The American Journal on Addictions, 28: 22–28, 2019

ISSN: 1055-0496 print / 1521-0391 online
DOI: 10.1111/ajad.12829

Drug Use and Hazardous Drinking Are Associated With PTSD Symptoms and Symptom Clusters in US Army Reserve/National Guard Soldiers

Gregory G. Homish, PhD,[1,2] Rachel A. Hoopsick, MS, MPH, CHES,[1] Sarah Cercone Heavey, PhD, MPH,[1] D. Lynn Homish, MS,[1] Jack R. Cornelius, MD, MPH[3]

[1]Department of Community Health and Health Behavior, State University of New York at Buffalo, 3435 Main Street, Buffalo 14214, New York
[2]Departments of Pediatrics and Family Medicine, State University of New York at Buffalo, 3435 Main Street, Buffalo 14214, New York
[3]Department of Psychiatry, University of Pittsburgh, 3811 O'Hara Street, Pittsburgh 15213, Pennsylvania

Background and Objectives: There is strong evidence of the association between Posttraumatic Stress Disorder (PTSD) symptoms and substance use. Previous work has found sex differences in these associations. With revisions to the DSM, it is important to understand how overall PTSD symptoms and the new symptom clusters relate to substance use among Reserve/Guard soldiers—a high risk group.
Methods: Data are from the baseline assessment of Operation: SAFETY (Soldiers and Families Excelling Through the Years), a longitudinal study of US Army Reserve/National Guard (USAR/NG) soldiers ($N = 389$ males, $N = 84$ females). We examined associations between current substance use (drug use, hazardous drinking, and smoking) and overall PTSD symptoms, and symptom clusters. Additionally, we examined PTSD by sex interactions.
Results: Greater overall PTSD symptoms were associated with higher odds of drug use (OR = 1.08; 95%CI: 1.05, 1.12) and hazardous drinking (OR = 1.04; 95%CI: 1.02, 1.07). Greater individual symptom cluster scores were associated with higher odds of drug use ($ps < .001$) and hazardous drinking ($ps < .01$). Interaction models revealed no differences in these associations on the basis sex ($ps > .05$). There were no associations between PTSD symptoms or symptom clusters on smoking ($ps > .05$).
Discussion and Conclusion: Soldiers experiencing PTSD symptoms are reporting current drug and hazardous alcohol use, suggestive of self-medication.
Scientific Significance: It is imperative to consider the impact of PTSD on substance use broadly, as this work shows that overall symptoms and symptom clusters have an impact on male and female USAR/NG soldiers. (Am J Addict 2019;28:22–28)

Received May 15, 2018; revised September 27, 2018; accepted November 17, 2018.
Address correspondence to Dr. Homish, PhD, Department of Community Health and Health Behavior, State University of New York at Buffalo, 325 Kimball Tower, 3435 Main Street, Buffalo, NY 14214. E-mail: ghomish@buffalo.edu

INTRODUCTION

Posttraumatic stress disorder (PTSD) is a prevalent and serious condition. Community sample estimates indicate that 4.7% have past-year PTSD while 6.1% have lifetime PTSD.[1] PTSD is associated with maladaptive health behaviors, including substance use.[2–4] PTSD is also associated with poor physical[5–7] and mental health.[7,8] Evidence suggests that even subthreshold PTSD symptomatology can produce significant distress and impairment.[9] PTSD is even more prevalent and persistent among military populations. Approximately 271,000 Vietnam Veterans currently have PTSD, 40 years after the conflict.[10] Soldiers who have served in current-era conflicts have PTSD estimates of 13.5% among all veterans and 15.8% among OEF/OIF veterans.[11] Further, it is estimated that approximately 25% of veterans[12] and 12% of current Guard soldiers experience subclinical PTSD symptomatology.[13] These symptoms have also been shown to be associated with poor physical[14] and mental health.[9]

The Reserve/Guard component represents a large portion of the US Military, comprising 42.5% of the forces.[15] During the post-deployment period, Reserve/Guard soldiers are more susceptible to mental health issues than active duty military personnel,[16] including exhibiting greater rates of new-onset PTSD.[17] Further, Reserve/Guard soldiers have greater prevalence of alcohol misuse, anger, depression, and post-deployment mental health conditions than active duty soldiers.[18–20] Reserve/Guard soldiers also experience additional stressors compared to active duty soldiers, including reduced unit support, financial difficulties, and family stress.[18,21,22] Given the important differences between the active duty and reserves, it is imperative to consider these groups individually[18–20]; however, much of the previous research on PTSD in the military has considered active duty and reserve/guard as one. Additional research is needed that

examines the role of PTSD in substance use among Reserve/Guard soldiers separately.

