

# UC San Diego

## UC San Diego Previously Published Works

### Title

Prevalence and Mental Health Correlates of Insomnia in First-Encounter Veterans with and without Military Sexual Trauma

### Permalink

<https://escholarship.org/uc/item/673319w8>

### Journal

Sleep, 38(10)

### ISSN

0161-8105

### Authors

Jenkins, Melissa M  
Colvonen, Peter J  
Norman, Sonya B  
[et al.](#)

### Publication Date

2015-10-01

### DOI

10.5665/sleep.5044

Peer reviewed

## INSOMNIA IN VETERANS WITH AND WITHOUT MILITARY SEXUAL TRAUMA

## Prevalence and Mental Health Correlates of Insomnia in First-Encounter Veterans with and without Military Sexual Trauma

Melissa M. Jenkins, PhD<sup>1,2</sup>; Peter J. Colvonen, PhD<sup>3,4</sup>; Sonya B. Norman, PhD<sup>1,2,3,4,5</sup>; Niloofar Afari, PhD<sup>1,3,4</sup>; Carolyn B. Allard<sup>1,3,4</sup>; Sean P.A. Drummond, PhD<sup>1,3,4,6</sup>

<sup>1</sup>Department of Psychiatry, University of California, San Diego, CA; <sup>2</sup>Research Service, VA San Diego Healthcare System, San Diego, CA; <sup>3</sup>Psychology Services, VA San Diego Healthcare System, San Diego, CA; <sup>4</sup>Center of Excellence for Stress and Mental Health (CESAMH), San Diego, CA; <sup>5</sup>National Center for PTSD, White River Junction, VT; <sup>6</sup>School of Psychological Sciences, Monash University, Clayton, VIC, Australia

**Study Objectives:** There is limited information about prevalence of insomnia in general populations of veterans of recent wars in Iraq and Afghanistan. No studies have examined insomnia in veterans with military sexual trauma (MST). We assess prevalence of insomnia, identify types of services sought by veterans with insomnia, and examine correlates of insomnia in veterans with and without MST.

**Design:** A cross-sectional study of first-encounter veterans registering to establish care.

**Setting:** Veteran Affairs San Diego Healthcare System.

**Participants:** Nine hundred seventeen veterans completed questionnaires assessing insomnia, MST, service needs, traumatic brain injury, resilience, and symptoms of depression, posttraumatic stress disorder (PTSD), pain, alcohol misuse, and hypomania.

**Interventions:** N/A.

**Measurements and Results:** 53.1% of veterans without MST and 60.8% of veterans with MST had clinically significant insomnia symptoms, with the MST subsample reporting more severe symptoms,  $P < 0.05$ . Insomnia was more prevalent than depression, hypomania, PTSD, and substance misuse. Veterans with insomnia were more likely to seek care for physical health problems and primary care versus mental health concerns,  $P < 0.001$ . For the veteran sample without MST, age, combat service, traumatic brain injury, pain, and depression were associated with worse insomnia,  $P < 0.001$ . For the MST subsample, employment status, pain, and depression were associated with worse insomnia,  $P < 0.001$ .

**Conclusions:** Study findings indicate a higher rate of insomnia in veterans compared to what has been found in the general population. Insomnia is more prevalent, and more severe, in veterans with military sexual trauma. Routine insomnia assessments and referrals to providers who can provide evidence-based treatment are crucial.

**Keywords:** insomnia, military sexual trauma, prevalence, veterans

**Citation:** Jenkins MM, Colvonen PJ, Norman SB, Afari N, Allard CB, Drummond SP. Prevalence and mental health correlates of insomnia in first-encounter veterans with and without military sexual trauma. *SLEEP* 2015;38(10):1547–1554.

## INTRODUCTION

Insomnia is a significant public health concern occurring in 10–15% of the US general population<sup>1</sup> with similar prevalence rates across several nations.<sup>2</sup> Insomnia symptoms include difficulty falling or staying asleep, early morning awakenings, sleep dissatisfaction, and distressed or impaired daytime functioning from sleep disturbance.<sup>3</sup> Individuals with insomnia report significantly lower quality of life,<sup>4</sup> are at greater risk for accidents,<sup>5</sup> and have high rates of psychiatric comorbidities.<sup>6,7</sup> Insomnia has been causally linked to a host of specific mental health issues, including depression, posttraumatic stress disorder (PTSD) and suicidality, and physical health problems such as hypertension, diabetes, and cardiac events.<sup>8–11</sup> Not surprisingly, then, insomnia carries substantial economic burden due to high healthcare costs and reduced work productivity.<sup>7</sup>

Proportionally, insomnia likely affects an even greater number of veterans than civilians. In active-duty military personnel, insomnia is one of the most common reasons for mental health referrals<sup>12</sup>; it is also a top complaint of recently deployed

veterans.<sup>13</sup> A recent review indicates insomnia is highly prevalent among service members deployed to combat (41%) and noncombat zones (25%).<sup>14,15</sup> Compared to civilians, veterans have higher rates of mental and physical health problems<sup>16</sup> commonly comorbid with insomnia.<sup>17</sup> Additionally, military personnel face increased risk of trauma and there is a well-established relationship between trauma and sleep disturbance (i.e., insomnia and distressing dreams).<sup>18</sup> Moreover, deployment can negatively affect sleep, independent of trauma, due to factors such as poor sleep environments and nighttime duties,<sup>19,20</sup> each of which can both initiate and maintain insomnia. Insomnia is a serious and realistic threat to veterans.

