

# Posttraumatic Stress Disorder Symptom Association With Subsequent Risky and Problem Drinking Initiation

Kara M. Bensley, PhD, MSc, Amber D. Seelig, MPH, Richard F. Armenta, PhD, MPH, Anna C. Rivera, MPH, Arthur V. Peterson, PhD, Isabel G. Jacobson, MPH, Alyson J. Littman, PhD, Charles Maynard, PhD, Jonathan B. Bricker, PhD, Edward J. Boyko, MD, MPH, Rudolph P. Rull, PhD, MPH, and Emily C. Williams, PhD, MPH

**Objectives:** Posttraumatic stress disorder (PTSD) and unhealthy alcohol use are commonly associated conditions. It is unknown whether specific symptoms of PTSD are associated with subsequent initiation of unhealthy alcohol use.

**Methods:** Data from the first 3 enrollment panels ( $n = 151,567$ ) of the longitudinal Millennium Cohort Study of military personnel were analyzed (2001–2012). Complementary log-log models were fit to estimate whether specific PTSD symptoms and symptom clusters were associated with subsequent initiation of 2 domains of unhealthy alcohol use: risky and problem drinking (experience of 1 or more alcohol-related consequences). Models were adjusted for other PTSD symptoms and demographic, service, and health-related characteristics.

**Results:** Eligible study populations included those without risky ( $n = 31,026$ ) and problem drinking ( $n = 67,087$ ) at baseline. In adjusted analyses, only 1 PTSD symptom—irritability/anger—was

associated with subsequent increased initiation of risky drinking (relative risk [RR] 1.05, 95% confidence interval [CI] 1.00–1.09) at least 3 years later. Two symptom clusters (dysphoric arousal [RR 1.17, 95% CI 1.11–1.23] and emotional numbing [RR 1.30, 95% CI 1.22–1.40]) and 5 symptoms (restricted affect [RR 1.13, 95% CI 1.08–1.19], sense of foreshortened future [RR 1.12, 95% CI 1.06–1.18], exaggerated startle response [RR 1.07, 95% CI 1.01–1.13], sleep disturbance [RR 1.11, 95% CI 1.07–1.15], and irritability/anger [RR 1.12, 95% CI 1.07–1.17]) were associated with subsequent initiation of problem drinking.

**Conclusions:** Findings suggest that specific PTSD symptoms and symptom clusters are associated with subsequent initiation of unhealthy alcohol use.

**Key Words:** military, posttraumatic stress disorder, unhealthy alcohol use

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From the Seattle Epidemiologic Research and Information Center, Department of Veterans Affairs Puget Sound Health Care System, Seattle, WA (KMB, ADS, AJL, CCM, EJB); Henry M Jackson Foundation for the Advancement of Military Medicine, Inc., Bethesda, MD (RFA, ACR, IGI); Department of Epidemiology, University of Washington School of Public Health, Seattle, WA (AJL, EJB); Department of Health Services, University of Washington School of Public Health, Seattle, WA (KMB, CCM, ECW); Seattle-Denver Center of Innovation for Veteran-Centered and Value-Driven Care, Health Services Research and Development, Department of Veterans Affairs Puget Sound Health Care System, Seattle, WA (KMB, AJL, CCM, ECW); Public Health Sciences Division, Fred Hutchinson Cancer Research Center, Seattle, WA (AVP, JBB); Military Population Health Directorate, Naval Health Research Center, San Diego, CA (RPR); Department of Biostatistics, University of Washington School of Public Health, Seattle, WA (AVP); Department of Psychology, University of Washington, Seattle, WA (JBB); Department of Kinesiology, College of Education, Health and Human Services, California State University, San Marcos (RFA).

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Send correspondence to Kara M. Bensley, PhD, MSc, Department of Veterans Affairs Puget Sound Health Care System, 1660 South Columbian Way, S-152E, Seattle, WA 98108. E-mail: [kbensley@uw.edu](mailto:kbensley@uw.edu).

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Posttraumatic stress disorder (PTSD) and unhealthy alcohol use are commonly associated conditions (Jacobson et al., 2008; McDevitt-Murphy et al., 2010; Fuehrlein et al., 2014; Kline et al., 2014; Williams et al., 2015). While the association between PTSD and unhealthy alcohol use appears to be bidirectional (Haller and Chassin, 2014), most research supports the hypothesis that PTSD increases the risk of development of alcohol-related problems, as alcohol can be used to cope with PTSD symptoms (Jacobson et al., 2008; Jakupcak et al., 2010), and PTSD diagnoses often precede alcohol use disorder diagnoses (Kline et al., 2014).

Experiencing specific PTSD symptoms may differentially relate to unhealthy alcohol use. While PTSD is a single diagnosis, it is in actuality a composite of symptoms that can together indicate PTSD, but also commonly occur outside of the context of PTSD. In the *Diagnostic and Statistical Manual of Mental Disorders*, 4th Edition (DSM-IV), 17 symptoms are included as components of PTSD: they are compiled into 3 symptom clusters in DSM-IV and 4 in DSM-5 (which includes additional symptoms). Individuals experiencing at least 6 symptoms meeting minimum scoring criteria across specific symptom clusters are considered to have PTSD in both the DSM-IV and DSM-5.

Understanding which symptoms and/or clusters of symptoms of PTSD are associated with subsequent initiation of unhealthy alcohol use may be informative for prevention efforts, particularly among persons who experience symptoms associated with PTSD, but have not necessarily been diagnosed with PTSD. A previous cross-sectional study identified associations between some symptom clusters (eg, emotional numbing) and unhealthy alcohol use (Jakupcak et al., 2010). However, whether certain clusters are associated with subsequent initiation of unhealthy alcohol use has not been studied. Moreover, the association between individual PTSD symptoms and unhealthy alcohol use has not been previously studied either cross-sectionally or longitudinally. The present study uses data from a large longitudinal survey of military personnel to assess whether individual PTSD symptoms and symptom clusters are associated with subsequent initiation of unhealthy alcohol use.

## METHODS

### Data Source and Sample

The study used data from the longitudinal Millennium Cohort Study, which began in 2001 and examines the health effects of military service. Recruitment of participants occurred in 4 enrollment phases approximately every 3 years (2001–2003, 2004–2006, 2007–2008, and 2011–2012). The initial enrollment phase (2001–2003) sampled from all current service members. Subsequent enrollments aimed to enroll new service members who had joined the service after initiation of the Millennium Cohort Study. As such, the second enrollment (2004–2006) invited those with 1 to 3 years of service, and the third enrollment (2007–2008) invited those with 1 to 2 years of service. All enrolled participants were invited to complete follow-up surveys every 3 years. Detailed descriptions of the Millennium Cohort methodology have been published elsewhere (Gray et al., 2002; Ryan et al.,

2007; Jacobson et al., 2008; Smith, 2009). This study was approved by Institutional Review Boards at the Naval Health Research Center and Department of Veterans Affairs Puget Sound Health Care System; all participants provided their written, informed consent.

The present study included Millennium Cohort participants who: completed a baseline questionnaire during 1 of the first 3 enrollment cycles (2001–2003, 2004–2006, 2007–2008; combined N=151,567); had at least 1 follow-up questionnaire 3 years after the baseline survey; and met the eligibility criteria for this study—no unhealthy alcohol use (defined in the following) at baseline.