To date, most research examining PTSD has understandably used DSM-IV criteria. However, with the adoption of DSM-5, there are now a number of important changes that warrant new investigations into the relation between PTSD and substance use. With DSM-5, there are now four distinct symptom clusters within the diagnosis of PTSD. These include re-experiencing (Cluster B), avoidance (Cluster C), negative cognitions and mood (Cluster D), and hyperarousal (Cluster E).[23] The change to four clusters was the result of splitting avoidance/numbing into two distinct clusters. This may be particularly salient as substance use is often associated with avoidance coping. Previously, the combined cluster may have not been able to identify this distinction. Additionally, in DSM-5, the stressor criterion (Criterion A) is now more explicit and the subjective reaction (Criterion A2) has now been eliminated.

Not considering the dimensional aspects of PTSD as well as differential relations between the various clusters and negative outcomes can result in failing to identify important information. For example, Shea et al.[24] found higher overall PTSD symptom scores (not simply diagnosed versus not) were associated with reduced functioning and greater distress, suggesting that PTSD symptoms can have an impact, even if clinical diagnostic criteria are not met. Further, individual PTSD symptom clusters are associated with different outcomes. For example, Shea et al.[24] found that numbing/avoidance cluster symptoms were associated with decreased interpersonal and social functioning, while hyperarousal symptoms were associated with increased psychological symptom severity and distress. There are also important PTSD symptom cluster associations with substance use. For example, lifetime cigarette smoking has been associated with emotional numbing in a civilian sample.[25] In addition, alcohol misuse was associated with emotional numbing in a sample of Iraq/Afghanistan War Veterans.[26] Most research, however, is based on now outdated PTSD diagnostic criteria with only three symptom clusters.

There are important sex differences with PTSD. Women have a higher PTSD prevalence than men, potentially because women are more likely to experience types of traumatic events (eg, sexual trauma).[27] Our previous work with community samples has found specific clusters are associated with nonmedical opioid use and abuse, such that nonmedical opioid use and abuse was associated with the avoidance symptom cluster for women and the arousal symptom cluster for men.[28] Others have also found sex differences. For example, trauma exposure was more strongly associated with high-frequency binge drinking, low-frequency binge drinking, and non-binge drinking for women than men, and PTSD was more strongly associated with low-frequency binge drinking and non-binge drinking for women than men, as well.[29] However, both of these studies used data from civilian samples and findings may not generalize to the military. Further, military service members have unique stressors such as combat exposure and higher rates of exposure to traumatic experiences. Research by Scott et al.[30] demonstrated that PTSD symptoms were associated with hazardous alcohol use among female veterans, but not for male veterans. However, this study did not consider Reserve/Guard veterans separately from active duty veterans.

Using a subsample from Operation: SAFETY (Soldiers and Families Excelling Through the Years), a longitudinal study of the health and well-being of male and female US Army Reserve/National Guard Soldiers (USAR/NG) and their partners, we examine whether there is increased odds of current drug use, hazardous alcohol use, and smoking associated with overall PTSD symptoms as well as for each individual cluster (Cluster B, Re-experiencing; Cluster C, Avoidance; Cluster D, Negative Mood; Cluster E, Hyperarousal). We examine crude models, as well as models adjusted for the soldier's race, education, years of military service, history of deployment, anxiety, and depression. Additionally, we examine whether there are differences in these associations on the basis of soldier sex.

METHOD

Recruitment

Operation: SAFETY recruited US Army and National Guard (USAR/NG) soldiers and their partners over Summer 2014–Fall 2015, at military training drills throughout Western New York, US. At these drills, soldiers were given a 10-minute overview of the project, including project goals, study timeline (three surveys over 2 years), and confidentiality procedures. Couples were screened on six inclusion criteria: one member is a current USAR/NG soldier; married/living as if married; soldier's age is between 18 and 45; both partners have had at least one alcoholic beverage in the past year; both partners speak and understand English; and both partners are willing and able to participate. Recruitment identified 731 who were eligible for the study. Of those, 572 (78%) agreed to participate and 83% of couples ($N = 472$) completed some part of the survey (435 males and 440 females completed the entire survey). We conducted sensitivity analyses and found that couples where a civilian partner screened for the study ($n = 11$) were less likely to enroll ($p < .001$) than couples where a soldier screened for the study. This work examined only baseline soldier data which consisted of 389 male soldiers and 84 female soldiers. The protocol was approved by the University at Buffalo Institutional Review Board and vetted through the Army Human Research Protections Office, Office of the Chief, Army Reserve, as well as the Adjutant General of the National Guard.