Despite large-scale studies reporting prevalence rates for insomnia in civilian populations, there is limited empirical information about the prevalence of insomnia among veterans, let alone veterans presenting to the Veterans Administration (VA) for the first time. Past research has focused on predominantly older, male veterans<sup>21</sup> and psychiatric populations.<sup>22</sup> These studies indicate 42% of older, male veterans in primary care and cardiology outpatient clinics are at high risk for insomnia (based on a three-item questionnaire),<sup>21</sup> and 94% of veterans returning from Iraq and Afghanistan with PTSD, traumatic brain injury (TBI), and pain endorse sleep disturbance, with PTSD and pain significantly contributing to their sleep difficulties.<sup>22</sup> Further, a study examining national administrative data on all individuals receiving veteran health care in 2010 found that only 3.4% of all 5,531,379 individuals receiving VA care had a diagnosis of insomnia.<sup>23</sup> This finding is surprising given

Submitted for publication November, 2014

Submitted in final revised form April, 2015

Accepted for publication April, 2015

Address correspondence to: Sean P.A. Drummond, PhD, Professor of Clinical Neuroscience, School of Psychological Sciences, Monash University, Clayton, Victoria, 3800, Australia; Email: sean.drummond@monash.edu

evidence pointing to substantially higher prevalence rates of insomnia among veterans than civilians, especially among veterans returning from Iraq and Afghanistan (e.g., 24–54% veterans who served in Operation Iraqi Freedom/Operation Enduring Freedom/Operation New Dawn endorsed sleep disturbance).<sup>13</sup> What is missing from the literature is a large-scale study examining insomnia prevalence in the general population of returning veterans from Iraq and Afghanistan, particularly research using standardized measures. More information on the prevalence of insomnia in this relatively young, diverse set of veterans would be useful for several reasons. Given their relatively young age, the negative health and economic effect of insomnia will compound over many years. Therefore, understanding the base rates of insomnia in this population, the demographic and clinical correlates of insomnia, and what services those with insomnia seek (e.g., medical, mental health) can assist agencies treating veterans to determine the resources needed to identify those with insomnia and provide access to evidence-based treatment.

Although relatively little is known about rates of insomnia in the general population of newer veterans, one well-studied area is insomnia in the context of PTSD.<sup>18</sup> However, information is limited largely to combat related PTSD. In contrast, there are no published papers discussing insomnia from another common source of trauma among veterans: military sexual trauma (MST), defined as severe or threatening sexual harassment and/or sexual assault encountered in military service. In contrast to sexual assault in other settings, veterans may experience more intense physical and mental health consequences as a result of MST due to unique attributes of military settings, including the likelihood perpetrators are other military personnel on whom victims may be dependent and with whom victims must continue living and working, and pressures related to unit cohesion (i.e., victims may be encouraged to remain silent about trauma).<sup>24</sup> Compared to civilian sexual trauma or other types of military trauma, MST is more likely to result in PTSD.<sup>25</sup> Although rates of insomnia in combat PTSD have been shown to be greater than those in the general population,<sup>26</sup> little is known about rates of insomnia among veterans with MST.

The aims of the current study are to: (1) examine the prevalence and distribution of insomnia severity scores in a broad population of first-encounter veterans and a subset of veterans who reported MST; (2) identify the services veterans with insomnia and veterans with insomnia plus MST seek upon registering for VA care; and (3) test multivariate models of clinical correlates of insomnia for veterans without MST and a subsample of veterans positive for MST. An exploratory aim is to examine potential differences between female and male veterans with MST.

## METHODS

### Participants and Procedures

The data used here were part of a larger study to screen newly enrolling Operation Iraqi Freedom/Operation Enduring Freedom/Operation New Dawn (OEF/OIF/OND) veterans registering for care at the VA San Diego Healthcare System (VASDHS) between March 2012 and August 2013. Iraq and

Afghanistan veterans who presented for enrollment into VA healthcare at the VASDHS Member Services offices at the main hospital facility were approached for a study to screen newly enrolling veterans for physical and mental healthcare needs. A total of 1,454 veterans who presented in person and consented to participate completed a battery of self-report instruments on a tablet. Analyses presented here focus on a subset of 917 veterans who were administered an insomnia questionnaire. Eight hundred forty-three veterans did not report a history of MST (hereafter, referred to as the MST negative subsample). Seventy-four of the 917 veterans (8%) reported a history of MST (hereafter, referred to as the MST positive subsample). The project was approved by the VASDHS Institutional Review Board and the Research and Development Committee.

### Assessment

Participants completed the Insomnia Severity Index (ISI), a widely used measure of insomnia with well-established reliability and validity.<sup>27</sup> The ISI consists of seven items, assessing severity of insomnia as well as satisfaction with sleep pattern, effect of sleep on daytime and social functioning, and concern about current sleep. A score of 10 or higher indicates insomnia in community samples (86% sensitivity; 88% specificity).<sup>27</sup> ISI total scores are classified into four severity categories: 0–9 (no insomnia); 10–14 (mild); 15–21 (moderate); and, 22–28 (severe).

To assess for MST, participants completed the VA Military Sexual Trauma Screen. This two-item screening instrument assesses uninvited or unwanted sexual attention and sexual contact against one's will. It has been validated against clinical interview assessments and individual items have demonstrated high sensitivity and specificity.<sup>28</sup>

Participants responded to several questions regarding their reason for coming to the VA and registering for care at the VASDHS, including physical health concerns, mental health concerns, establish primary care, and other. Participants were instructed to indicate all that apply.

