder diagnoses after adjusting for related psychiatric diagnoses and whether these findings varied by sex. We demonstrated that a history of MST was associated with an increased likelihood of an eating disorder diagnosis. This increase was

TABLE 2 Eating disorder subtypes among veterans with a VHA-documented eating disorder diagnosis within 1 and 5 years of first VHA encounter

	1-year cohort				5-year cohort			
	Female		Male		Female		Male	
	MST+	MST–	MST+	MST–	MST+	MST–	MST+	MST–
Any eating disorder diagnosis	176 (100%)	203 (100%)	9 (100%)	125 (100%)	160 (100%)	196 (100%)	6 (100%)	142 (100%)
Eating disorder, not otherwise specified	70 (32.8%)	93 (45.8%)	2 (22.2%)	41 (32.8%)	52 (32.5%)	64 (32.7%)	2 (33.3%)	36 (25.4%)
Bulimia nervosa	63 (35.8%)	68 (33.5%)	4 (44.4%)	63 (50.4%)	53 (33.1%)	83 (42.3%)	2 (33.3%)	89 (62.7%)
Anorexia nervosa	6 (3.4%)	17 (8.4%)	1 (11.1%)	8 (6.4%)	7 (4.4%)	14 (7.1%)	1 (16.7%)	7 (4.9%)
Co-occurring eating disorder diagnoses	37 (21.0%)	25 (12.3%)	2 (22.2%)	13 (10.4%)	48 (30.0%)	35 (17.9%)	1 (16.7%)	10 (7.0%)

Note. Cases in the 5-year cohort are also represented in the 1-year cohort.



**FIGURE 1** Adjusted odds for VHA-documented eating disorder diagnosis as a function of MST status and sex among OEF/OIF/OND veterans within 1 and 5 years of first VHA encounter. Notes: Cases in the 5-year cohort are also represented in the 1-year cohort. VHA = veterans health administration. MST = military sexual trauma. OEF/OIF/OND = operations enduring freedom, Iraqi freedom, and New Dawn. Estimates are based on step 2 models re-estimated separately for males and female veterans

higher among male veterans in the 1-year cohort. The rate of eating disorders observed in the current sample was slightly lower than the rate observed in the National Comorbidity Survey (Hudson, Hiripi, Pope, & Kessler, 2007) and similar to rates observed in previous studies of military studies using VA administrative data (Maguen et al., 2012a). We demonstrated that a positive history of MST increased the likelihood for disordered eating diagnoses nearly twofold in both 1- and 5-year cohorts of VA-enrolled veterans. Moreover, this likelihood was particularly increased in male relative to female veterans. Finally, and consistent with prior research (Maguen et al., 2012a), eating disorder diagnoses were more likely in those with other psychiatric diagnoses including PTSD, depression, alcohol misuse, and drug use disorder.

Results from the current study extend the extant literature on MST and eating disorders in several key ways. Prior research on the relationship of MST and eating disorders, and whether this association varied by sex, was limited to veterans with comorbid PTSD diagnoses (Maguen et al., 2012a) or female veterans (Forman-Hoffman et al., 2012). Current findings show that a positive history of MST increases the likelihood of being diagnosed with eating disorders regardless of psychiatric comorbidities, including PTSD. Moreover, these results suggest that male veterans may be a particularly vulnerable group in the early period following military separation, as evidenced by the trend toward differentially greater likelihood for eating disorder diagnoses in male veterans with a history of MST relative to female veterans in the 1-year cohort. The documentation of first VA-diagnosed eating disorders beyond the initial year of service usage and the presence of a significant relationship between eating disorders and MST over both follow-up periods suggests that there may be delayed symptom experience or symptom disclosure among some veterans, leading to non-diagnosis during the early reintegration period. Thus, providers should continue to be sensitive to the differential likelihood for eating disorders among veterans with a positive screen for MST in the long term.

Findings from the current study are consistent with previous studies demonstrating a strong association of sexual trauma with eating disorders in nonveteran samples (Madowitz, Matheson, & Liang, 2015). Prior research in nonveteran samples shows that eating disorders can proceed or precede sexual trauma (Madowitz et al., 2015). Given the nature of our data, it is not clear whether eating disorders resulted from MST or vice versa. Additional data in veteran samples are needed to better understand the temporal precedence of eating disorders and MST. Better understanding this association would provide key information regarding critical intervention points aimed at improving the well-being of veterans.