Participants

Male soldiers and female soldiers had an average of 9.8 (SD: 6.1) and 7.5 (4.8) years of military service. The sample is mostly non-Hispanic White (79.4% male soldiers; 79.8% female soldiers) and had at least some college education

(57.1% male soldiers; 56.0% female soldiers) or a college degree (28.5% male soldiers; 39.3% female soldiers). More soldiers were married than cohabitating (62.5% male soldiers; 50.0% female soldiers). The median gross household income bracket for both male and female soldiers was $40,000 to $59,999. Male and female soldiers were 31.6 (6.6) and 29.4 (5.4) years of age, respectively.

Surveys were administered through a secure HIPAA-compliant, encrypted online survey programming software, StudyTrax™. Each participant received a $60 check for their time completing the first survey ($120 per couple). Baseline data are presented here.

Measures

Drug Use

The NIDA Modified ASSIST 2.0 assessed current drug use. The ASSIST was vigorously tested to ensure reliability and validity across settings and cultures.[31] The present work combined past 3 month use of any illicit (ie, cannabis, cocaine, methamphetamine, inhalants, hallucinogens, street opioids, other illicit drugs) and nonmedical drug use (ie, prescription stimulants, sedatives or sleeping pills, prescription pain medication, and other prescription drugs) into one dichotomous yes/no variable.

Hazardous Alcohol Use

Alcohol use over the past year was assessed with the AUDIT (Alcohol Use Disorders Identification Test),[32,33] a 10 item scale on a 4-point scale from 0 (*never*) to 4 (*daily or almost daily*) with scores ranging from 0 to 40 (alphas: .76 male soldiers; .80 female soldiers). It was dichotomized at a score of 8 to indicate hazardous alcohol use.[34]

Smoking

Current smoking (dichotomized yes/no) includes those participants who indicated smoking at least 100 cigarettes in their lifetime and who also reported currently smoking cigarettes.

PTSD

The PTSD Checklist, revised for DSM 5, is a 20-item measure used to assess symptoms of PTSD in the past month.[23] Each response is rated on a 5-point Likert-type scale from 0 (*not at all*) to 4 (*extremely*) with an overall range of 0–80; higher scores indicate greater severity (alphas: .95 males and females). Additionally, the scale assesses four symptom clusters. Re-experiencing the event consists of 5 items (0–20 points) covering memories, dreams, flashbacks, and physical reaction (sample alphas: .91 male soldiers; .92 female soldiers). Avoidance is made up of two items (0–8 points) for avoiding internal and external memories (alphas: .89 for males and females). Negative Mood comprises seven items (0–28 points) and examines dissociative amnesia, negative beliefs/feelings, blame, negative affect, detachment or estrangement and numbing (alphas: .91 males, .90 females). Lastly, Hyperarousal consists of six items (0–24) covering irritability/aggressive behavior, reckless behavior, hypervigilance, startle, concentration, and sleep (alphas: .86 male soldiers; .82 female soldiers).

Covariates

Given that more time involved in the military allows for a greater opportunity for exposure to trauma (and possibly resultant PTSD), a cumulative number of years served in all military branches was used as covariate in the regression models. Likewise, history of deployment (ever/never) was included in all final models. Race (coded white versus nonwhite) and education were also modeled as covariates. Race and education were selected based on a meta-analysis that showed that both race and education were related to PTSD in military samples.[35] This is in contrast to civilian samples which found these factors less important. In order to control for the potential effects of psychiatric disorders that are highly comorbid with PTSD and substance use disorders, anxiety and depression were also included as covariates in our full adjusted models. Anxiety was assessed with 10 items based upon the "emerging measures" from DSM-5 (alphas: .91 males, .90 females)[36] and depression was assessed with the Patient Health Questionnaire (PHQ-8) (alphas: .90 males, .91 females).[37] Both anxiety and depression were included as dichotomous covariates using a greater than moderate score as a cut point.