Participants completed questionnaires assessing symptoms commonly found in veterans including the PTSD Checklist-Civilian Version (PCL-C), a 17-item self-report questionnaire assessing PTSD symptoms over the past month, using a four-point Likert scale ranging from 1 (not at all) to 5 (extremely).<sup>29</sup> Responses were summed for a total score. To assess depressive symptoms, participants completed the Patient Health Questionnaire-9 (PHQ-9),<sup>30</sup> a nine-item self-report questionnaire used for diagnostic and treatment monitoring purposes that has demonstrated adequate validity and reliability. Participants also completed the Mood Disorders Questionnaire (MDQ), a screening measure for lifetime history of hypomania and mania.<sup>31</sup> The Alcohol Use Disorders Identification Test-Consumption (AUDIT-C) was administered to assess for alcohol misuse.<sup>32</sup>

Additionally, participants completed the Veteran Traumatic Brain Injury Screening Tool (VATBIST), a brief screen for TBI that has demonstrated adequate psychometric properties.<sup>33</sup> The

VATBIST is a standard assessment given to all veterans enrolled in the VA Healthcare System nationwide and assesses history of TBI symptoms as well as concussive symptoms experienced within the past week. Participants completed the Patient-Reported Outcomes Measurement Information System

(PROMIS) Pain Intensity Short Form (PROMIS Pain Intensity SF),<sup>34</sup> a self-report questionnaire that asks respondents to rate the intensity of their pain on a five-point scale (no pain to very severe) at its average. Finally, participants completed the Connor-Davidson Resilience Scale: 10-item version (CD-RISC-10), a self-report questionnaire of one's perceived resilience.<sup>35</sup> It is a measure of stress-coping ability with higher scores indicating greater resilience. The CD-RISC-10 has demonstrated sound psychometric properties and differentiates between those with greater or lesser resilience.<sup>35</sup>

### Statistical Analyses

Data were screened to ensure quality and to check standard statistical assumptions. Missing data were excluded listwise. Analyses compared individuals with missing data to individuals with complete data to formally examine possible nonresponse biases. Every variable in Table 1 and 2 was examined. We found no systematic bias.

Descriptive statistics including means and frequencies were run for all study variables within the MST negative and MST positive subsamples. Insomnia severity was compared between veterans in the MST negative and positive subsamples. *T* tests and chi-square tests compared the MST negative and positive subsamples on clinical measures. Chi-square tests examined the frequency of insomnia severity scores between the two subsamples. Descriptive statistics assessed service needs leading veterans to enroll in the VA.

Bivariate and point biserial correlations examined the relationship between clinical variables and insomnia (the outcome variable), separately for the MST negative and MST positive subsamples. Next, subsequent multivariate models were run, using hierarchical linear regression. For the MST negative and positive subsamples, the first step in the model included static variables of age, relationship status, employment status, TBI, and combat service. Relationship status was defined as living with a partner versus not; employment status was defined as employed or full-time student versus not. The second step included clinical correlates of alcohol misuse, depression, pain intensity, mood and resilience. PTSD and depression symptom scores were multicollinear with correlations of 0.83 (MST negative sample) and 0.84 (MST positive subsample). Thus, regression models were run with either PTSD or depression, never together. Both PTSD and depressions models are presented.

**Table 1**—Demographics of first-encounter veterans with and without military sexual trauma.

Characteristic	MST Positive Sample (n = 74)	MST Negative Sample (n = 843)
Sex, male	23 (31)	748 (89)
Age, years	31.45 (8.4)	31.6 (8.1)
Combat service	45 (61)	530 (65)
Current relationship status		
Single	20 (27)	291 (35)
Married or civil union	22 (30)	364 (44)
Separated	13 (18)	49 (6)
Divorced	14 (19)	91 (11)
Cohabiting	5 (7)	40 (5)
Race/ethnicity		
Asian (Filipino, Japanese, Korean, Chinese, Vietnamese)	10 (14)	103 (13)
Native Hawaiian or Pacific Islander	1 (1)	17 (2)
Black/African American	16 (23)	124 (15)
White/Caucasian	40 (57)	479 (59)
Hispanic	14 (23)	191 (30)
American Indian or Alaskan Native	5 (7)	28 (3)
Other	1 (1)	29 (4)
Declined to answer	3 (6)	30 (5)
Highest level of education attained		
Some high school	2 (3)	10 (1)
High school diploma or GED	15 (21)	185 (22)
Some college	43 (59)	516 (62)
College graduate	8 (11)	95 (11)
Graduate school	5 (7)	30 (5)
Work status		
Not employed	59 (81)	618 (74)
Part-time (20 h/w or less)	6 (8)	63 (8)
Full-time (40 h/w)	8 (11)	153 (18)
Primary source of income		
None	16 (22)	139 (17)
Work	9 (12)	199 (24)
Unemployment	22 (30)	232 (28)
Disability	14 (19)	99 (12)
GI Bill	19 (26)	267 (32)
Other	14 (19)	117 (14)

Values presented as n (%) with the exception of age which is presented as mean (standard deviation).

### RESULTS

Table 1 provides a detailed characterization of the MST negative and the MST positive subsamples. Table 2 provides mean scores on clinical measures as well as the percent of veterans screening positive for clinically significant symptoms of a clinical condition (e.g., PTSD, depression). Compared to veterans negative for MST, veterans positive for MST had significantly higher scores on measures of insomnia, depression, PTSD, and bipolar disorder, *P* < 0.05. Veterans negative for MST had significantly higher resiliency scores than veterans positive for MST, *P* < 0.05.

Exploratory analyses of potential differences between men and women with MST indicate men had significantly higher scores on measures of PTSD (men, mean = 50.9 ± 22.6;

women, mean = 37.02 ± 17.82; P = 0.006), depression (men, mean = 13.4 ± 8.8; women, mean = 8.2 ± 6.4; P = 0.02), alcohol misuse (men, mean = 5.3 ± 3.1; women, mean = 2.1 ± 1.8; P < 0.001), and bipolar disorder ( $\chi^2(1) = 6.9, P = 0.01$ ). There was not a significant difference between men and women on the ISI.

