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SUBSTANCE ABUSE IS HIGHLY CORRELATED with posttraumatic stress disorder (PTSD) and other psychological disorders that may occur after stressful and traumatic events, such as those associated with war.¹⁻⁷ Published studies of military personnel deployed to Iraq and Afghanistan confirm the association between stress related to combat and adverse mental health consequences and report significantly higher rates of PTSD, major depression, and alcohol misuse postdeployment.⁸⁻¹² Similar findings have been reported among Vietnam^{13,14} and 1991 Gulf War veterans.^{15,16} Many of these studies, however, have been limited by the lack of adequate comparison groups for combat veterans and by the inability to control for baseline factors that might influence the association between combat, mental health outcomes, and alcohol misuse.¹⁷

Because alcohol use may serve as a coping mechanism after traumatic events, it is plausible that deployment is associated with increased rates of alcohol consumption or problem drinking. It is also possible that depression, PTSD, or stressors related to deployment

Context High rates of alcohol misuse after deployment have been reported among personnel returning from past conflicts, yet investigations of alcohol misuse after return from the current wars in Iraq and Afghanistan are lacking.

Objectives To determine whether deployment with combat exposures was associated with new-onset or continued alcohol consumption, binge drinking, and alcohol-related problems.

Design, Setting, and Participants Data were from Millennium Cohort Study participants who completed both a baseline (July 2001 to June 2003; n=77 047) and follow-up (June 2004 to February 2006; n=55 021) questionnaire (follow-up response rate=71.4%). After we applied exclusion criteria, our analyses included 48 481 participants (active duty, n=26 613; Reserve or National Guard, n=21 868). Of these, 5510 deployed with combat exposures, 5661 deployed without combat exposures, and 37 310 did not deploy.

Main Outcome Measures New-onset and continued heavy weekly drinking, binge drinking, and alcohol-related problems at follow-up.

Results Baseline prevalence of heavy weekly drinking, binge drinking, and alcohol-related problems among Reserve or National Guard personnel who deployed with combat exposures was 9.0%, 53.6%, and 15.2%, respectively; follow-up prevalence was 12.5%, 53.0%, and 11.9%, respectively; and new-onset rates were 8.8%, 25.6%, and 7.1%, respectively. Among active-duty personnel, new-onset rates were 6.0%, 26.6%, and 4.8%, respectively. Reserve and National Guard personnel who deployed and reported combat exposures were significantly more likely to experience new-onset heavy weekly drinking (odds ratio [OR], 1.63; 95% confidence interval [CI], 1.36-1.96), binge drinking (OR, 1.46; 95% CI, 1.24-1.71), and alcohol-related problems (OR, 1.63; 95% CI, 1.33-2.01) compared with nondeployed personnel. The youngest members of the cohort were at highest risk for all alcohol-related outcomes.

Conclusion Reserve and National Guard personnel and younger service members who deploy with reported combat exposures are at increased risk of new-onset heavy weekly drinking, binge drinking, and alcohol-related problems.

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ment or return from deployment may make it more difficult to control the effects of alcohol, resulting in greater alcohol-related problems, with or without a commensurate change in weekly drinking. Similarly, baseline overall drinking quantities may remain relatively unchanged while binge drinking increases. The Millennium Cohort Study¹⁸ is positioned to prospectively describe alcohol consumption patterns and alcohol-related problems among US service members, many of