Analysis

Descriptive statistics were used to characterize the sample. Logistic regression models were used to examine the relation between total PTSD symptom scores and substance use (ie, drug use, hazardous alcohol use, and smoking). Individual PTSD symptom clusters were examined independently for drug use, hazardous alcohol use, and smoking. Adjusted models controlled for soldier's race, education, years of military service, history of deployment, anxiety, and depression. We used interaction models to examine for differences in these associations on the basis of soldier sex. Missing data were minimal and cases with missing data on any variable were omitted from the analyses.

RESULTS

Male and female soldiers' average PTSD symptom scores were 9.1 (SD: 11.8) and 10.3 (SD: 11.2), respectively. Among male soldiers, 5.4% met criteria for DSM-V PTSD and 9.5% of female soldiers met criteria for DSM-V PTSD.[23] The mean (SD) scores for male soldiers on each cluster were as follows: Re-experiencing the event 1.8 (3.0); Avoidance .8 (1.5); Negative Mood 2.9 (4.4); and Hyperarousal 3.6 (4.4). Among female soldiers, the mean (SD) scores for each cluster were as follows: Re-experiencing the event 2.0 (3.1); Avoidance 1.0

(1.5); Negative mood 3.8 (4.7); and Hyperarousal 3.4 (3.7). Current drug use was 6.2% for male soldiers and 8.3% for female soldiers. Hazardous alcohol use was 16.2% for male soldiers and 10.7% for female soldiers. Finally, 18.5% of male soldiers and 15.5% of female soldiers were current cigarette smokers.

Main Effects of Overall PTSD Score on Substance Use

Main Effects of Overall PTSD Score on Current Drug Use

Greater overall PTSD symptom scores were associated with higher odds of current drug use (OR = 1.08; 95%CI: 1.05, 1.12), controlling for the effects of race, education, years of military service, deployment history, anxiety, and depression (Table 1, Model 1A).

Main Effects of Overall PTSD Score on Current Hazardous Drinking

Greater overall PTSD symptom scores were also associated with higher odds of current hazardous drinking (1.04; 95%CI: 1.02, 1.07), adjusting for race, education, years of military service, deployment history, anxiety, and depression (Table 1, Model 1B).

Main Effects of Overall PTSD Score on Current Smoking

There was no significant association between overall PTSD symptom scores and current smoking (OR = 1.01, 95%CI: .99, 1.04; Table 1, Model 1C).

Main Effects of PTSD Symptom Clusters on Substance Use

Main Effects of PTSD Symptom Clusters on Current Drug Use

After controlling for race, education, years of military service, deployment history, anxiety, and depression, all of the following symptom clusters were each associated with higher odds of current drug use: re-experiencing symptoms (OR = 1.28; 95%CI: 1.14, 1.45; Table 1, Model 2A), avoidance symptoms (OR = 1.56; 95%CI: 1.26, 1.94; Table 1, Model 3A), negative mood symptoms (OR = 1.18, 95%CI: 1.09, 1.28; Table 1, Model 4A), and hyperarousal symptoms (OR = 1.18, 95%CI: 1.08, 1.28; Table 1, Model 5A).

Main Effects of PTSD Symptom Clusters on Current Hazardous Drinking

All of the following symptom clusters were associated with a higher odds of current hazardous drinking, controlling for the effects of race, education, years of military service, deployment history, anxiety, and depression: re-experiencing symptoms (OR = 1.13; 95%CI: 1.04, 1.23; Table 1, Model 2B), avoidance symptoms (OR = 1.31; 95% CI: 1.11, 1.55; Table 1, Model 3B), negative mood symptoms (OR = 1.07, 95%CI: 1.01, 1.14; Table 1, Model 4B), and hyperarousal symptoms (OR = 1.12, 95%CI: 1.05, 1.19; Table 1, Model 5B).

Main Effects of PTSD Symptom Clusters on Current Smoking

Re-experiencing symptoms (Table 1, Model 2C), avoidance symptoms (Table 1, Model 3C), negative mood symptoms (Table 1, Model 4C), and hyperarousal symptoms (Table 1, Model 5C) were not associated with current smoking (ps > .05).

Interaction Effects of Overall PTSD Score and Sex on Substance Use

Interaction Effects of Overall PTSD Score and Sex on Current Drug Use

There was no significant interaction between total PTSD symptom score and soldier sex on current drug use ($p > .05$; Table 2, Model 1A).