### Prevalence and Severity of Insomnia

In the MST negative subsample, 53.1% had ISI scores over the clinical cutoff, with 19.9% reporting mild, 23.6% moderate, and 9.6% severe insomnia. In the MST positive subsample, 60.8%

had ISI scores over the clinical cutoff, with 13.5% reporting mild, 28.4% moderate, and 18.9% severe insomnia. Figure 1 illustrates the percentage of veterans in each ISI category by the MST negative and the MST positive subsample. Veterans with MST showed lower rates of no and mild insomnia and higher rates of moderate and severe insomnia compared with those without a reported history of MST,  $\chi^2(3) = 8.6, P = 0.035$ .

### Services Veterans Seek when Registering for VA Care

Figure 2 shows the services veterans were seeking when enrolling in the VA, separated into three groups (e.g., no insomnia, insomnia, MST plus insomnia). Fifty-eight percent of the 495 veterans with insomnia report seeking VA care for physical health concerns, 58% establishing primary care, 41% mental health concerns, and 14% other. Relative to those veterans without insomnia (n = 424), veterans positive for insomnia (n = 495) are overrepresented in the categories of physical health concerns, mental health concerns, and establishing primary care,  $\chi^2(3) = 25.38, P < 0.001$ .

Of the 45 veterans with MST plus insomnia, 62% reported physical health concerns, 60% primary care, 41% mental health concerns, and 13% other. Relative to those veterans without insomnia (n = 424), veterans positive for insomnia plus MST (n = 45) are overrepresented in the categories of physical health concerns, mental health concerns, and establishing primary care,  $\chi^2(3) = 9.88, P = 0.02$ .

### Correlates of Insomnia

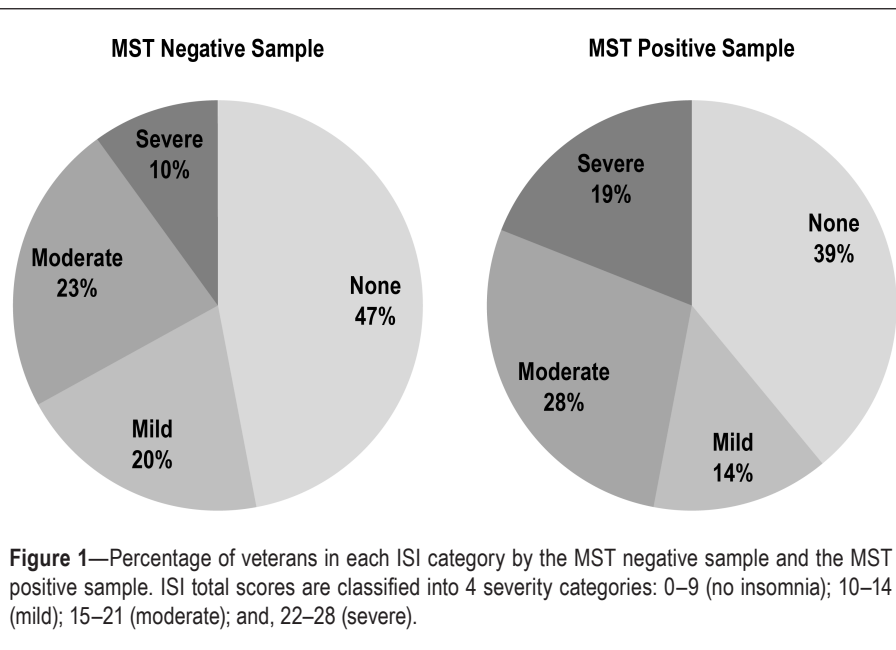
Table 3 provides the correlation coefficients between insomnia and the static and clinical correlates. Tables 4 and 5 provide regression results. Results of regression analyses indicate that for the MST negative subsample, static variables significantly accounted for 14% of the variance in insomnia severity scores. Addition of clinical correlates accounted for another 42% of the variance. Within the full model, age, TBI, combat, pain, and depression severity were significantly associated with insomnia severity, with all showing positive relationships with insomnia severity (Table 4).

For the MST positive subsample, static variables significantly accounted for 30% of the variance in insomnia severity scores. Clinical correlates accounted for another 33% of the variance. Within the full model, unemployment,

**Table 2**—Characteristics of first-encounter veterans with and without military sexual trauma.

Characteristic	MST Positive Sample (n = 74)	MST Negative Sample (n = 843)
Insomnia <sup>a</sup>	13.4 ± 8.1 (61)	10.8 ± 7.6 (53)
Military sexual trauma, n (%)	74 (100)	0 (0)
Male, n (%)	23 (31)	0 (0)
Depression <sup>a</sup>	9.9 ± 7.6 (37)	7.4 ± 6.6 (33)
PTSD <sup>a</sup>	41.4 ± 20.4 (32)	33.2 ± 16.9 (20)
Alcohol misuse	3.1 ± 2.7 (45)	3.5 ± 2.7 (46)
Pain intensity score	8.5 ± 2.6 (52)	7.9 ± 2.9 (45)
Traumatic brain injury, n (% positive)	21 (29)	181 (23)
(Hypo)mania screen, n (% positive) <sup>a</sup>	11 (16)	56 (7)
Resiliency score <sup>a</sup>	26.2 ± 8.8	28.7 ± 7.9

Values presented as mean ± standard deviation (% positive) unless otherwise indicated. <sup>a</sup>Indicates MST positive and MST negative groups have significantly different scores at P < 0.05. Criteria for each condition included insomnia, a score ≥ 10 on the Insomnia Severity Index; MST, a positive response to either uninvited or unwanted sexual attention or sexual contact against one's will on the VA Military Sexual Trauma Screen; depression, a score ≥ 10 on the Patient Health Questionnaire-9; PTSD, a score ≥ 50 on the PTSD Checklist-Civilian Version (PCL-C); alcohol misuse, a score ≥ 4 (male) and ≥ 3 (female) on the Alcohol Use Disorders Identification Test-Consumption; pain intensity, a score ≥ 9 on the Patient-Reported Outcomes Measurement Information System Pain Intensity Short Form; TBI, a positive screen on the Veteran Traumatic Brain Injury Screening Tool. A mood score was positive if indicated on results from the Mood Disorders Questionnaire.<sup>26</sup> MST, military sexual trauma; PTSD, posttraumatic stress disorder.