Eating disorder diagnoses were highest among those serving in the Air Force, Navy, and Coast Guard, which contradicts prior research showing heightened rates of eating disorders in Marines compared to other branches of service (McNulty, 2001). The Navy recently adopted a revised set of fitness standards that allows for a greater diversity of body composition. Future studies should examine how changing fitness standards relate to disordered eating among the different service branches over time.

Recent research on sex differences related to the adverse sequelae of MST, when coupled with the current findings, show that male veterans are likely more vulnerable for psychiatric distress and dysfunction than initially thought. Indeed, in a large sample of VA-enrolled veterans who served in Afghanistan and Iraq found MST conferred a greater risk for homelessness 30-days and 1-year following initial VA encounter in male relative to female veterans (Brignone et al., 2016). Similarly, male veterans with a history of MST reported higher suicidal ideation and planning, PTSD, and poorer perceived physical health relative to female veterans (Bryan et al., 2015; Shipherd et al., 2009). The impact of eating disorders and MST on post-deployment functioning in male veterans remains poorly understood and our data suggests that additional research is needed.

Consistent with prior research (Maguen et al., 2012a), the presence of psychiatric comorbidities, including PTSD, depression, alcohol misuse, and drug use disorder increased the likelihood for eating disorders diagnoses relative to those without comorbidities. Given the high overlap between PTSD and depression with eating disorders observed in our study, PTSD and depression might also be considered clinical markers associated with eating disorders. As PTSD and depressive symptoms are part of routine mental health screenings in VA, clinicians have existing tools to help them identify veterans at risk for disordered eating behaviors. Improving our detection for disordered eating would involve further evaluation for those in these high-risk groups.

There are several limitations that should be acknowledged. The sample was restricted to users of VA care, which limits the generalizability of study findings. A positive history of MST is based on self-report and prior research shows that some veterans decline to disclose their true MST status (Blais et al., 2016; Monteith, Bahraini, Matarazzo, Soberay, & Smith, 2016). Because of the use of the MST screening tool as our indicator of a positive history of MST, we were unable to determine if variations in MST (e.g., inappropriate verbal remarks versus sexual assault) were uniquely associated with eating disorder diagnoses.

**TABLE 3** Results of logistic regression models for likelihood of VHA-documented eating disorder diagnoses among OEF/OIF/OND veterans within 1 and 5 years of first VHA encounter