Interaction Effects of Overall PTSD Score and Sex on Current Hazardous Drinking

Likewise, there was no significant interaction between total PTSD symptom score and soldier sex on current hazardous drinking ($p > .05$; Table 2, Model 1B).

TABLE 1. Main effects of PTSD symptoms on current drug use, hazardous drinking, and smoking among US Army Reserve and National Guard Soldiers

	OR[a] [95%CI]					
	Current drug use		Current hazardous drinking		Current smoking	
Total PTSD score	Model 1A:	1.08*** [1.05, 1.12]	Model 1B:	1.04** [1.02, 1.07]	Model 1C:	1.01 [.99, 1.04]
Cluster B: re-experiencing	Model 2A:	1.28*** [1.14, 1.45]	Model 2B:	1.13** [1.04, 1.23]	Model 2C:	1.05 [.96, 1.15]
Cluster C: avoidance	Model 3A:	1.56*** [1.26, 1.94]	Model 3B:	1.31** [1.11, 1.55]	Model 3C:	1.08 [.90, 1.29]
Cluster D: negative mood	Model 4A:	1.18*** [1.09, 1.28]	Model 4B:	1.07* [1.01, 1.14]	Model 4C:	1.05 [.99, 1.11]
Cluster E: hyperarousal	Model 5A:	1.18*** [1.08, 1.28]	Model 5B:	1.12** [1.05, 1.19]	Model 5C:	1.01 [.95, 1.08]

[a]Adjusted for race, education, years of military service, deployment history, anxiety, and depression.
***$p < .001$.
**$p < .01$.
*$p < .05$.

TABLE 2. Interaction effects of PTSD symptoms and sex on current drug use, hazardous drinking, and smoking among US Army Reserve and National Guard Soldiers

		OR[a] [95%CI]			
		Current drug use		Current hazardous drinking	
Model 1	Total PTSD score X sex	Model 1A:	1.07 [.98, 1.17]	Model 1B:	1.01 [.95, 1.08]
Model 2	Cluster B: re-experiencing X sex	Model 2A:	1.04 [.80, 1.36]	Model 2B:	1.13 [.92, 1.39]
Model 3	Cluster C: avoidance X sex	Model 3A:	1.22 [.73, 2.02]	Model 3B:	1.31 [.85, 2.02]
Model 4	Cluster D: negative mood X sex	Model 4A:	1.15 [.94, 1.41]	Model 4B:	1.00 [.86, 1.17]
Model 5	Cluster E: hyperarousal X sex	Model 5A:	1.11 [.90, 1.36]	Model 5B:	.94 [.79, 1.12]

[a]Adjusted for race, education, years of military service, deployment history, anxiety, and depression.

Interaction Effects of PTSD Symptom Clusters and Sex on Substance Use

Interaction Effects of PTSD Symptom Clusters and Sex on Current Drug Use

There were no significant interactions between any of the PTSD symptom clusters and soldier sex on current drug use ($ps > .05$; Table 2, Models 2A–5A).

Interaction Effects of PTSD Symptom Clusters and Sex on Current Hazardous Drinking

There were also no significant interactions between any of the PTSD symptom clusters and soldier sex on current hazardous drinking ($ps > .05$; Table 2, Models 2B–5B).

DISCUSSION

These results indicate that greater overall PTSD symptoms and individual symptom cluster scores are associated with higher odds of current drug use and hazardous drinking among both male and female USAR/NG soldiers. Importantly, these findings are based on the updated DSM criteria for PTSD. However, there was no relation between PTSD symptoms and current smoking. This is a surprising finding in light of other work that has shown PTSD to be associated with smoking.[38] Despite the fact that the prevalence of current smoking in our sample is consistent with other, similar samples, it may be that these soldiers smoke fewer cigarettes per day than soldiers in other samples. For instance, none of the soldiers in this sample had "high addiction" according to the Heaviness of Smoking Index,[39] and the majority fell in the "low nicotine addiction" range (71% of males, 92% of females).

The hazardous alcohol use and drug use findings may be explained with the self-medication hypothesis, in which those with greater PTSD symptoms self-medicate with alcohol and drugs.[40,41] In addition, Dabbs et al.[42] found that among current service members, the odds of a prior diagnosis of PTSD were 28 times greater for service members with opioid abuse/dependency than for the non-substance using controls. This is important because as Jacobsen et al.[43] suggest, self-medication with alcohol, drugs, or even nicotine for PTSD symptoms may create a cycle perpetuating relapse and additional use. Thus, these findings may also be explained by substance use exacerbating PTSD symptoms.