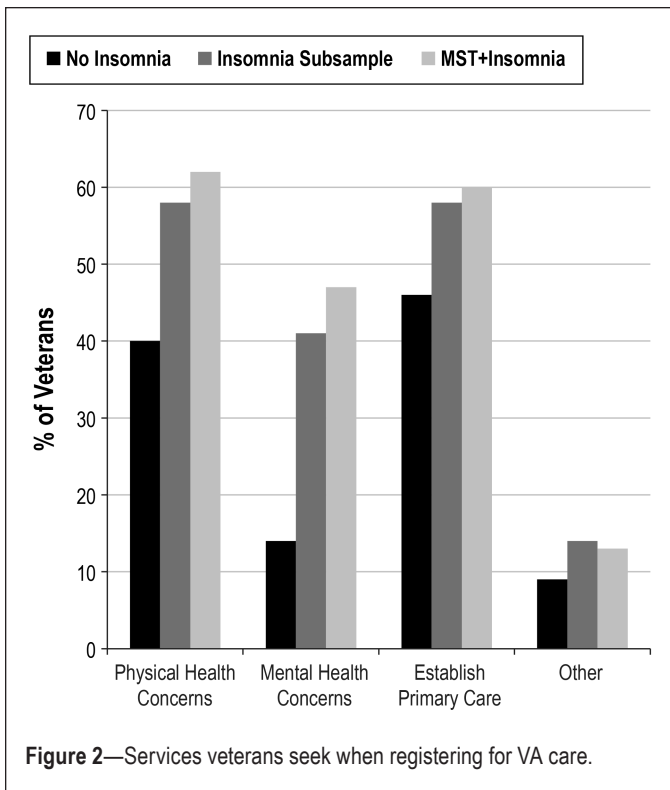


Figure 2—Services veterans seek when registering for VA care.

pain, and depression severity were uniquely associated with insomnia severity for the MST positive sample (Table 5).

## DISCUSSION

Insomnia was more prevalent than depression, hypomania, PTSD, and substance misuse in both the MST negative subsample and the MST positive subsample of veterans. More than half of all veterans had clinically significant insomnia symptoms at their initial encounter with the VA system, and nearly two thirds of veterans reporting a history of MST had ISI scores over the clinical cutoff. These rates are well above those found in the general population.<sup>1</sup> Moreover, veterans with MST had significantly more cases of moderate and severe insomnia, compared to those without a reported history of MST. Thus, a large proportion of veterans were above threshold for insomnia, and findings suggest veterans with MST may experience even worse insomnia. These findings empirically confirm previous suggestions that veterans are an especially vulnerable group when it comes to sleep disturbance.

In addition to a higher prevalence of insomnia and more severe insomnia symptoms, veterans reporting a history of MST endorsed more depression, PTSD, bipolar symptoms, and, at the same time, lower resilience than veterans without MST. Further, exploratory aims examining potential differences between male and female veterans with MST indicate males experience more depression, PTSD, alcohol misuse, and bipolar symptoms than females.

Veterans with clinically significant insomnia symptoms most frequently sought primary care and services for physical health. Only 41% of all veterans with insomnia and 47% of the MST plus insomnia subsample endorsed seeking mental health services. This finding is noteworthy for two reasons. First, empirically validated sleep measures are not routinely

Table 3—Bivariate and point biserial correlations for correlates of insomnia.

	MST Negative (n = 843)	MST Positive (n = 74)
Demographic variables		
Sex	-0.02	-0.09
Age	0.07	0.23 <sup>a</sup>
Relationship status	0.07 <sup>a</sup>	0.06
Employment status	-0.11 <sup>b</sup>	-0.32 <sup>b</sup>
Traumatic brain injury	0.33 <sup>b</sup>	0.39 <sup>b</sup>
Combat service	0.23 <sup>b</sup>	0.31 <sup>b</sup>
Clinical variables		
Alcohol misuse	0.12 <sup>b</sup>	0.23 <sup>a</sup>
Depression	0.71 <sup>b</sup>	0.71 <sup>b</sup>
Pain intensity score	0.44 <sup>b</sup>	0.58 <sup>b</sup>
Posttraumatic stress disorder	0.71 <sup>b</sup>	0.75 <sup>b</sup>
Mood	0.23 <sup>b</sup>	0.25 <sup>a</sup>
Resiliency	-0.38 <sup>b</sup>	-0.49 <sup>b</sup>

<sup>a</sup>P < 0.05. <sup>b</sup>P < 0.01.

administered outside of specialty sleep clinics in the VA healthcare system. This raises the possibility that insomnia may be underdiagnosed in veterans, a possibility reinforced by the high prevalence of insomnia found in the current study compared to research documenting that in 2010 only 3.4% of all 5,531,379 individuals receiving VA care had a diagnosis of insomnia.<sup>23</sup> Second, the setting in which veterans report insomnia problems will likely influence the type of sleep services provided (e.g., pharmacological versus behavioral). Primary care providers are most likely to provide pharmacological treatment for insomnia, rather than behavioral treatment.<sup>36</sup> In contrast, mental health providers are more likely to be trained in behavioral interventions for insomnia, especially in the Veterans Affairs system within the US where there is a national effort to train mental health providers in such interventions. The insomnia treatment literature indicates Cognitive Behavioral Therapy for Insomnia (CBT-I) is a first line treatment for insomnia.<sup>37,38</sup> The treatment is efficacious, individuals maintain therapeutic gains at long-term follow-up, and research indicates its superiority to pharmacotherapy in several randomized controlled trials.<sup>37,39</sup> In fact, there has been a large-scale national effort to train providers within the VA in CBT-I and the resultant data indicate strong treatment effects for CBT-I in veteran populations.<sup>40-43</sup> Given the large proportion of veterans we found with clinically significant insomnia symptoms, routine insomnia assessments and referrals to behavioral interventions for insomnia are crucial. Thus, these data may call for modifications to current practices for providers treating veterans, including increased education about the availability of efficacious behavioral interventions and even further dissemination of CBT-I in the VA.