Two study subsamples were identified in order to assess associations between PTSD symptoms and clusters, and 2 different dimensions of subsequent unhealthy alcohol use. These included those who, at baseline, met eligibility criterion for no “risky drinking” (defined below) (n = 31,026; 25% of study sample) or no “problem drinking” (defined below) (n = 67,087; 44.3% of study sample). Each sample was followed until initiation of the dimension that was absent at baseline (eg, those without risky drinking at baseline were followed to assess initiation of risky drinking), until they were missing data for outcomes or covariates of interest, or until end of the observation period (2011–2012 cycle).

### Predictors

Predictors of interest were individual PTSD symptoms and PTSD symptom clusters, both of which were measured using the PTSD Checklist—Civilian Version (PCL-C). The PCL-C comprises 17 items that measure all symptoms associated with PTSD in the DSM-IV (Blanchard et al., 1996; Dobie et al., 2002; Smith et al., 1999) resulting in a score of 17 to 85. Participants rated how much they experienced each symptom using a Likert-type item based on experience of symptoms in the last month (1 = not at all, 2 = a little bit, 3 = moderately, 4 = quite a bit, 5 = extremely). Participants who endorsed a 3 or higher for a symptom were considered to have that symptom (McLay et al., 2010; Pigeon et al., 2013; Selaman et al., 2014). Consistent with most recent studies (Harpaz-Rotem et al., 2014; Trautmann et al., 2015), 5 PTSD symptom clusters were examined: *re-experiencing* (intrusive thoughts, recurrent dreams, flashbacks, emotional reactivity, and physiological reactivity); *avoidance* (avoiding thoughts of trauma and avoiding reminders of trauma); *emotional numbing* (includes inability to recall aspects of trauma, loss of interest, detachment, restricted affect, and sense of foreshortened future); *dysphoric arousal* (sleep disturbance, irritability/anger, and difficulties concentrating); and *anxious arousal* (hypervigilance and exaggerated startle response). See Appendix A for further definition of PTSD symptoms (<http://links.lww.com/JAM/A89>). Because these clusters have a different number of symptoms, ratings comprising each cluster were averaged to compute cluster scores, a method used in a similar study (Trautmann et al., 2015).

### Outcomes

Outcomes included 2 dimensions of unhealthy alcohol use that captured different, but related aspects of unhealthy alcohol use (Rubinsky et al., 2013). Risky drinking was defined as weekly drinking over recommended sex-specific

limits: greater than 14 drinks per week or 5 drinks per occasion for men; greater than 7 drinks per week or 4 drinks per occasion for women (National Institute of Alcohol and Alcoholism, 2015). Problem drinking was measured by positive endorsement of at least 1 item from the 5-item Patient Health Questionnaire (PHQ) alcohol use subscale, indicating whether or not participants used alcohol even though a doctor suggested they stop drinking because of a problem with their health; drank alcohol, were high from alcohol, or were hungover while working, going to school, taking care of children, or other responsibilities; missed or were late for work, school, or other activities because they were drinking or hung over; had a problem getting along with people while drinking; or drove a car after having several drinks or drinking too much. This measure of problem drinking was similar to that used in prior studies (Jacobson et al., 2008; Jakupcak et al., 2010; Williams et al., 2015), and refers to the range from experiencing a single consequence to more. The problems assessed are similar to those that comprise diagnostic criteria for alcohol use disorders, but do not assess all criteria (Dawson et al., 2013). Thus, persons meeting criteria for problem drinking in this study may include those who have an alcohol use disorder. However, this measure has not been validated for this purpose and not all persons meeting criteria for problem drinking may meet criteria for alcohol use disorder.

## Covariates

Several factors may confound the association between PTSD symptoms and initiation of unhealthy alcohol use (Jacobson et al., 2008; Jakupcak et al., 2010; McDevitt-Murphy et al., 2010; Fuehrlein et al., 2014; Kline et al., 2014). These include demographic (age, sex, race/ethnicity, education, and marital status), service-related (pay grade, service branch, occupation, service component, combat deployment during follow-up, deployment before enrollment, and separation from military service), and health-related (physical component summary score based on the Medical Outcomes Study Short Form 36-Item Health Survey for Veterans, experience of life stressors, panic or anxiety disorder and depression identified using the PHQ, body mass index, and smoking status) characteristics. Nontime-varying covariates (age, sex, race/ethnicity, education, and marital status) were measured at baseline. All other covariates were time-varying and were measured at the assessment immediately before the outcome measured. See Appendix A for further definition of covariates (<http://links.lww.com/JAM/A89>).

## Primary Analyses

Among all Millennium Cohort participants meeting inclusion criteria, proportions and chi-square tests were used to describe the samples and compare outcomes and covariates of interest at baseline as a function of whether problem and risky drinking were initiated during the study period. To assess whether each symptom cluster was associated with initiation of risky or problem drinking, complementary log-log models were used because log-log models better allow time intervals to be accounted for in the model, given that this study uses interval survival data and a small number of intervals. Complementary log-log models were fit to estimate

the relative risk of unhealthy alcohol use initiation outcomes in relation to average cluster scores. Iterative model building was conducted; initial analyses were unadjusted (model 1), adjusted for demographic characteristics (model 2), and then additionally adjusted for service related-characteristics (model 3), comorbid conditions/measures of health status (model 4), and other PTSD symptom clusters (model 5). The same model building techniques were used to assess associations between individual PTSD symptoms and subsequent initiation of risky and problem drinking. Model 5 was considered the fully adjusted model to describe associations between PTSD symptom clusters or symptoms independent of remaining clusters and symptoms. We did not correct *P* values for multiple comparisons because each predictor was assessed independent of other clusters or symptoms.

## Secondary Analyses

We conducted secondary analyses to examine associations of interest only among participants who screened positive for PTSD at baseline—those who met cut-off scores of >35 and affirmed experiences of symptoms across symptom clusters meeting DSM-IV diagnostic criteria on the PCL-C checklist (risky drinking sample *n* = 2361; problem drinking sample *n* = 5130).

## Sensitivity Analyses

Our inclusion criteria assessed initiation of risky and problem drinking in the past year, excluding those with past-year risky or problem drinking. Because it was unknown whether those who did not meet criteria for either aspect of unhealthy alcohol use at baseline had ever met criteria for lifetime history of unhealthy alcohol use, we repeated primary analyses among a subsample of participants who responded to the CAGE (cut back, annoyed, guilty, and eye opener) questionnaire—a validated screen for lifetime alcohol use disorder (Ewing, 1984)—at baseline. These analyses were conducted among the sub-sample of all Millennium Cohort participants eligible for initiating both risky (*n* = 17,908) and problem drinking (*n* = 50,234) who were administered the CAGE at baseline. The questionnaire was not administered to participants in the first wave and panel of the survey who reported no past-year drinking at baseline. All analyses were conducted using SAS version 9.3.