These findings may also support the susceptibility hypothesis; PTSD symptoms and substance use may be caused by common factors for both conditions.[3] Our results indicate associations between PTSD and alcohol/drug use, but the cross-sectional nature of our data limits the ability to determine which condition precedes the other. It is possible that common factors such as genetics, may predispose participants to both PTSD symptomatology and substance use resulting in our findings. Although the prevalence of a positive PTSD diagnosis was relatively low among this sample, research suggests that nearly one in four veterans has subclinical PTSD.[12] Further, evidence suggests that subthreshold PTSD symptomatology may produce similar levels of distress and impairment as clinically diagnosed PTSD,[9] and may also contribute to poor physical functioning.[14]

We found that greater overall PTSD symptoms and individual symptom cluster scores are associated with higher odds of current drug use and hazardous drinking, and that this association did not vary on the basis of sex. These results are contrary to civilian work which found hyperarousal to correlate with male substance use and avoidance to correlate with female substance use.[4] Overall, our results did not find unique associations between alcohol or drug use and different PTSD clusters. However, avoidance symptoms had the strongest association with current drug use and hazardous drinking of the individual symptom clusters. Avoidance-oriented coping can often be considered adaptive in the context of combat deployment when traumatic responses must be suppressed in order to carry out a mission, but these strategies are often maladaptive outside of this context, and have been shown to contribute to greater risk of problematic substance use.[44]

This work should be understood within the context of its limitations. First, the data are cross-sectional and therefore present correlational effects rather than predictive relationships. Thus, it is possible that substance use is exacerbating

PTSD. It should also be acknowledged that the results of this study are small in effect size. However, the directionality and significance of the findings are consistent across all symptoms clusters and overall PTSD score. Another limitation was a relatively small number of women in this sample ($n = 84$, 17.8% of the sample). However, this is consistent with USAR/NG national estimates that show 15–19% of reserve soldiers are female.[15] Likewise, all study participants were either married or living as married at baseline, which may limit generalizability; however, the majority of U.S. service members are married.[45] Unlike other studies, our results indicate the associations between PTSD/symptom clusters and substance use do not differ on the basis of soldier sex. It is possible that common military experiences could ameliorate the sex differences seen in civilian work. For example, ethnographic research conducted by Vest[46] suggests that National Guard soldiers share a "citizen-soldier" identity and dual cultural belonging. Research by Griffith[47] also demonstrated that male and female reservists tend to share a strong social identity as a reserve soldier, which may transcend identities on the basis of sex. The "citizen-soldier" identity is unique to Ready Reserve components of the military and may explain why our findings differ from research involving active duty service members. Given the dynamic nature of the PTSD symptom clusters and the impact of time since exposure to a traumatic event, future research should examine the longitudinal relationship between PTSD clusters and substance use. Additional studies are also needed to examine the relationships between PTSD and substance use in other branches of the military to determine if these findings are unique to USAR/NG populations.

This work was supported by the National Institute on Drug Abuse of the National Institutes of Health R01DA034072 to GGH and the National Center for Advancing Translational Sciences of the National Institutes of Health under award number UL1TR001412 to the University at Buffalo. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