Multivariate models examining clinical correlates of insomnia for the MST negative subsample and the MST positive subsample both produced large effect sizes. For the MST negative subsample, age, TBI, combat service, depression (or PTSD, in a separate model), and pain were significantly associated

**Table 4**—Hierarchical multiple regression analyses using insomnia severity index scores as the outcome variable for the military sexual trauma negative subsample of veterans.

Predictor	Including Depression (n = 683)			Including PTSD (n = 679)		
	$\Delta R^2$	$\beta$	P	$\Delta R^2$	$\beta$	P
Step 1	0.14		< 0.0001	0.15		< 0.0001
Age		0.10	0.01		0.09	0.02
Relationship status		0.07	0.08		0.07	0.05
Employment status		-0.11	0.00		-0.10	0.002
Traumatic brain injury		0.26	< 0.0001		0.27	< 0.0001
Combat service		0.15	< 0.0001		0.15	< 0.0001
Step 2	0.42		< 0.0001	0.40		< 0.0001
Age		0.07	0.01		0.07	0.01
Relationship status		0.01	0.68		0.01	0.66
Employment status		-0.03	0.22		-0.04	0.11
Traumatic brain injury		0.06	0.04		-0.01	0.70
Combat service		0.05	0.05		0.02	0.46
Pain score intensity		0.18	< 0.0001		0.19	< 0.0001
Alcohol misuse		0.02	0.42		0.05	0.06
Depression		0.62	< 0.0001		-	-
Trauma		-	-		0.62	< 0.0001
Mania/hypomania		0.01	0.73		-0.00	0.97
Resilience		0.03	0.40		-0.02	0.56
Total R <sup>2</sup>	0.56		< 0.0001	0.55		< 0.0001

Sample size differences due to missing data on individual measures. Given the multicollinearity of PTSD and depression symptoms scores, regression models were run with either depression or PTSD, not together. Results are provided for each model.  $\beta$ , standardized beta coefficient; PTSD, posttraumatic stress disorder.

**Table 5**—Hierarchical multiple regression analyses using insomnia severity index scores as the outcome variable for the military sexual trauma positive subsample of veterans.

Predictor	Including Depression (n = 64)			Including PTSD (n = 64)		
	$\Delta R^2$	$\beta$	P	$\Delta R^2$	$\beta$	P
Step 1	0.30		0.001	0.29		0.001
Age		0.10	.37		0.10	0.37
Relationship Status		0.24	0.04		0.19	0.10
Employment Status		-0.37	0.002		-0.34	0.005
Traumatic brain injury		0.19	0.12		0.20	0.09
Combat Service		0.23	0.05		0.25	0.04
Step 2	0.33		< 0.0001	0.37		< 0.0001
Age		0.09	0.34		0.13	0.11
Relationship Status		0.02	0.87		0.001	0.99
Employment Status		-0.19	0.05		-0.18	0.04
Traumatic brain injury		-0.06	0.54		-0.09	0.38
Combat Service		0.11	0.23		0.08	0.39
Pain Score Intensity		0.36	0.001		0.24	0.04
Alcohol Misuse		0.03	0.79		-0.00	0.96
Depression		0.33	0.03		-	-
Trauma		-	-		0.48	0.002
Mania/hypomania		-0.08	0.43		-0.08	0.40
Resilience		-0.18	0.14		-0.16	0.14
Total R <sup>2</sup>	0.63		< 0.0001	0.66		< 0.0001

Given the multicollinearity of PTSD and depression symptoms scores, regression models were run with either depression or PTSD, not together. Results are provided for each model.  $\beta$ , standardized beta coefficient; PTSD, posttraumatic stress disorder.

with insomnia severity. These findings are consistent with previous work on the relationship between insomnia and the “polytrauma clinic triad”<sup>22</sup> which found pain and PTSD significantly associated with sleep. Similarly, for the MST positive subsample, pain and depression (or PTSD, in separate model), were significantly associated with insomnia. For providers, this information can help develop a clinical profile of veterans at heightened risk of insomnia. Specifically, clinicians working with veterans reporting symptoms of pain, depression, and/or PTSD should routinely assess for insomnia and either incorporate, or refer veterans for, insomnia treatment as needed. This may be especially important for providers in clinics directly addressing MST sequelae.

Bidirectional relationships have been well established between insomnia and pain,<sup>36</sup> depression,<sup>45</sup> and PTSD.<sup>18</sup> However, treating those other disorders does not adequately treat insomnia, and sleep symptoms typically remain despite improvements in daytime clinical measures. This has led to recent research documenting the benefit of specifically treating insomnia in the context of pain, depression<sup>46</sup> or PTSD.<sup>47</sup> There are also those who argue treating insomnia first, or at the very least aggressively in conjunction with another treatment (e.g., before prolonged exposure for PTSD or in tandem with CBT for depression), could enhance clinical outcomes. Again, our findings should raise awareness among providers working with veterans of the need to thoroughly assess, and directly treat, insomnia.