## RESULTS

As shown in Table 1, of the 31,026 participants who met eligibility criteria for no risky drinking at baseline, 27% (*n* = 8453) initiated risky drinking during follow-up. Of the 67,087 participants who met eligibility criteria for no problem drinking at baseline, 8.4% (*n* = 5628) initiated problem drinking during follow-up. For both samples, those who initiated risky or problem drinking, compared with those who did not, were more likely to be younger, male, non-Hispanic white, current smokers, junior enlisted, in the Marine Corps, combat specialists, have a high school education or less, never have been married, deployed with combat, separated from military service, or screen positive for a panic or anxiety disorder or depression, as compared with a chi-square test at *P* < 0.05 (Table 1). Participants who initiated either risky or problem

**TABLE 1.** Initiation Percentage by Baseline Characteristics of Nonrisky or Problem Drinking Current and Former US Service Members (2001–2012)

Baseline Characteristics	Problem Drinking Participants		Risky Drinking Participants	
	Total for Analysis, n	Initiated During Follow-up, %	Total for Analysis, n	Initiated During Follow-up, %
Sample	67,087	8.4	31,026	27.0
Age at enrolment, yrs				
17–24	19,582	11.9	6264	38.4
25–34	24,874	7.9	10,131	28.2
35–44	16,444	6.2	10,075	24.0
45 or older	6187	5.2	4556	16.9
Female	21,158	6.1	11,070	23.8
Race/ethnicity				
White, non-Hispanic	48,665	7.6	20,889	28.6
Black, non-Hispanic	7308	5.1	4759	19.8
Other	11,114	7.0	5378	28.4
Education				
High school or less	10,859	10.9	4157	35.6
Some college/associate degree	33,837	8.9	14,969	29.0
Bachelor's degree or higher	22,391	6.4	11,900	22.2
Marital status				
Never married	19,069	11.5	6379	33.0
Married	40,946	6.9	21,170	25.7
Divorced/separated/widowed	7072	8.3	3477	26.2
Pay grade				
Junior enlisted	37,063	10.2	14,026	32.1
Senior enlisted	13,884	6.6	8443	24.7
Officer/warrant officer	16,140	5.8	8557	21.8
Service branch				
Army	29,563	10.0	14,417	28.5
Navy/Coast Guard	11,941	8.2	5365	28.2
Marine Corps	4321	14.7	1239	33.6
Air Force	21,262	5.0	10,005	24.1
Occupation				
Combat specialist	11,766	9.5	5034	30.1
Health care	8038	7.3	4384	22.3
Other	47,283	8.3	21,608	27.6
Service component				
Reserve/National Guard	25,531	7.5	12,895	25.5
Active duty	41,556	7.1	17,131	28.7
Combat deployment during follow-up*				
Not deployed	53,430	7.8	27,208	26.6
Deployed, no combat	5553	7.1	1668	29.5
Deployed, with combat	8104	12.9	2150	33.2
Deployed prior to enrollment	12,486	6.9	24,613	26.9
Separated from military service	19,794	10.6	10,283	27.7
Physical component summary score†				
1–15	9020	10.1	4604	26.1
16–85	47,631	8.0	21,772	26.9
86–100	10,436	8.8	4650	30.2
Life stressors‡				
None	38,319	7.9	16,231	27.5
1 event	18,224	8.5	9185	27.5
2+ events	10,544	9.8	5610	26.2
Panic or anxiety disorder§	1788	15.9	799	34.4
Depression§	2010	15.7	891	32.5
Smoking status				
Never	41,585	6.8	21,601	24.1
Former	15,137	9.8	6266	32.1
Current	10,365	12.8	3159	39.2
Body mass index, kg/m <sup>2</sup>				
<24.9	28,378	8.2	12,053	27.1
25–29.9	32,327	8.4	14,879	27.7
>30	6382	8.9	3094	25.4

\*Combat was defined as report of witnessing a person's death due to war, disaster, or tragic event; instances of physical abuse (torture, beating, rape); dead and/or decomposing bodies; maimed soldiers/civilians; or prisoners of war/refugees.

†Scored using the Medical Outcomes Study Short Form 36-Item Health Survey for Veterans.

‡Included items such as divorce, bankruptcy, sexual assault, death of loved one, and others.

§Identified using the Patient Health Questionnaire.

drinking had higher mean PTSD cluster scores for all clusters and were more likely to endorse all individual PTSD symptoms than those who did not (chi-square test  $P < 0.05$ ; Table 2).

Initiation of risky drinking was associated with all PTSD symptom clusters and symptoms in unadjusted models, and also models adjusted for demographic characteristics (Tables 3 and 4, models 1 and 2). However, after additional adjustment for service-related characteristics, health-related characteristics and other PTSD symptoms, no PTSD symptom clusters were associated with subsequent initiation of risky drinking (Table 3), and only 1 individual PTSD symptom—irritability/anger—was associated with subsequent initiation of risky drinking (relative risk [RR] 1.05, 95% confidence interval [CI] 1.00–1.09) (Table 4).

In unadjusted models, all PTSD symptoms were associated with subsequent initiation of problem drinking (Table 4). In models fully adjusted for potential confounders, and also other PTSD symptom clusters, 2 symptom clusters

(dysphoric arousal [RR 1.17, 95% CI 1.11–1.23] and emotional numbing [RR 1.30, 95% CI 1.22–1.40]) and 5 symptoms (restricted affect [RR 1.13, 95% CI 1.08–1.19], sense of foreshortened future [RR 1.12, 95% CI 1.06–1.18], exaggerated startle response [RR 1.07, 95% CI 1.01–1.13], sleep disturbance [RR 1.11, 95% CI 1.07–1.15], and irritability/anger [RR 1.12, 95% CI 1.07–1.17]) were associated with subsequent initiation of problem drinking (Tables 3 and 4). While all PTSD symptom clusters were associated with initiation of risky and problem drinking in bivariate analyses, associations were attenuated after adjusting for other PTSD symptom clusters and additional covariates.

In secondary analyses limited to those who screened positive for PTSD (data not shown), no PTSD symptom clusters or symptoms were associated with subsequent initiation of risky drinking after adjustment. All PTSD symptom clusters and symptoms were associated with subsequent initiation of problem drinking in unadjusted and models adjusted for demographics. However, only the *emotional*

**TABLE 2.** Percentage of Participants Who Initiated Risky and Problem Drinking by PTSD Clusters and Symptoms (2001–2012)