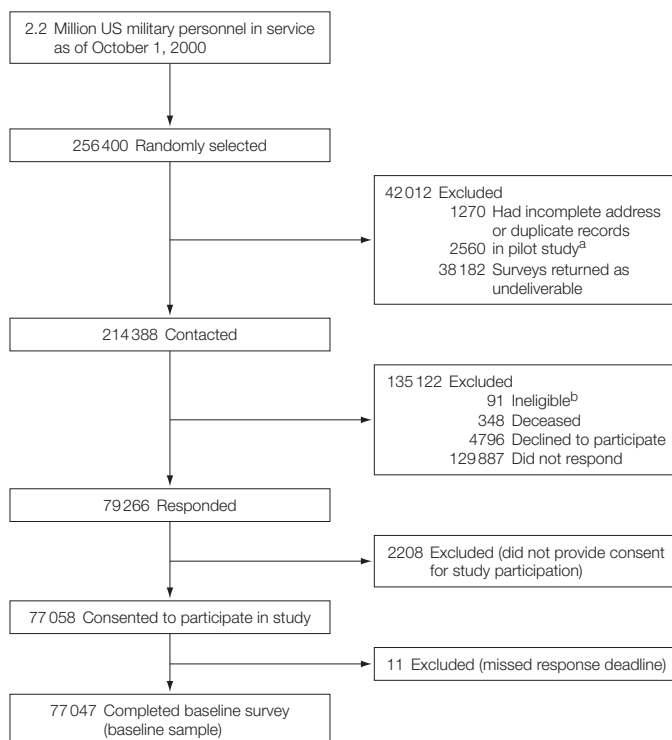
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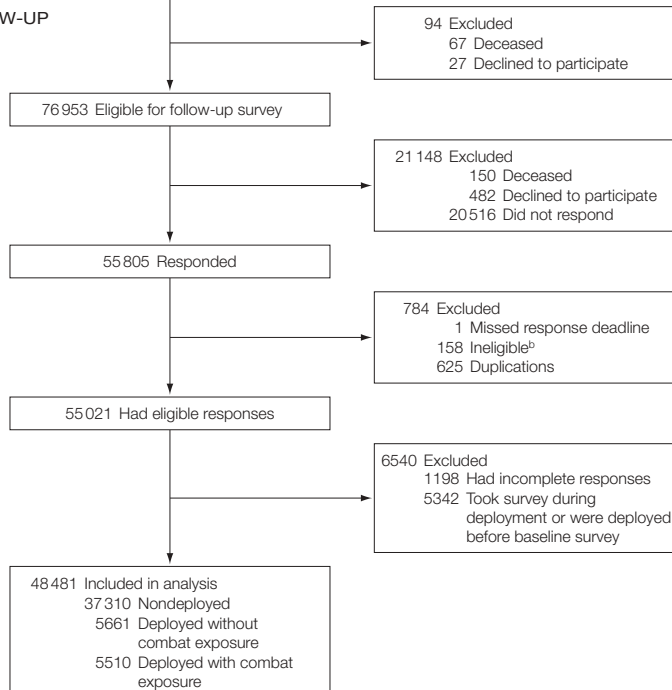
See also p 720.

Figure. Millennium Cohort Study Flow of Participants From Original Sample to Baseline and Follow-up Enrollments to Final Study Population

BASELINE



FOLLOW-UP



^aThe 2560 individuals included in the pilot or feasibility study were removed from the mailing list so they would not receive an additional survey.

^bIndividuals were considered ineligible if they had an invalid Social Security number, were not serving in the military as of October 1, 2000, or if the survey was filled out by someone other than the invited individual.

whom deployed in support of the wars in Iraq and Afghanistan. The purpose of this exploratory investigation was to determine whether military deployment was associated with new-onset or changes in alcohol consumption, binge drinking behavior, and other alcohol-related problems.

METHODS

Population and Data Sources

The Millennium Cohort Study¹⁸ was launched in 2001, with the primary goal of prospectively evaluating the long-term health of military service members and the potential influence of deployment and other military exposures on health. The population-based sample was randomly selected from all US military personnel on rosters as of October 1, 2000. Members of the Reserve and National Guard (Reserve/Guard), women, and those deployed to southwest Asia, Bosnia, or Kosovo between 1998 and 2000 were oversampled to ensure adequate statistical power to detect differences in these smaller subgroups.