REFERENCES

1. Goldstein RB, Smith SM, Chou SP, et al. The epidemiology of DSM-5 posttraumatic stress disorder in the United States: Results from the National Epidemiologic Survey on Alcohol and Related Conditions-III. *Soc Psychiatry Psychiatr Epidemiol*. 2016;51:1137–1148.
2. Pietrzak RH, Goldstein RB, Southwick SM, et al. Prevalence and Axis I comorbidity of full and partial posttraumatic stress disorder in the United States: results from Wave 2 of the National Epidemiologic Survey on Alcohol and Related Conditions. *J Anxiety Disord*. 2011;25:456–465.
3. Brady KT, Back SE, Coffey SF. Substance abuse and posttraumatic stress disorder. *Curr Dir Psychol Sci*. 2004;13:206–209.
4. Smith KZ, Smith PH, Cercone SA, et al. Past year non-medical opioid use and abuse and PTSD diagnosis: Interactions with sex and associations with symptom clusters. *Addict Behav*. 2016;58:167–174.
5. Bruffaerts R, Vilagut G, Demyttenaere K, et al. Role of common mental and physical disorders in partial disability around the world. *Br J Psychiatry*. 2012;200:454–461.
6. Pietrzak RH, Goldstein RB, Southwick SM, et al. Medical comorbidity of full and partial posttraumatic stress disorder in US adults: Results from Wave 2 of the National Epidemiologic Survey on Alcohol and Related Conditions. *Psychosom Med*. 2011;73:697–707.
7. Sareen J, Cox BJ, Stein MB, et al. Physical and mental comorbidity, disability, and suicidal behavior associated with posttraumatic stress disorder in a large community sample. *Psychosom Med*. 2007;69: 242–248.
8. Gadermann AM, Alonso J, Vilagut G, et al. Comorbidity and disease burden in the National Comorbidity Survey Replication (NCS-R). *Depress Anxiety*. 2012;29:797–806.
9. Marshall RD, Olfson M, Hellman F, et al. Comorbidity, impairment, and suicidality in subthreshold PTSD. *Am J Psychiatry*. 2001;158:1467–1473.
10. Marmar CR, Schlenger W, Henn-Haase C, et al. Course of posttraumatic stress disorder 40 years after the Vietnam War: Findings from the National Vietnam Veterans Longitudinal Study. *JAMA Psychiatry*. 2015;72:875–881.
11. Dursa EK, Reinhard MJ, Barth SK, et al. Prevalence of a positive screen for PTSD among OEF/OIF and OEF/OIF-era veterans in a large population-based cohort. *J Trauma Stress*. 2014;27:542–549.
12. Steenkamp MM, Nickerson A, Maguen S, et al. Latent classes of PTSD symptoms in Vietnam veterans. *Behav Modif*. 2012;36:857–874.
13. Fink DS, Gradus JL, Keyes KM, et al. Subthreshold PTSD and PTSD in a prospective-longitudinal cohort of military personnel: Potential targets for preventive interventions. *Depress Anxiety*. 2018;35:1048–1055.
14. El-Gabalawy R, Blaney C, Tsai J, et al. Physical health conditions associated with full and subthreshold PTSD in U.S. military veterans: Results from the National Health and Resilience in Veterans Study. *J Affect Disord*. 2018;227:849–853.
15. Ryan MA, Smith TC, Smith B, et al. Millennium Cohort: Enrollment begins a 21-year contribution to understanding the impact of military service. *J Clin Epidemiol*. 2007;60:181–191.
16. Milliken CS, Auchterlonie JL, Hoge CW. Longitudinal assessment of mental health problems among active and reserve component soldiers returning from the Iraq War. *JAMA*. 2007;298:2141–2148.
17. Smith TC, Wingard DL, Ryan MA, et al. Prior assault and posttraumatic stress disorder after combat deployment. *Epidemiology*. 2008;19:505–512.
18. Griffith J. Citizens coping as soldiers: A review of deployment stress symptoms among reservists. *Military Psychol*. 2010;22:176–206.
19. Renshaw KD. Deployment experiences and postdeployment PTSD symptoms in National Guard/Reserve service members serving in operations Enduring Freedom and Iraqi Freedom. *J Trauma Stress*. 2010;23:815–818.
20. Riviere LA, Kendall-Robbins A, McGurk D, et al. Coming home may hurt: Risk factors for mental ill health in US reservists after deployment in Iraq. *Br J Psychiatry*. 2011;198:136–142.
21. Lapp CA, Taft LB, Tollefson T, et al. Stress and coping on the home front: Guard and reserve spouses searching for a new normal. *J Fam Nurs*. 2010;16:45–67.
22. Griffith J. Decades of transition for the US reserves: Changing demands on reserve identity and mental well-being. *Int Rev Psychiatry*. 2011;23:181–191.
23. Weathers F, Litz B, Keane T, *et al.* The PTSD Checklist for DSM-5 (PCL-5). 2013, Scale available from the National Center for PTSD at www.ptsd.va.gov
24. Shea MT, Vujanovic AA, Mansfield AK, et al. Posttraumatic stress disorder symptoms and functional impairment among OEF and OIF National Guard and Reserve veterans. *J Trauma Stress*. 2010;23:100–107.
25. Greenberg JB, Ameringer KJ, Trujillo MA, et al. Associations between posttraumatic stress disorder symptom clusters and cigarette smoking. *Psychol Addict Behav*. 2012;26:89–98.