	Within 1 year			Within 5 years		
	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3
Odds ratio (95% CI)						
MST* sex			2.13 (1.01, 4.5) <sup>a</sup>			1.49 (0.64, 3.48)
MST screen (Ref = Negative)		2.03 (1.64, 2.50) <sup>a</sup>	1.94 (1.57, 2.4) <sup>a</sup>		1.90 (1.53, 2.36) <sup>a</sup>	1.86 (1.49, 2.32) <sup>a</sup>
Demographic characteristics						
Sex (Ref = female)	0.04 (0.04, 0.05) <sup>a</sup>	0.06 (0.05, 0.07) <sup>a</sup>	0.06 (0.04, 0.07) <sup>a</sup>	0.05 (0.04, 0.07) <sup>a</sup>	0.07 (0.06, 0.09) <sup>a</sup>	0.07 (0.05, 0.09) <sup>a</sup>
Race (Ref = White)						
Black	0.27 (0.19, 0.40) <sup>a</sup>	0.28 (0.19, 0.42) <sup>a</sup>	0.28 (0.19, 0.42) <sup>a</sup>	0.31 (0.20, 0.46) <sup>a</sup>	0.32 (0.21, 0.48) <sup>a</sup>	0.32 (0.21, 0.48) <sup>a</sup>
Hispanic	0.83 (0.62, 1.11)	0.84 (0.63, 1.13)	0.84 (0.63, 1.13)	0.97 (0.73, 1.29)	0.98 (0.74, 1.31)	0.98 (0.73, 1.30)
Other	1.03 (0.73, 1.47)	1.03 (0.72, 1.46)	1.03 (0.72, 1.46)	0.98 (0.68, 1.43)	0.98 (0.67, 1.44)	0.98 (0.67, 1.43)
Unknown	0.72 (0.56, 0.92) <sup>a</sup>	0.72 (0.56, 0.93) <sup>a</sup>	0.72 (0.56, 0.92) <sup>a</sup>	0.74 (0.58, 0.93) <sup>a</sup>	0.74 (0.59, 0.94) <sup>a</sup>	0.74 (0.59, 0.94) <sup>a</sup>
Marital status (Ref = divorced/other)						
Married	1.33 (0.84, 2.11)	1.47 (0.89, 2.42)	1.36 (0.86, 2.14)	1.46 (0.89, 2.41)	1.47 (0.89, 2.42)	1.47 (0.89, 2.42)
Never married	1.68 (1.07, 2.66) <sup>a</sup>	1.99 (1.21, 3.29) <sup>a</sup>	1.72 (1.09, 2.72) <sup>a</sup>	1.97 (1.19, 3.25) <sup>a</sup>	1.99 (1.21, 3.29) <sup>a</sup>	1.99 (1.21, 3.29) <sup>a</sup>
Education (Ref = high school)						
Beyond high school	1.23 (0.93, 1.62)	1.24 (0.93, 1.65)	1.22 (0.92, 1.61)	1.25 (0.94, 1.67)	1.24 (0.93, 1.65)	1.24 (0.93, 1.65)
Age	0.97 (0.95, 0.98) <sup>a</sup>	0.97 (0.95, 0.98) <sup>a</sup>	0.97 (0.95, 0.98) <sup>a</sup>	0.97 (0.95, 0.98) <sup>a</sup>	0.97 (0.95, 0.98) <sup>a</sup>	0.97 (0.95, 0.98) <sup>a</sup>
Military service characteristics						
Component (Ref = active duty)						
Guard	0.92 (0.71, 1.19)	0.95 (0.73, 1.24)	0.95 (0.73, 1.24)	0.70 (0.53, 0.93) <sup>a</sup>	0.72 (0.54, 0.96) <sup>a</sup>	0.72 (0.54, 0.96) <sup>a</sup>
Reserve	0.77 (0.57, 1.03)	0.79 (0.59, 1.06)	0.79 (0.59, 1.06)	0.68 (0.50, 0.92) <sup>a</sup>	0.69 (0.51, 0.94) <sup>a</sup>	0.69 (0.51, 0.94) <sup>a</sup>
Branch of service (ref = army)						
Navy/coast guard	1.94 (1.51, 2.49) <sup>a</sup>	1.84 (1.43, 2.37) <sup>a</sup>	1.83 (1.43, 2.36) <sup>a</sup>	1.56 (1.20, 2.04) <sup>a</sup>	1.48 (1.14, 1.93) <sup>a</sup>	1.48 (1.14, 1.93) <sup>a</sup>
Marines	1.40 (1.02, 1.94) <sup>a</sup>	1.40 (1.02, 1.94) <sup>a</sup>	1.41 (1.02, 1.95) <sup>a</sup>	1.18 (0.87, 1.62)	1.19 (0.87, 1.63)	1.19 (0.87, 1.63)
Air force	1.74 (1.32, 2.28) <sup>a</sup>	1.70 (1.30, 2.23) <sup>a</sup>	1.70 (1.29, 2.23) <sup>a</sup>	1.59 (1.19, 2.13) <sup>a</sup>	1.57 (1.17, 2.10) <sup>a</sup>	1.57 (1.17, 2.10) <sup>a</sup>
Rank (ref = officer/warrant)						
Enlisted	1.14 (0.73, 1.79)	1.14 (0.73, 1.79)	1.14 (0.73, 1.79)	1.39 (0.89, 2.17)	1.41 (0.90, 2.21)	1.41 (0.90, 2.21)
Mental health diagnoses						
PTSD (ref = no)	1.50 (1.23, 1.83) <sup>a</sup>	1.33 (1.09, 1.62) <sup>a</sup>	1.33 (1.09, 1.63) <sup>a</sup>	1.72 (1.39, 2.13) <sup>a</sup>	1.51 (1.21, 1.88) <sup>a</sup>	1.51 (1.22, 1.88) <sup>a</sup>
Depressive disorder (ref = no)	7.31 (5.83, 9.17) <sup>a</sup>	6.93 (5.52, 8.70) <sup>a</sup>	6.92 (5.51, 8.69) <sup>a</sup>	5.52 (4.20, 7.25) <sup>a</sup>	5.34 (4.06, 7.02) <sup>a</sup>	5.33 (4.05, 7.01) <sup>a</sup>
Alcohol-related disorder (ref = no)	2.29 (1.81, 2.89) <sup>a</sup>	2.24 (1.78, 2.83) <sup>a</sup>	2.25 (1.78, 2.84) <sup>a</sup>	1.59 (1.26, 2.00) <sup>a</sup>	1.55 (1.24, 1.95) <sup>a</sup>	1.55 (1.24, 1.95) <sup>a</sup>
Substance-related disorder (ref = no)	1.61 (1.21, 2.14) <sup>a</sup>	1.57 (1.18, 2.08) <sup>a</sup>	1.56 (1.17, 2.07) <sup>a</sup>	1.71 (1.34, 2.18) <sup>a</sup>	1.66 (1.31, 2.12) <sup>a</sup>	1.66 (1.30, 2.12) <sup>a</sup>
Nagelkerke's R <sup>2</sup> (R <sup>2</sup> change)	.233	.238 .05	.239 .01	.215	.219 .04	.219 .00