PTSD Clusters and Symptoms	Problem Drinking			Risky Drinking		
	Nonproblem Drinker	Initiated During Follow-up, n (%)	Total, n (%)	Nonrisky Drinker	Initiated During Follow-up, n (%)	Total, n (%)
Sample	n = 61,459	n = 5628	n = 67,087	n = 22,573	n = 8453	n = 31,026
Re-experiencing cluster, mean (SD)	1.22 (0.51)	1.38 (0.69)	1.23 (0.53)	1.20 (0.51)	1.24 (0.55)	1.21 (0.52)
Repeated, disturbing memories of stressful experiences from the past	3671 (6.0)	611 (10.9)	4282 (6.4)	1298 (5.8)	586 (6.9)	1884 (6.1)
Repeated, disturbing dreams of stressful experiences from the past	2480 (4.0)	433 (7.9)	2923 (4.4)	805 (3.6)	370 (4.4)	1175 (3.8)
Suddenly acting or feeling as if stressful experiences were happening again	2661 (4.3)	477 (8.5)	3138 (4.7)	920 (4.1)	430 (5.1)	1350 (4.4)
Feeling very upset when something happened that reminds you of stressful experiences from the past	3613 (5.9)	619 (11.0)	4232 (6.3)	1252 (5.5)	583 (6.9)	1835 (5.9)
Physical reactions when something reminds you of stressful experiences from the past	1864 (3.0)	358 (6.4)	2222 (3.3)	637 (2.8)	303 (3.6)	940 (3.0)
Emotional numbing cluster, mean (SD)	1.20 (0.56)	1.49 (0.73)	1.29 (0.56)	1.26 (0.54)	1.32 (0.60)	1.28 (0.56)
Trouble remembering important parts of stressful experiences from the past	1939 (3.2)	374 (6.6)	2313 (3.4)	671 (3.0)	317 (3.8)	988 (3.2)
Loss of interest in activities that you used to enjoy	4598 (7.5)	810 (14.4)	5408 (8.1)	1645 (7.3)	790 (9.3)	2435 (7.8)
Feeling distant or cut off from other people	5491 (8.9)	924 (16.4)	6415 (9.6)	1890 (8.4)	870 (10.3)	2760 (8.9)
Feeling emotionally numb, or being unable to have loving feelings for those close to you	3882 (6.3)	804 (14.3)	4686 (7.0)	1264 (5.6)	644 (7.6)	1908 (6.1)
Feeling as if your future will somehow be cut short	2751 (4.5)	557 (9.9)	3308 (4.9)	989 (4.4)	506 (6.0)	1495 (4.8)
Anxious arousal cluster, mean (SD)	1.28 (0.71)	1.48 (0.92)	1.29 (0.73)	1.25 (0.69)	1.31 (0.76)	1.26 (0.71)
Feeling “super-alert”, watchful, or on guard	4087 (6.6)	688 (12.2)	4775 (7.1)	1329 (5.9)	646 (7.6)	1975 (6.4)
Feeling jumpy or easily startled	2764 (4.5)	541 (9.6)	3305 (4.9)	872 (3.9)	452 (5.3)	1324 (4.3)
Dysphoric arousal cluster, mean (SD)	1.47 (0.71)	1.74 (0.87)	1.49 (0.73)	1.43 (0.69)	1.51 (0.76)	1.45 (0.71)
Trouble falling asleep or staying asleep	8650 (14.1)	1349 (24.0)	9999 (14.9)	2737 (12.1)	1270 (15.0)	4007 (12.9)
Feeling irritable or having angry outbursts	6180 (10.1)	1060 (18.8)	7240 (10.8)	1945 (8.6)	982 (11.6)	2927 (9.4)
Difficulty concentrating	4457 (7.3)	738 (13.1)	5195 (7.7)	1524 (6.8)	735 (8.7)	2259 (7.3)
Avoidance cluster, mean (SD)	1.20 (0.56)	1.36 (0.76)	1.21 (0.58)	1.19 (0.56)	1.23 (0.62)	1.20 (0.58)
Efforts to avoid thinking about your stressful experiences from the past or avoid having feelings about them	3119 (5.1)	573 (10.2)	3692 (5.5)	1081 (4.8)	524 (6.2)	1605 (5.2)
Efforts to avoid activities or situations because they remind you of stressful experiences from the past	2367 (3.9)	424 (7.5)	2791 (4.2)	856 (3.8)	410 (4.9)	1266 (4.1)

PTSD, posttraumatic stress disorder; SD, standard deviation.

**TABLE 3.** Risk for Problem and Risky Drinking Initiation by PCL-C Symptom Clusters among Current and Former US Service Members (2001–2012)

Clusters	Models	Problem Drinking RR (95% CI)	Risky Drinking RR (95% CI)
Re-experiencing	Model 1: unadjusted	<b>1.59 (1.53–1.65)</b>	<b>1.19 (1.14–1.23)</b>
	Model 2: model 1 + demographic characteristics	<b>1.51 (1.46–1.56)</b>	<b>1.10 (1.06–1.14)</b>
	Model 3: model 2 + service-related characteristics	<b>1.30 (1.24–1.36)</b>	<b>1.08 (1.04–1.12)</b>
	Model 4: model 3 + comorbid conditions/health status	1.05 (0.98–1.12)	1.01 (0.96–1.06)
	Model 5: model 4 + other PTSD symptom clusters	1.02 (0.95–1.10)	0.97 (0.91–1.04)
Emotional numbing	Model 1: unadjusted	<b>1.70 (1.64–1.76)</b>	<b>1.23 (1.18–1.27)</b>
	Model 2: model 1 + demographic characteristics	<b>1.57 (1.52–1.62)</b>	<b>1.12 (1.08–1.16)</b>
	Model 3: model 2 + service-related characteristics	<b>1.48 (1.43–1.53)</b>	<b>1.10 (1.06–1.14)</b>
	Model 4: model 3 + comorbid conditions/health status	<b>1.46 (1.40–1.53)</b>	<b>1.05 (1.00–1.10)*</b>
	Model 5: model 4 + other PTSD symptom clusters	<b>1.30 (1.22–1.40)</b>	1.04 (0.97–1.11)
Anxious arousal	Model 1: unadjusted	<b>1.39 (1.35–1.43)</b>	<b>1.16 (1.13–1.19)</b>
	Model 2: model 1 + demographic characteristics	<b>1.30 (1.27–1.34)</b>	<b>1.08 (1.05–1.11)</b>
	Model 3: model 2 + service-related characteristics	<b>1.21 (1.18–1.25)</b>	<b>1.06 (1.03–1.09)</b>
	Model 4: model 3 + comorbid conditions/health status	<b>1.13 (1.09–1.16)</b>	1.03 (0.99–1.06)
	Model 5: model 4 + other PTSD symptom clusters	0.99 (0.95–1.03)	1.02 (0.98–1.06)
Dysphoric arousal	Model 1: unadjusted	<b>1.53 (1.48–1.57)</b>	<b>1.18 (1.14–1.21)</b>
	Model 2: model 1 + demographic characteristics	<b>1.46 (1.42–1.50)</b>	<b>1.10 (1.07–1.13)</b>
	Model 3: model 2 + service-related characteristics	<b>1.38 (1.34–1.42)</b>	<b>1.08 (1.05–1.11)</b>
	Model 4: model 3 + comorbid conditions/health status	<b>1.35 (1.30–1.40)</b>	<b>1.05 (1.01–1.09)</b>
	Model 5: model 4 + other PTSD symptom clusters	<b>1.17 (1.11–1.23)</b>	1.04 (0.99–1.09)
Avoidance	Model 1: unadjusted	<b>1.45 (1.40–1.50)</b>	<b>1.15 (1.11–1.19)</b>
	Model 2: model 1 + demographic characteristics	<b>1.39 (1.35–1.43)</b>	<b>1.07 (1.04–1.11)</b>
	Model 3: model 2 + service-related characteristics	<b>1.30 (1.26–1.35)</b>	<b>1.06 (1.03–1.10)</b>
	Model 4: model 3 + comorbid conditions/health status	<b>1.20 (1.15–1.24)</b>	1.00 (0.96–1.04)
	Model 5: model 4 + other PTSD symptom clusters	0.98 (0.92–1.04)	0.98 (0.93–1.03)

Demographic characteristics: age, sex, race/ethnicity, education, marital status, and pay grade.

Service-related characteristics: service branch, service component, occupation, combat deployment, deployment prior to baseline, and separation from military.

Health characteristics: physical component summary score, life stressors, panic/anxiety, depression, body mass index, and unhealthy alcohol use.

$P < 0.05$  are bolded.

CI, confidence interval; PCL, PTSD Checklist; PTSD, posttraumatic stress disorder; RR, relative risk.

\*The lower bound = 1.0025, rounded to 1.00,  $P = 0.0387$ .

*numbing* symptom cluster was associated with subsequent initiation of problem drinking after full adjustment (RR 1.30, 95% CI 1.22–1.40).