Several limitations warrant comment. First, the cross-sectional study design precludes drawing conclusions about the relationship between insomnia and veterans’ demographic and clinical characteristics beyond associations. Second, veterans who do not establish VA care are not represented in this study. Thus, results are not generalizable to veterans who do not enroll in the VA. Third, veterans were identified as positive for a given condition based on their responses to self-report questionnaires. Although the study measures are well validated and have sound psychometric properties, in-person clinical interviews may have generated different results. Finally, the MST subsample was relatively small and predominantly male, limiting generalizability and statistical power. Furthermore, the prevalence of MST in the current sample is likely an underrepresentation of actual prevalence. Although assessment methods in the current sample (i.e., veterans used a tablet without providers present) resulted in greater proportions of veterans endorsing MST than more traditional screening methods, rates found here remain lower than those reported in studies with anonymous screening.<sup>48</sup> Nonetheless, compared to other published studies in the MST literature, especially those focused on male participants, the current sample is comparatively large.<sup>49</sup> Overall, this study likely represents the best estimate currently available of insomnia prevalence in a broad cross-section of veterans from the recent conflicts, and in veterans with MST.

In the civilian literature, insomnia has been recognized as a highly prevalent and impairing condition. Insomnia appears to affect an even greater number of veterans, and especially those with MST. Improving assessment and intervention efforts, therefore, has the potential to help a significant number of veterans improve their health and well being.

## DISCLOSURE STATEMENT

This was not an industry supported study. Dr. Drummond has received fees from Arena Pharmaceuticals and grants from Actelion Clinical Research, Inc., unrelated to this paper. The other authors have indicated no financial conflicts of interest. This material is based upon work supported by the Department of Veterans Affairs Center of Excellence for Stress and Mental Health (CESAMH) and the Veterans Affairs Center for Innovation. This material also is the result of work supported with resources of the VA San Diego Healthcare System. The views expressed in this paper are those of the authors and do not reflect the official policy or position of the Department of Veterans Affairs or any of the institutions with which the authors are affiliated. The funding source did not play a role in the study design, in the collection, analysis, and interpretation of data, in the writing of the manuscript, or in the decision to submit the paper for publication.

## REFERENCES

1. National Institutes of Health. National Institutes of Health State of the Science Conference statement on Manifestations and Management of Chronic Insomnia in Adults. *Sleep* 2005;28:1049–57.
2. Ohayon MM. Epidemiology of insomnia: what we know and what we still need to learn. *Sleep* 2002;6:97–111.
3. American Psychiatric Association. *Diagnostic and statistical manual of mental disorders*, 5th ed. Washington, DC: American Psychiatric Association, 2013.
4. LeBlanc M, Beaulieu-Bonneau S, Mérette C, Savard J, Ivers H, Morin CM. Psychological and health-related quality of life factors associated with insomnia in a population-based sample. *J Psychosom Res* 2007;63:157–66.
5. Léger D, Guilleminault C, Bader G, Lévy E, Paillard M. Medical and socio-professional impact of insomnia. *Sleep* 2002;25:625–9.
6. Ford DE, Kamerow DB. Epidemiologic study of sleep disturbances and psychiatric disorders: an opportunity for prevention? *JAMA* 1989;262:1479–84.
7. Morin CM, Jarrin DC. Epidemiology of insomnia: prevalence, course, risk factors, and public health burden. *Sleep Med Clin* 2013;8:281–97.
8. Bjørngaard JH, Bjerkeset O, Romundstad P, Gunnell D. Sleeping problems and suicide in 75,000 Norwegian adults: a 20 year follow-up of the HUNT I study. *Sleep* 2011;34:1155–9.
9. Ohayon MM, Roth T. Place of chronic insomnia in the course of depressive and anxiety disorders. *J Psychiatr Res* 2003;37:9–15.
10. Bryant RA, Creamer M, O’Donnell M, Silove D, McFarlane AC. Sleep disturbance immediately prior to trauma predicts subsequent psychiatric disorder. *Sleep* 2010;33:69–74.
11. Bernert RA, Turvey CL, Conwell Y, Joiner TE Jr. Association of poor subjective sleep quality with risk for death by suicide during a 10-year period: a longitudinal, population-based study of late life. *JAMA Psychiatry* 2014;71:1129–37.
12. Cozza S, Benedek D, Bradley J, Grieger T, Nam T, Waldrep D. Topics specific to the psychiatric treatment of military personnel. *Iraq War Clinician Guide* 2004;2:4–20.
13. Hoge CW, McGurk D, Thomas JL, Cox AL, Engel CC, Castro CA. Mild traumatic brain injury in US soldiers returning from Iraq. *N Engl J Med* 2008;358:453–63.
14. Bramoweth AD, Germain A. Deployment-related insomnia in military personnel and veterans. *Current Psychiatry Rep* 2013;15:1–8.
15. McLay RN, Klam WP, Volkert SL. Insomnia is the most commonly reported symptom and predicts other symptoms of post-traumatic stress disorder in US service members returning from military deployments. *Military Med* 2010;175:759–62.
16. Agha Z, Lofgren RP, VanRuiswyk JV, Layde PM. Are patients at Veterans Affairs medical centers sicker? A comparative analysis of health status and medical resource use. *Arch Intern Med* 2000;160:3252–7.
17. Hoge CW, Auchterlonie JL, Milliken CS. Mental health problems, use of mental health services, and attrition from military service after returning from deployment to Iraq or Afghanistan. *JAMA* 2006;295:1023–32.