This study was approved by the institutional review board at the Naval Health Research Center. A more detailed description of the methodology of this study can be found elsewhere.¹⁸

With a modified Dillman approach,¹⁹ 77 047 of the 256 400 personnel included in the original sample provided informed, voluntary consent and were enrolled in the first panel of the study. Informed consent included acknowledgment of institutional review board-mandated information and the Privacy Act statement. Of the 77 047 participants who completed a baseline survey (2001-2003), 55 021 (71%) completed a follow-up survey (2004-2006). Individuals were excluded from this study if they deployed to Iraq or Afghanistan before the baseline assessment or if they took their survey while deployed because reporting during deployment would likely differ from reporting after deployment. Individuals also were excluded if they did not answer any alcohol outcome questions or were missing demographic or covariate data (FIGURE).

For multivariate modeling, including longitudinal data, participants were analyzed in 2 groups. New onset of alcohol outcomes at follow-up was examined among the group with no alcohol outcomes at baseline. Continued alcohol outcomes at follow-up were examined among the group with reported alcohol outcomes at baseline.

Deployment dates were determined with electronic military data. Individuals categorized as deployed in support of the wars in Iraq and Afghanistan must have completed their first deployment between baseline and follow-up. Length of deployment was assessed as the cumulative amount of time deployed between baseline and follow-up surveys. This variable was categorized as nondeployed, deployed 1 to 180 days, deployed 181 to 270 days, and deployed greater than 270 days. Combat-related exposures, reported at follow-up, were assessed by affirmative responses to questions that asked whether participants had personally witnessed a person's death because of war, disaster, or tragic event; witnessed instances of physical abuse; and seen dead or decomposing bodies, maimed soldiers or civilians, or prisoners of war or refugees.

Demographic and military data were obtained from military electronic personnel files and included sex, birth date, race/ethnicity, service branch (Army, Navy, Air Force, Marines), service component (active duty or Reserve/Guard), military pay grade, military occupation, and deployment experience before baseline to southwest Asia, Bosnia, or Kosovo from 1998 to 2000.

Baseline characteristics of the study population were assessed and included in these analyses. History of life stress, which included such items as divorce, experiencing a violent assault, or having a family member die, was assessed by applying scoring mechanisms from the Holmes and Rahe Social Readjustment Rating Scale^{20,21} to categorize as low/mild, moderate, or severe. Self-reported history of a mental disorder was categorized as those having self-reported symptoms or diagnosis of PTSD only, self-reported symptoms or diagnosis of depression only, and self-

reported symptoms or diagnosis of PTSD and depression, and the "other" mental health category was composed of people who self-reported symptoms of other anxiety disorder or panic disorder; self-reported a diagnosis of schizophrenia, psychosis, or manic-depressive disorder; or reported taking medication for anxiety, depression, or stress. PTSD symptoms were measured with the PTSD Checklist-Civilian Version, a 17-item self-report measure of PTSD symptoms that asks respondents to rate the severity of each symptom during the past 30 days on a 5-point Likert scale, ranging from 1 (not at all) to 5 (extremely).²² Participants were identified as having PTSD symptoms if they reported a moderate or higher level of at least 1 intrusion symptom, 3 avoidance symptoms, and 2 hyperarousal symptoms (criteria established by the *Diagnostic and Statistical Manual of Mental Disorders* (Fourth Edition) [DSM-IV]).²³ Other anxiety (6 items) and panic (15 items) symptoms were assessed with the Patient Health Questionnaire instrument.²⁴⁻²⁶ Self-reported depression symptoms (9 items) were assessed with the Patient Health Questionnaire instrument (sensitivity=0.93; specificity=0.89)²⁷ and correspond to the depression diagnosis from the DSM-IV.²⁸

Baseline survey questions were used to identify nonsmokers, past smokers, or current smokers. History of potential alcohol dependence was evaluated with the CAGE^{29,30} (cut back, annoyed, guilty, eye opener) questions that evaluate whether individuals believed that they needed to cut back on their drinking, felt annoyed at someone who suggested they cut back on drinking, felt guilty about their drinking, or reported needing an eye opener in the morning.