In sensitivity analyses among those who did not screen positive for a lifetime alcohol use disorder, results were largely similar (data not shown). In fully adjusted models, the 3 exceptions were that *irritability/anger* was not (RR 1.06, 95% CI 0.97–1.16) and *avoiding reminders of trauma* was (RR 1.19, 95% CI 1.01–1.39) associated with subsequent risky drinking initiation, while *exaggerated startle response* was not associated with subsequent problem drinking initiation (RR 1.06, 95% CI 0.98–1.14).

## DISCUSSION

While PTSD is known to be associated with subsequent unhealthy alcohol use, this is the first study to our knowledge to describe associations between individual PTSD symptoms and symptom clusters, and subsequent initiation of facets of unhealthy alcohol use. After adjusting for potential confounders and other PTSD symptoms, we found that some individual PTSD symptoms were independently associated with subsequent initiation of risky and problem drinking. Initiation of risky drinking was independently associated with only 1 PTSD symptom: irritability/anger. Initiation of problem drinking was independently associated with 5 PTSD symptoms, including irritability/anger, restricted affect, sense of foreshortened future, exaggerated startle response, and sleep

disturbance. No symptom clusters were associated with initiation of risky drinking, but 2 symptom clusters (dysphoric arousal and emotional numbing) were associated with initiation of problem drinking.

We build on the previous understanding of unhealthy alcohol use and PTSD in a number of ways. Although PTSD is well known to be associated with unhealthy alcohol use (Jakupcak et al., 2010; Debell et al., 2014; Heltemes et al., 2014), the directionality and functionality of this relationship is not entirely understood. No studies have looked at associations between PTSD symptom clusters and subsequent risky drinking. We assessed this question and identified no associations. Several studies have looked at associations between symptom clusters and subsequent problem drinking. Despite changes over time in the way in which these clusters have been measured, our findings are largely consistent with those of previous studies (Debell et al., 2014), which have generally found that re-experiencing (Hien et al., 2010; Read et al., 2012; Scott et al., 2013) and avoidance (Jakupcak et al., 2010; Scott et al., 2013) are not associated with problem drinking, whereas emotional numbing and dysphoric arousal are (Jakupcak et al., 2010; Khoury et al., 2010; Read et al., 2012; Scott et al., 2013).

In this study, only 1 PTSD symptom (irritability/anger) was associated with both initiation of risky drinking and initiation of problem drinking. The finding supports previous findings that alcohol use may be a coping mechanism for

**TABLE 4.** Risk for Problem and Risky Drinking Initiation by Each of the 17 PTSD Symptoms Used in the PCL-C Checklist, Among Former and Current US Service Members (2001–2012)

PCL-C Item	Iterative Models	Problem Drinking RR (95% CI)	Risky Drinking RR (95% CI)
Re-experiencing			
Repeated, disturbing memories of stressful experiences from the past	Model 1: unadjusted	<b>2.19 (2.00–2.39)</b>	<b>1.32 (1.21–1.43)</b>
	Model 2: adjusted for demographic characteristics	<b>1.41 (1.35–1.46)</b>	<b>1.07 (1.03–1.12)</b>
	Model 3: model 2 + service-related characteristics	<b>1.30 (1.24–1.35)</b>	<b>1.05 (1.01–1.10)</b>
	Model 4: model 3 + comorbid conditions/health status	<b>1.16 (1.11–1.21)</b>	0.99 (0.90–1.09)
	Model 5: model 4 + other PCL symptoms	1.02 (0.96–1.09)	1.00 (0.94–1.07)
Repeated, disturbing dreams of stressful experiences from the past	Model 1: unadjusted	<b>2.35 (2.12–2.59)</b>	<b>1.37 (1.24–1.52)</b>
	Model 2: adjusted for demographic characteristics	<b>1.43 (1.37–1.50)</b>	<b>1.07 (1.02–1.12)</b>
	Model 3: model 2 + service-related characteristics	<b>1.30 (1.24–1.36)</b>	1.05 (1.00–1.10)*
	Model 4: model 3 + comorbid conditions/health status	<b>1.14 (1.08–1.20)</b>	0.98 (0.93–1.04)
	Model 5: model 4 + other PCL symptoms	0.97 (0.91–1.04)	0.97 (0.90–1.05)
Suddenly acting or feeling as if stressful experiences were happening again	Model 1: unadjusted	<b>2.31 (2.09–2.55)</b>	<b>1.40 (1.27–1.53)</b>
	Model 2: adjusted for demographic characteristics	<b>1.44 (1.38–1.51)</b>	<b>1.08 (1.02–1.13)</b>
	Model 3: model 2 + service-related characteristics	<b>1.34 (1.28–1.40)</b>	<b>1.06 (1.01–1.11)</b>
	Model 4: model 3 + comorbid conditions/health status	<b>1.18 (1.12–1.25)</b>	0.99 (0.94–1.05)
	Model 5: model 4 + other PCL symptoms	1.00 (0.93–1.07)	0.99 (0.92–1.06)
Feeling very upset when something happened that reminds you of stressful experiences from the past	Model 1: unadjusted	<b>2.28 (2.09–2.49)</b>	<b>1.33 (1.22–1.44)</b>
	Model 2: adjusted for demographic characteristics	<b>1.42 (1.36–1.48)</b>	<b>1.06 (1.01–1.10)</b>
	Model 3: model 2 + service-related characteristics	<b>1.32 (1.27–1.37)</b>	1.04 (1.00–1.09)†
	Model 4: model 3 + comorbid conditions/health status	<b>1.19 (1.13–1.24)</b>	0.98 (0.94–1.03)
	Model 5: model 4 + other PCL symptoms	1.02 (0.95–1.09)	0.97 (0.91–1.03)
Physical reactions when something reminds you of stressful experiences from the past	Model 1: unadjusted	<b>2.45 (2.20–2.73)</b>	<b>1.36 (1.22–1.52)</b>
	Model 2: adjusted for demographic characteristics	<b>1.48 (1.41–1.56)</b>	<b>1.08 (1.02–1.15)</b>
	Model 3: model 2 + service-related characteristics	<b>1.34 (1.27–1.41)</b>	<b>1.06 (1.01–1.13)</b>
	Model 4: model 3 + comorbid conditions/health status	<b>1.17 (1.10–1.24)</b>	0.99 (0.93–1.06)
	Model 5: model 4 + other PCL symptoms	0.98 (0.91–1.06)	0.98 (0.90–1.06)
Emotional numbing			
Trouble remembering important parts of stressful experiences from the past	Model 1: unadjusted	<b>2.36 (2.11–2.63)</b>	<b>1.40 (1.26–1.56)</b>
	Model 2: adjusted for demographic characteristics	<b>1.45 (1.38–1.53)</b>	<b>1.08 (1.02–1.14)</b>
	Model 3: model 2 + service-related characteristics	<b>1.34 (1.27–1.41)</b>	<b>1.06 (1.01–1.12)</b>
	Model 4: model 3 + comorbid conditions/health status	<b>1.17 (1.11–1.24)</b>	1.01 (0.95–1.07)
	Model 5: model 4 + other PCL symptoms	1.03 (0.97–1.10)	1.00 (0.94–1.07)
Loss of interest in activities that you used to enjoy	Model 1: unadjusted	<b>2.19 (2.03–2.38)</b>	<b>1.36 (1.27–1.47)</b>
	Model 2: adjusted for demographic characteristics	<b>1.40 (1.35–1.45)</b>	<b>1.09 (1.05–1.13)</b>
	Model 3: model 2 + service-related characteristics	<b>1.31 (1.27–1.36)</b>	<b>1.08 (1.04–1.12)</b>
	Model 4: model 3 + comorbid conditions/health status	<b>1.20 (1.15–1.26)</b>	1.04 (0.99–1.08)
	Model 5: model 4 + other PCL symptoms	1.02 (0.97–1.08)	1.03 (0.98–1.08)
Feeling distant or cut off from other people	Model 1: unadjusted	<b>2.27 (2.11–2.44)</b>	<b>1.38 (1.29–1.48)</b>
	Model 2: adjusted for demographic characteristics	<b>1.39 (1.34–1.44)</b>	<b>1.07 (1.03–1.11)</b>
	Model 3: model 2 + service-related characteristics	<b>1.31 (1.26–1.35)</b>	<b>1.05 (1.02–1.09)</b>
	Model 4: model 3 + comorbid conditions/health status	<b>1.21 (1.16–1.26)</b>	1.01 (0.97–1.05)
	Model 5: model 4 + other PCL symptoms	1.01 (0.96–1.07)	0.97 (0.92–1.02)
Feeling emotionally numb, or being unable to have loving feelings for those close to you	Model 1: unadjusted	<b>2.70 (2.49–2.92)</b>	<b>1.51 (1.39–1.63)</b>
	Model 2: adjusted for demographic characteristics	<b>1.48 (1.43–1.54)</b>	<b>1.11 (1.07–1.16)</b>
	Model 3: model 2 + service-related characteristics	<b>1.38 (1.33–1.44)</b>	<b>1.09 (1.05–1.14)</b>
	Model 4: model 3 + comorbid conditions/health status	<b>1.28 (1.23–1.33)</b>	<b>1.05 (1.00–1.10)‡</b>
	Model 5: model 4 + other PCL symptoms	<b>1.13 (1.08–1.19)</b>	1.05 (0.99–1.10)
Feeling as if your future will somehow be cut short	Model 1: unadjusted	<b>2.56 (2.33–2.80)</b>	<b>1.41 (1.29–1.54)</b>
	Model 2: adjusted for demographic characteristics	<b>1.48 (1.42–1.54)</b>	<b>1.10 (1.05–1.15)</b>
	Model 3: model 2 + service-related characteristics	<b>1.40 (1.34–1.47)</b>	<b>1.08 (1.03–1.13)</b>
	Model 4: model 3 + comorbid conditions/health status	<b>1.27 (1.21–1.34)</b>	1.04 (0.99–1.09)
	Model 5: model 4 + other PCL symptoms	<b>1.12 (1.06–1.18)</b>	1.02 (0.97–1.08)
Anxious arousal			
Feeling “super-alert” or watchful or on guard	Model 1: unadjusted	<b>2.22 (2.04–2.41)</b>	<b>1.45 (1.34–1.57)</b>
	Model 2: adjusted for demographic characteristics	<b>1.37 (1.31–1.42)</b>	<b>1.09 (1.05–1.13)</b>
	Model 3: model 2 + service-related characteristics	<b>1.24 (1.20–1.30)</b>	<b>1.07 (1.03–1.12)</b>
	Model 4: model 3 + comorbid conditions/health status	<b>1.13 (1.09–1.18)</b>	1.03 (0.99–1.08)
	Model 5: model 4 + other PCL symptoms	0.99 (0.94–1.04)	1.01 (0.96–1.07)