Note. Cases in the 5-year cohort are also represented in the 1-year cohort. Step 1 models include predictors sex, race, marital status, education, age, component, branch of service, rank, PTSD, depressive disorders, alcohol-related disorders, and substance-related disorders. Step 2 models include the addition of a predictor for MST screen status. Step 3 models include the addition of predictors for MST screen status and the interaction between MST screen status and sex.

VHA = Veterans Health Administration. OEF/OIF/OND = Operations Enduring Freedom, Iraqi Freedom, and New Dawn. MST = Military Sexual Trauma. PTSD = Post-traumatic Stress Disorder.

<sup>a</sup>Indicates statistical significance,  $p < .05$ .

Several pre- and post-military experiences not included in this study may increase, or better explain, the increased likelihood for eating disorders. Eating disorder diagnoses were based on ICD-9 codes, which do not overlap completely with the Diagnostic and Statistical Manual for Mental Disorders—5th Edition (American Psychiatric Association, 2013). Because information relating to mental health status and other traumatic stressors during or prior to military service is unavailable, the causal role of MST in the development of eating disorders cannot be established. Similarly, it is not clear whether the PTSD diagnoses were a result of MST, other military or non-military exposures, or both. Because of low power, we were unable to determine if MST relates to specific eating disorders of anorexia nervosa, bulimia nervosa, or binge eating disorder. Individual variability in the time between discharge and first VHA visit could not be analyzed due to inconsistencies in discharge data documentation. As such, cohorts were selected based on availability of data from 1- and 5-years after initial VHA encounter. Finally, given that veterans in VA care are not routinely screened for eating problems as they are for more common mental health disorders, sole use of administrative data to denote eating disorder diagnoses may underestimate this important public health concern.

Psychiatrically distressed military veterans are at an increased risk for physical health problems (Maguen et al., 2015; Pietrzak & Cook, 2013) and pre-mature death (Bryan & Rudd, 2015), and are reticent to seek or receive adequate mental health care (Maguen et al., 2012a). Gaining a more comprehensive understanding of the association between two under-studied health concerns, MST and eating disorders, could inform the development of targeted eating disorder screening strategies, thereby improving early detection and allowing for the timely provision of appropriate treatment such as trauma-informed care. This may subsequently lower dysfunction secondary to eating disorders, including psychiatric and medical mortality and morbidity. In addition, a more comprehensive understanding of the association between MST and eating disorders, including their relationship to shared mental health diagnoses and potential variations by sex, will inform integrated treatment strategies for veterans with MST-related healthcare needs. Current findings suggest that screening for eating disorders in male and female veterans with a positive history of MST may help identify those at risk for disordered eating. Early detection and management of eating disorders will decrease the morbidity and mortality associated with eating disorders (Arcelus et al., 2011; Fichter & Quadflieg, 2016).

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## AUTHOR CONTRIBUTIONS

Dr. Blais, Ms. Brignone, Dr. Fargo, and Dr. Gundlapalli had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and

design: Blais, Brignone, Maguen, Fargo, Gundlapalli. Acquisition, analysis, or interpretation of data: Blais, Brignone, Carter, Fargo, Gundlapalli. Drafting of the manuscript: Blais, Brignone, Maguen, Carter, Fargo, Gundlapalli. Critical revision of the manuscript for important intellectual content: All authors. Statistical analysis: Brignone, Fargo. Obtaining funding: Gundlapalli. Administrative, technical, or material support: Carter, Gundlapalli. Study supervision: Gundlapalli.

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