Outcomes

Heavy Weekly Drinking. Heavy weekly drinking, which has shown strong criterion-related validity among military populations in past validation work,³¹ was estimated at baseline and follow-up by summing the number of drinks reportedly consumed on each day of the week before completing the ques-

tionnaire. Heavy drinkers were defined as men who consumed more than 14 drinks per week and women who consumed more than 7 drinks per week, according to research indicating that drinking beyond this level may increase the risk for alcohol-related problems.³²⁻³⁶

Binge Drinking. Binge drinking was estimated at baseline and follow-up by using the number of drinks consumed on each day of the week before taking the questionnaire or the frequency with which participants consumed 5 or more drinks per day or occasion. Binge drinkers were defined as those who reported drinking 5 or more drinks (for men) or 4 or more drinks (for women) on at least 1 day of the week or those who reported "drinking 5 or more alcoholic beverages" on at least 1 day or occasion during the past year.³⁷

Alcohol-Related Problems. Alcohol-related problems were assessed at baseline and follow-up with questions from the Patient Health Questionnaire.²⁴⁻²⁶ This instrument asked whether any of the following happened more than once in the last 12 months: (a) you drank alcohol even though a physician suggested that you stop drinking because of a problem with your health; (b) you drank alcohol, were high from alcohol, or were hung over while you were working, going to school, or taking care of children or other responsibilities; (c) you were late for or missed work, school, or other activities because you were drinking or hung over; (d) you had a problem getting along with people while you were drinking; and (e) you drove a car after having several drinks or after drinking too much. For this analysis, individuals who endorsed at least 1 item were classified as having an alcohol-related problem.

Statistical Analysis

These analyses were largely exploratory, marking the first investigation of alcohol use in the Millennium Cohort. Univariate analyses including χ^2 tests of association were used to investigate unadjusted associations between each alcohol outcome and deployment, occupational, demographic, and behavioral characteristics. Initial

analyses were conducted to assess the presence of multicollinearity by using a variance inflation factor of 4 or greater.

Before examination of these data, the variables sex,^{38,39} birth year,⁴⁰ race/ethnicity,^{38,41,42} education,⁴²⁻⁴⁴ marital status,⁴⁵ service branch,^{46,47} service component,^{10,48} military pay grade,⁴⁹ occupation,⁵⁰ deployment length,⁵¹ deployment to a different conflict before baseline,⁵² history of life stressors,⁵³⁻⁵⁵ self-reported symptoms or diagnosis of mental disorders,^{5,56} smoking status,^{40,57} and history of potential alcohol dependence⁵⁸ were considered for analyses according to the literature, and the decision to test for a first-order multiplicative interaction between combat deployment status and service branch was made. Significant associations between reported alcohol measures and independent variables included an investigation of possible confounding while adjusting for all other variables in the model. Variables were considered confounders if they changed the measure of association between alcohol use and deployment by more than 10%.⁵⁹ Variables that were not significant in the models ($P < .05$) or were not confounders were removed from the models by using a backward elimination process. Interaction terms were considered significant at $P \leq .10$.

After examination of these data, the covariates sex, birth year, race/ethnicity, service branch, service component, deployment length, history of mental disorders, smoking status, and CAGE/alcohol were found to most influence the relationship of combat deployment and alcohol use and were retained for analyses. Race/ethnicity was included because drinking behaviors and values about alcohol may be tied to racial or cultural values.⁴¹ Race and ethnicity were self-designated by personnel on intake forms, with multiple selections permitted, and captured by the Defense Enrollment Eligibility Reporting System (DEERS). We accessed this information from electronic military files that are created with the reporting system data and in-

cluded a race/ethnicity variable as follows: (1) American Indian/Alaskan native, (2) Asian/Pacific Islander, (3) black, non-Hispanic, (4) white, non-Hispanic, (5) Hispanic, (6) other, and (7) unknown. For the purposes of these analyses, categories were collapsed to black, non-Hispanic, white, non-Hispanic, and other. Because service branch did not significantly modify the relationship between combat deployment and alcohol use and the military experiences of active duty and Reserve/Guard personnel are different, an interaction between combat deployment status and service component was tested and found to be significant. For both active duty and Reserve/Guard populations, separate multivariate logistic regression models were used to compare the adjusted odds of association between deployment to support the wars in Iraq and Afghanistan and new-onset and continued heavy drinking, binge drinking, and alcohol-related problems at follow-up, resulting in a total of 12 models. Because of the exploratory nature of these analyses, no statistical adjustments were made for multiple comparisons. Data management and statistical analyses were performed with SAS software (version 9.1; SAS Institute Inc, Cary, North Carolina).