(Continued on next page)

TABLE 4. (Continued)

PCL-C Item	Iterative Models	Problem Drinking	Risky Drinking
		RR (95% CI)	RR (95% CI)
Feeling jumpy or easily startled	Model 1: unadjusted	<b>2.55 (2.33–2.80)</b>	<b>1.52 (1.38–1.66)</b>
	Model 2: adjusted for demographic characteristics	<b>1.48 (1.42–1.54)</b>	<b>1.12 (1.07–1.18)</b>
	Model 3: model 2 + service-related characteristics	<b>1.34 (1.28–1.40)</b>	<b>1.10 (1.05–1.16)</b>
	Model 4: model 3 + comorbid conditions/health status	<b>1.20 (1.15–1.26)</b>	1.05 (1.00–1.11) <sup>§</sup>
	Model 5: model 4 + other PCL symptoms	<b>1.07 (1.01–1.13)</b>	1.05 (0.99–1.12)
Dysphoric arousal Trouble falling asleep or staying asleep	Model 1: unadjusted	<b>2.04 (1.91–2.17)</b>	<b>1.28 (1.21–1.36)</b>
	Model 2: adjusted for demographic characteristics	<b>1.35 (1.31–1.39)</b>	<b>1.07 (1.04–1.10)</b>
	Model 3: model 2 + service-related characteristics	<b>1.29 (1.25–1.33)</b>	<b>1.06 (1.02–1.09)</b>
	Model 4: model 3 + comorbid conditions/health status	<b>1.20 (1.16–1.24)</b>	1.02 (0.99–1.06)
	Model 5: model 4 + other PCL symptoms	<b>1.11 (1.07–1.15)</b>	1.01 (0.98–1.05)
Feeling irritable or having angry outbursts	Model 1: unadjusted	<b>2.28 (2.13–2.45)</b>	<b>1.47 (1.38–1.57)</b>
	Model 2: adjusted for demographic characteristics	<b>1.43 (1.39–1.48)</b>	<b>1.11 (1.07–1.14)</b>
	Model 3: model 2 + service-related characteristics	<b>1.34 (1.30–1.39)</b>	<b>1.09 (1.05–1.13)</b>
	Model 4: model 3 + comorbid conditions/health status	<b>1.25 (1.20–1.30)</b>	<b>1.05 (1.01–1.09)</b>
	Model 5: model 4 + other PCL symptoms	<b>1.12 (1.07–1.17)</b>	<b>1.05 (1.00–1.09)</b> <sup>  </sup>
Difficulty concentrating	Model 1: unadjusted	<b>2.09 (1.93–2.27)</b>	<b>1.34 (1.24–1.44)</b>
	Model 2: adjusted for demographic characteristics	<b>1.36 (1.31–1.41)</b>	<b>1.06 (1.02–1.10)</b>
	Model 3: model 2 + service-related characteristics	<b>1.28 (1.23–1.33)</b>	<b>1.05 (1.01–1.09)</b>
	Model 4: model 3 + comorbid conditions/health status	<b>1.17 (1.12–1.22)</b>	1.01 (0.96–1.05)
	Model 5: model 4 + other PCL symptoms	0.98 (0.93–1.03)	0.97 (0.92–1.02)
Avoidance Efforts to avoid thinking about your stressful experiences from the past or avoid having feelings about them	Model 1: unadjusted	<b>2.30 (2.09–2.52)</b>	<b>1.40 (1.28–1.53)</b>
	Model 2: adjusted for demographic characteristics	<b>1.42 (1.36–1.48)</b>	<b>1.08 (1.03–1.13)</b>
	Model 3: model 2 + service-related characteristics	<b>1.32 (1.26–1.38)</b>	<b>1.07 (1.02–1.12)</b>
	Model 4: model 3 + comorbid conditions/health status	<b>1.17 (1.11–1.23)</b>	1.00 (0.96–1.05)
	Model 5: model 4 + other PCL symptoms	1.02 (0.95–1.09)	0.99 (0.93–1.06)
Efforts to avoid activities or situations because they remind you of stressful experiences from the past	Model 1: unadjusted	<b>2.25 (2.03–2.50)</b>	<b>1.38 (1.25–1.52)</b>
	Model 2: adjusted for demographic characteristics	<b>1.43 (1.36–1.50)</b>	<b>1.09 (1.03–1.14)</b>
	Model 3: model 2 + service-related characteristics	<b>1.33 (1.26–1.39)</b>	<b>1.07 (1.02–1.13)</b>
	Model 4: model 3 + comorbid conditions/health status	<b>1.16 (1.09–1.22)</b>	1.01 (0.96–1.07)
	Model 5: model 4 + other PCL symptoms	0.98 (0.91–1.05)	1.01 (0.94–1.09)

*P* < 0.05 are bolded.