18. Germain A, Buysse DJ, Nofzinger E. Sleep-specific mechanisms underlying posttraumatic stress disorder: integrative review and neurobiological hypotheses. *Sleep Med Rev* 2008;12:185–95.
19. Seelig AD, Jacobson IG, Smith B, et al. Sleep patterns before, during, and after deployment to Iraq and Afghanistan. *Sleep* 2010;33:1615–22.
20. Taylor MK, Hilton SM, Campbell JS, Beckerley SE, Shobe KK, Drummond SPA. Prevalence and mental health correlates of sleep disruption among military members serving in a combat zone. *Military Medicine* 2014;179:744–51.
21. Mustafa M, Erokwu N, Ebose I, Strohl K. Sleep problems and the risk for sleep disorders in an outpatient veteran population. *Sleep Breath* 2005;9:57–63.
22. Lew HL, Pogoda TK, Hsu P-T, et al. Impact of the “polytrauma clinical triad” on sleep disturbance in a department of veterans affairs outpatient rehabilitation setting. *Am J Phys Med Rehabil* 2010;89:437–45.
23. Hermes E, Rosenheck R. Prevalence, pharmacotherapy and clinical correlates of diagnosed insomnia among veterans health administration service users nationally. *Sleep Med* 2014;15:508–14.
24. Niebuhr RE. Sexual harassment in the military. In: O’Donohue W, ed. *Sexual harassment: theory, research, and treatment*. Needham Heights, MA: Allyn & Bacon, 1997:250–62.
25. Yaeger D, Himmelfarb N, Cammack A, Mintz J. DSM-IV diagnosed posttraumatic stress disorder in women veterans with and without military sexual trauma. *J Gen Intern Med* 2006;21:S65–9.
26. Neylan TC, Marmar CR, Metzler TJ, et al. Sleep disturbances in the Vietnam generation: findings from a nationally representative sample of male Vietnam veterans. *Am J Psychiatry* 1998;155:929–33.
27. Morin CM, Belleville G, Bélanger L, Ivers H. The insomnia severity index: psychometric indicators to detect insomnia cases and evaluate treatment response. *Sleep* 2011;34:601–8.
28. McIntyre LM, Butterfield MI, Nanda K, et al. Validation of a trauma questionnaire in veteran women. *J Gen Intern Med* 1999;14:186–9.
29. Weathers FW, Litz B, Huska J, Keane T. *PCL-C for DSM-IV*. Boston, MA: National Center for PTSD-Behavioral Sciences Division, 1994.
30. Kroenke K, Spitzer RL, Williams JB. The PHQ-9. *J Gen Intern Med* 2001;16:606–13.
31. Hirschfeld RM, Williams JB, Spitzer RL, et al. Development and validation of a screening instrument for bipolar spectrum disorder: the Mood Disorder Questionnaire. *Am J Psychiatry* 2000;157:1873–5.
32. Bradley KA, DeBenedetti AF, Volk RJ, Williams EC, Frank D, Kivlahan DR. AUDIT-C as a brief screen for alcohol misuse in primary care. *Alcohol Clin Exp Res* 2007;31:1208–17.
33. Donnelly KT, Donnelly JP, Dunnam M, et al. Reliability, sensitivity, and specificity of the VA traumatic brain injury screening tool. *J Head Trauma Rehabil* 2011;26:439–53.
34. Cella D, Riley W, Stone A, et al. The Patient-Reported Outcomes Measurement Information System (PROMIS) developed and tested its first wave of adult self-reported health outcome item banks: 2005-2008. *J Epidemiol* 2010;63:1179–94.
35. Connor KM, Davidson JR. Development of a new resilience scale: the Connor-Davidson resilience scale (CD-RISC). *Depress Anxiety* 2003;18:76–82.
36. Simon GE, VonKorff M. Prevalence, burden, and treatment of insomnia in primary care. *Am J Psychiatry* 1997;154:1417–23.
37. Morin CM, Vallières A, Guay B, et al. Cognitive behavioral therapy, singly and combined with medication, for persistent insomnia: a randomized controlled trial. *JAMA* 2009;301:2005–15.
38. Morin CM, Benca R. Chronic insomnia. *Lancet* 2012;379:1129–41.
39. Edinger JD, Wohlgenuth WK, Radtke RA, Marsh GR, Quillian RE. Cognitive behavioral therapy for treatment of chronic primary insomnia: a randomized controlled trial. *JAMA* 2001;285:1856–64.
40. Karlin BE, Trockel M, Taylor CB, Gimeno J, Manber R. National dissemination of cognitive behavioral therapy for insomnia in veterans: therapist-and patient-level outcomes. *J Consulting Clin Psychology* 2013;81:912.
41. Karlin BE, Trockel M, Spira AP, Taylor CB, Manber R. National evaluation of the effectiveness of cognitive behavioral therapy for insomnia among older versus younger veterans. *Int J Geriatr Psychiatry* 2015;30:308–15.
42. Manber R, Carney C, Edinger J, et al. Dissemination of CBTI to the non-sleep specialist: protocol development and training issues. *J Clin Sleep Med* 2012;8:209–18.
43. Trockel M, Karlin BE, Taylor CB, Manber R. Cognitive behavioral therapy for insomnia with veterans: evaluation of effectiveness and correlates of treatment outcomes. *Behav Res Ther* 2014;53:41–6.
44. Smith MT, Haythornthwaite JA. How do sleep disturbance and chronic pain inter-relate? Insights from the longitudinal and cognitive-behavioral clinical trials literature. *Sleep Med Rev* 2004;8:119–32.
45. Sivertsen B, Salo P, Mykletun A, et al. The bidirectional association between depression and insomnia: the HUNT study. *Psychosom Med* 2012;74:758–65.
46. Manber R, Bernert RA, Suh S, Nowakowski S, Siebern AT, Ong JC. CBT for insomnia in patients with high and low depressive symptom severity: adherence and clinical outcomes. *J Clin Sleep Med* 2011;7:645–52.
47. Margolies SO, Rybarczyk B, Vrana SR, Leszczyszyn DJ, Lynch J. Efficacy of a cognitive-behavioral treatment for insomnia and nightmares in Afghanistan and Iraq veterans with PTSD. *J Clin Psychol* 2013;69:1026–42.
48. Allard CB, Nunnink S, Gregory AM, Klest B, Platt M. Military sexual trauma research: a proposed agenda. *J Trauma Dissociation* 2011;12:324–45.
49. Suris A, Lind L. Military sexual trauma a review of prevalence and associated health consequences in veterans. *Trauma Violence Abuse* 2008;9:250–69.