26. Jakupcak M, Tull MT, McDermott MJ, et al. PTSD symptom clusters in relationship to alcohol misuse among Iraq and Afghanistan War Veterans seeking post-deployment VA health care. *Addict Behav*. 2010;35: 840–843.
27. Tolin DF, Foa EB. Sex differences in trauma and posttraumatic stress disorder: A quantitative review of 25 years of research. *Psychol Bull*. 2006;132:959–992.
28. Smith KZ, Smith PH, Violanti JM, et al. Posttraumatic stress disorder symptom clusters and perpetration of intimate partner violence: Findings from a U.S. nationally representative sample. *J Trauma Stress*. 2015;28 :469–474.
29. Kachadourian LK, Pilver CE, Potenza MN. Trauma, PTSD, and binge and hazardous drinking among women and men: Findings from a national study. *J Psychiatr Res*. 2014;55:35–43.
30. Scott JC, Pietrzak RH, Mattocks K, et al. Gender differences in the correlates of hazardous drinking among Iraq and Afghanistan veterans. *Drug Alcohol Depend*. 2013;127:15–22.
31. WHO Assist Working Group. The alcohol, smoking and substance involvement screening test (ASSIST): Development, reliability and feasibility. *Addiction*. 2002;97:1183–1194.
32. Babor TF, Del Boca FK. Just the facts: Enhancing measurement of alcohol consumption using self-report methods. In: Litten RZ, Allen JP, eds. *Measuring alcohol consumption: Psychosocial and biochemical methods*. pp. 3–20. Totowa, NJ: Humana Press; 1992.
33. Saunders J, Aasland O, Babor T, et al. Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption-II. *Addiction*. 1993;88:791–804.
34. Babor TF, Higgins-Biddle JC, Saunders JB, et al. *AUDIT: The Alcohol Use Disorders Identification Test: Guidelines for Use in Primary Care: Department of Mental Health and Substance Dependence*. Geneva Switzerland: World Health Organization; 2001.
35. Brewin CR, Andrews B, Valentine JD. Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *J Consult Clin Psychol*. 2000;68:748–766.
36. Craske M, Wittchen U, Bogels S, et al. *Severity Measure for Generalized Anxiety Disorder—Adult, in Diagnostic and Stastical Manual V*. American Psychiatric Association, Editor. Arlington, VA: American Psychiatric Publishing; 2013.
37. Kroenke K, Strine TW, Spitzer RL, et al. The PHQ-8 as a measure of current depression in the general population. *J Affect Disord*. 2009;114: 163–173.
38. Fu SS, McFall M, Saxon AJ, et al. Post-traumatic stress disorder and smoking: A systematic review. *Nicotine Tob Res*. 2007;9:1071–1084.
39. Kozlowski LT, Porter CQ, Orleans CT, et al. Predicting smoking cessation with self-reported measures of nicotine dependence: FTQ, FTND, and HSI. *Drug Alcohol Depend*. 1994;34:211–216.
40. Vujanovic AA, Bonn-Miller MO, Petry NM. Co-occurring posttraumatic stress and substance use: Emerging research on correlates, mechanisms, and treatments-Introduction to the special issue. *Psychol Addict Behav*. 2016;30:713–719.
41. Chilcoat HD, Breslau N. Investigations of causal pathways between PTSD and drug use disorders. *Addict Behav*. 1998;23:827–840.
42. Dabbs C, Watkins EY, Fink DS, et al. Opiate-related dependence/abuse and PTSD exposure among the active-component U.S. military, 2001 to 2008. *Mil Med*. 2014;179:885–890.
43. Jacobsen LK, Southwick SM, Kosten TR. Substance use disorders in patients with posttraumatic stress disorder: A review of the literature. *Am J Psychiatry*. 2001;158:1184–1190.
44. Norman SB, Schmied Larson EGE. Predictors of continued problem drinking and substance use following military discharge. *J Stud Alcohol Drugs*. 2014;75:556–557.
45. Department of Defense. *2015 Demographics Profile of the Military Community*. 2015 [cited 2017; Available from: http://download.militaryonesource.mil/12038/MOS/Reports/2015-Demographics-Report .pdf
46. Vest BM. Citizen, soldier, or citizen-soldier? Negotiating identity in the US National Guard. *Armed Forces Soc*. 2013;39:602–627.
47. Griffith J. Being a reserve soldier: A matter of social identity. *Armed Forces Soc*. 2009;36:38–64.