CI, confidence interval; PCL, PTSD Checklist; PTSD, posttraumatic stress disorder; RR, relative risk.

<sup>†</sup>The lower bound = 0.9972, rounded to 1.00, *P* = 0.0638.

<sup>‡</sup>The lower bound = 0.9997, rounded to 1.00, *P* = 0.0516.

<sup>§</sup>The lower bound = 1.0045, rounded to 1.00, *P* = 0.0311.

<sup>||</sup>The lower bound = 0.9974, rounded to 1.00, *P* = 0.0625.

<sup>||</sup>The lower bound = 1.0026, rounded to 1.00, *P* = 0.0377.

persons with anger/irritability (Cooper et al., 1995). No other symptoms or symptom clusters were associated with initiation of risky drinking, whereas 4 other symptoms and 2 symptom clusters were associated with initiation of problem drinking. Findings related to initiation of problem drinking are consistent with previous literature that has found experience of these common symptoms, such as sleep disturbance (Crum et al., 2004), or negative affect (Peacock et al., 2015) are associated with unhealthy alcohol use. The current study builds on this previous work by determining that these are independently associated with subsequent problem drinking, adjusting for other PTSD symptoms.

Differing findings for the association between PTSD symptoms and risky and problem drinking were surprising, given the strong correlation between consumption and consequences (Rubinsky et al., 2013) and previous studies that have identified the association between PTSD and both consumption (McDevitt-Murphy et al., 2010) and consequences (Kline et al., 2014). Differences in findings may be due to

differences in sample sizes and inclusion criteria. For instance, perhaps persons with prior risky drinking, who were excluded from the assessment of risky drinking initiation, differ from persons with prior problem drinking, who were excluded from assessment of problem drinking initiation, in ways that relate to how PTSD symptoms would influence subsequent initiation of either behavior. Future research is needed to better understand why PTSD symptoms and clusters may have differing associations with later initiation of risky versus problem drinking.

The overlap between symptoms and symptom clusters associated with subsequent initiation of problem drinking was inexact. For example, of the 5 symptoms that make up the emotional numbing symptom cluster, only 2—restricted affect and sense of foreshortened future—were associated with subsequent initiation of problem drinking after adjusting for potential confounders and other PTSD symptoms. Similarly, of 3 dysphoric arousal symptoms—sleep disturbance and irritability/anger, but not concentration difficulties—were



associated with subsequent problem drinking initiation after adjusting for potential confounders and other PTSD symptoms. Also, while anxious arousal was not associated with initiation of problem drinking as a PTSD symptom cluster, exaggerated startle response (1 anxious arousal symptom) was associated with initiation of problem drinking after adjusting for potential confounders and other PTSD symptoms. Future work is needed to understand whether individual symptoms add to prediction of initiation of problem drinking above and beyond that of PTSD symptom clusters.

In secondary analyses among individuals who screened positive for PTSD, we found fewer significant associations between PTSD symptoms and initiation of problem or risky drinking, although the magnitude of the estimates remained similar. These findings may be, in part, due to restriction of range and reduced power. Specifically, people who screen positive for PTSD by definition have multiple PTSD symptoms, and as other symptoms were adjusted for in the analyses, this may have attenuated findings in this sample. Additionally, a previous study among veterans with PTSD and alcohol use disorders showed that those with more severe PTSD had fewer heavy drinking days than those with lower overall PTSD severity (Fuehrlein et al., 2014). Similarly, previous studies have shown that individuals with PTSD have worse alcohol-related consequences at lower levels of alcohol use (Krystal et al., 1999; Fuehrlein et al., 2014), indicating the small sample of those with PTSD may have different alcohol-related risk than those without. Thus, specific symptoms for PTSD may not be as relevant for predicting unhealthy alcohol use outcomes among people who have severe enough experience of multiple symptoms to screen positive for PTSD.

However, because screening positive for PTSD requires endorsement of multiple symptoms, our findings suggest that individual PTSD symptoms may be associated with unhealthy alcohol use outcomes, even for individuals who do not meet all criteria needed to screen positive for PTSD. These findings may be of particular utility for identifying increased risk of unhealthy alcohol use among people who have PTSD symptoms that are common among people who experience trauma even when they do not screen positive for PTSD.

Findings from this study have several clinical and/or policy implications. First, though routine alcohol screening to identify risky drinking is recommended and should be provided across patient populations, findings from this study suggest that persons who experience PTSD symptoms may benefit from additional assessment of alcohol-related problems and/or assessment for alcohol use disorder. Further, findings from this large study of military personnel may have implications for military health and readiness. Military personnel are at increased risk for experience of PTSD-related symptoms, and unhealthy alcohol use may be particularly problematic in this population because alcohol use is associated with inability to deploy and early military separation, and also increased alcohol problems, medical burden, and associated costs (Harwood et al., 2009; Stahre et al., 2009; Mattiko et al., 2011). In this study, we found that several of those individual symptoms and symptom clusters were associated with increased risk of initiating problem drinking. While

further research is needed, these findings contribute to a growing body of knowledge highlighting the importance of considering individual effects of PTSD symptoms and symptom clusters (Jakupcak et al., 2010; Trautmann et al., 2015), and also considering whether specific PTSD symptoms and symptom clusters mediate the association between PTSD and unhealthy alcohol use as part of targeted interventions and/or policies aimed at preventing initiation of unhealthy alcohol use (Arbona and Schwartz, 2016; Walton et al., 2018).

This study has several limitations. Data were collected at 3-year intervals, making it possible that changes in risky or problem drinking over time were not fully captured because assessment of those outcomes had a past-year timeframe (ie, questions asked about the year prior to each survey). Further, though validated as a measure of problem drinking and used in previous studies, our measure of problem drinking has not been validated for and does not indicate a diagnosis for alcohol use disorder, though symptoms assessed overlap with disorder symptoms. Similarly, our secondary analyses were conducted among a sample screening positive for PTSD and not those with clinical diagnoses for PTSD, resulting in potential misclassification. This study was also based on self-reported data, which may be subject to recall bias or response biases. However, examination of response bias among those in the first phase of recruited participants, in which complete case analyses and inverse probability weighted analyses were compared across multiple outcomes, showed very little evidence for response bias in the Millennium Cohort Study (Littman et al., 2010). In addition, our primary models were adjusted for other symptoms and/or clusters to evaluate the association between each symptom and cluster independent of other symptoms and clusters. However, preliminary analyses suggested a moderate correlation of PTSD symptoms and clusters; thus, we examined the unique aspects of each symptom and cluster. Further, despite the longitudinal design of the present study, causal inference remains limited, and future research is needed to determine whether PTSD symptoms are useful predictors of risky and problem drinking initiation. In addition, observed associations between symptoms or symptom clusters may be modified by risk factors, such as other mental health conditions (eg, depression and anxiety) or military-specific exposures (eg, combat exposure). Therefore, future work is needed to examine whether the increased risk of initiation of unhealthy alcohol use associated with specific PTSD symptoms varies across certain subpopulations. Because the study was conducted in a large sample of military personnel who may have unique characteristics and experiences, results may not be generalizable to nonmilitary populations.

Despite these limitations, findings from this large longitudinal study suggest that specific PTSD symptoms and symptom clusters are associated with future development of unhealthy alcohol use. Moreover, different symptoms and clusters are associated with subsequent initiation of different facets of unhealthy alcohol use. This information may help identify those at risk of subsequent development of 2 dimensions of unhealthy alcohol use based on symptoms commonly experienced by persons with PTSD, even in the absence of a positive screen for PTSD.

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<b>Appendix. Definition of Terms</b>	
<b>PTSD Symptoms</b>	
Intrusive thoughts	Repeated, disturbing <u>memories</u> of stressful experiences from the past
Recurrent dreams	Repeated, disturbing <u>dreams</u> of stressful experiences from the past
Flashbacks	Suddenly acting or feeling as if stressful experiences were happening again
Emotional reactivity	Feeling very upset when something happened that reminds you of stressful experiences from the past
Inability to recall aspects of trauma	Trouble remembering important parts of stressful experiences from the past
Loss of interest	Loss of interest in activities that you used to enjoy
Detachment	Feeling distant or cut off from other people
Restricted affect	Feeling emotionally numb, or being unable to have loving feelings for those close to you
Sense of foreshortened future	Feeling as if your future will somehow be cut short
Sleep disturbance	Trouble falling asleep or staying asleep
Irritability/anger	Feeling irritable or having angry outbursts
Difficulties concentrating	Difficulty concentrating
Hypervigilance	Feeling “super-alert”, watchful, or on guard
Exaggerated startle response	Feeling jumpy or easily startled
Physiological reactivity	Physical reactions when something reminds you of stressful experiences from the past*
Avoiding thoughts of trauma	Efforts to avoid thinking about your stressful experiences from the past or avoid having feelings about them*
Avoiding reminders of trauma	Efforts to avoid activities or situations because they remind you of stressful experiences from the past*
<p>*Wording of items from all panels and waves from 2004–2014. Previous wording of these items was used in 2001 (given in the following section) but then changed improve readability of question and item responses:</p> <ul style="list-style-type: none"> <li>• Having physical reactions when something reminds you of stressful experiences from the past</li> <li>• Avoid thinking about your stressful experiences from the past or avoid having feelings about them</li> <li>• Avoid activities or situations because they remind you of stressful experiences from the past</li> </ul>	
<b>Unhealthy Alcohol Use Initiation Outcomes</b>	

Risky drinking initiation	Report of drinking over NIAAA recommendations for gender-specific limits: greater than 14 drinks per week or 5 drinks per occasion for men; greater than 7 drinks per week or 4 drinks per occasion for women.
Problem drinking initiation	Positive endorsement of at least 1 item from the 5-item PHQ alcohol screening tool where participants indicate (Y/N) if they have experienced each of the 5 risky drinking behaviors listed more than once in the past year (eg, driving a car after drinking too much or missing work because you were drinking or hung over) at the wave following reported PTSD symptoms.
<b>Covariates</b>	
Gender	Categorized as female or male, measured at baseline
Race/ethnicity	Categorized as black (non-Hispanic), white (non-Hispanic), or other, measured at baseline
Age	Categorized as 17–24, 25–34, 35–44, 45 or older, measured at baseline
Marital status	Categorized as never married, married, or divorced/separated/widowed, measured at baseline
Education	Categorized as high school or less, some college/Associate degree, or Bachelor's degree/higher, measured at baseline
Pay grade	Categorized as junior enlisted, senior enlisted, or officer/warrant officer, measured at the assessment immediately prior to the outcome measured
Service branch	Categorized as Army, Navy/Coast Guard, Marine Corps, or Air Force, measured at the assessment immediately prior to the outcome measured
Occupation	Categorized as combat specialist, health care, or other, measured at the assessment immediately prior to the outcome measured
Service component	Categorized as Reserve/National Guard or active duty, measured at the assessment immediately prior to the outcome measured
Combat deployment during follow-up	Categorized as not deployed, deployed with no combat, or deployed with combat, measured at the assessment immediately prior to the outcome measured
Deployed prior to enrollment	Categorized as binary (Y/N), measured at baseline
Separated from military service	Categorized as binary (Y/N), measured at the assessment immediately prior to the outcome measured
Physical health components summary	Summary score based on the Medical Outcomes Study Short Form 36-Item Health Survey for Veterans categorized as scores of 1–15, 16–85, or 86–100, measured at the assessment immediately prior to the outcome measured

Life stressor events	Lifetime history of events such as divorce, bankruptcy, sexual assault, death of a loved one, etc. categorized by number of events: none, 1 event, 2+ events, measured at the assessment immediately prior to the outcome measured
Panic or anxiety disorder	Identified using the PHQ (categorized as binary Y/N), measured at the assessment immediately prior to the outcome measured
Depression	Identified using the PHQ (categorized as binary Y/N), measured at the assessment immediately prior to the outcome measured
Smoking status	Categorized as never smoker, former smoker, or current smoker, measured at the assessment immediately prior to the outcome measured
Body mass index	Categorized as underweight and normal weight ( $<24.5 \text{ kg/m}^2$ ), over weight ( $25\text{--}29.9 \text{ kg/m}^2$ ), or obese ( $>30 \text{ kg/m}^2$ ), measured at the assessment immediately prior to the outcome measured

PHQ, Patient Health Questionnaire; PTSD, posttraumatic stress disorder; NIAAA, National Institute on Alcohol Abuse and Alcoholism.

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14. ABSTRACT Objectives: Posttraumatic stress disorder (PTSD) and unhealthy alcohol use are commonly associated conditions. It is unknown whether specific symptoms of PTSD are associated with subsequent initiation of unhealthy alcohol use. Methods: Data from the first 3 enrollment panels (n = 151,567) of the longitudinal Millennium Cohort Study of military personnel were analyzed (2001–2012). Complementary log-log models were fit to estimate whether specific PTSD symptoms and symptom clusters were associated with subsequent initiation of 2 domains of unhealthy alcohol use: risky and problem drinking (experience of 1 or more alcohol-related consequences). Models were adjusted for other PTSD symptoms and demographic, service, and health-related characteristics. Results: Eligible study populations included those without risky (n = 31,026) and problem drinking (n = 67,087) at baseline. In adjusted analyses, only 1 PTSD symptom—irritability/anger—was associated with subsequent increased initiation of risky drinking (relative risk [RR] 1.05, 95% confidence interval [CI] 1.00–1.09) at least 3 years later. Two symptom clusters (dysphoric arousal [RR 1.17, 95% CI 1.11–1.23] and emotional numbing [RR 1.30, 95% CI 1.22–1.40]) and 5 symptoms (restricted affect [RR 1.13, 95% CI 1.08–1.19], sense of foreshortened future [RR 1.12, 95% CI 1.06–1.18], exaggerated startle response [RR 1.07, 95% CI 1.01–1.13], sleep disturbance [RR 1.11, 95% CI 1.07–1.15], and irritability/anger [RR 1.12, 95% CI 1.07–1.17]) were associated with subsequent initiation of problem drinking. Conclusions: Findings suggest that specific PTSD symptoms and symptom clusters are associated with subsequent initiation of unhealthy alcohol use.						
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