RESULTS

Of the 77 047 Millennium Cohort baseline participants, 55 021 completed a follow-up questionnaire and 22 026 were nonresponders. The response rate for the follow-up study was calculated as 71.4% with a standard definition from the American Association for Public Opinion Research.⁶⁰ For longitudinal data analyses, those with baseline and follow-up data were included. Of these participants, 5342 deployed before taking the baseline survey or took either survey while deployed, 525 were missing alcohol outcome information at baseline or follow-up, and 673 were missing demographic or covariate data, leaving 48 481 individuals for analyses (62.9% of baseline participants).

Participants were further classified into those with and without reported alcohol outcomes at baseline to examine both continued and newly reported alcohol outcomes at follow-up. To ascertain newly reported drinking outcomes, participants reporting alcohol use behavior at baseline were removed from analyses. For analyses of continued alcohol behavior, participants not reporting alcohol outcomes at baseline were removed from analyses.

The demographic characteristics of baseline participants, follow-up participants, and those excluded because of missing baseline or follow-up data are displayed in TABLE 1. Of the 48 481 study participants, 5510 (11.4%) were deployed with combat exposures, 5661 (11.7%) were deployed without combat exposures, and 37 310 (77.0%) were not deployed. Proportions of individuals followed up were similar across demographic subgroups among those who deployed with and without combat exposure and those who deployed before baseline or took their survey while deployed, except that those who deployed with combat exposures were more likely to report PTSD symptoms at follow-up. Those excluded because of missing baseline or follow-up data were more likely to be younger, black, non-Hispanic or unknown race/ethnicity, Marines, current smokers, and to report PTSD and depression symptoms or diagnosis at baseline.

Among active-duty personnel, the baseline, follow-up, and new-onset prevalence of all 3 drinking outcomes was highest among those deployed with combat exposures compared with those deployed without combat exposures and nondeployed personnel (TABLE 2). Proportionally more women than men reported heavy weekly drinking at baseline and new onset, whereas proportionally more men reported binge drinking and alcohol-related problems at all points. Baseline, follow-up, and new-onset prevalence of all outcomes was highest among those who were younger, white, non-Hispanic, Marines, and current smokers and those

Table 1. Characteristics of Millennium Cohort Participants at Baseline and Follow-up by Deployment and Response Status

Characteristic	No. (%) ^a					
	Baseline Survey Respondents (n = 77 047)	Follow-up Survey Respondents (n = 48 481)			Deployed Before Baseline or Took Survey During Deployment (n = 5342)	Excluded Because of Missing Baseline or Follow-up Data ^b (n = 23 224)
		Deployed With Combat Exposures (n = 5510)	Deployed Without Combat Exposures (n = 5661)	Nondeployed (n = 37 310)		
Sex						
Male	56 415 (73.2)	4572 (8.1)	4516 (8.0)	25 952 (46.0)	4455 (7.9)	16 920 (30.0)
Female	20 632 (26.8)	938 (4.5)	1145 (5.5)	11 358 (55.1)	887 (4.3)	6304 (30.6)
Birth, y						
Before 1960	16 652 (21.6)	843 (5.1)	1107 (6.6)	10 473 (62.9)	753 (4.5)	3476 (20.9)
1960-1969	29 177 (37.9)	2200 (7.5)	2434 (8.3)	15 029 (51.5)	2177 (7.5)	7337 (25.1)
1970-1979	26 672 (34.6)	2136 (8.0)	1849 (6.9)	10 479 (39.3)	2121 (8.0)	10 087 (37.8)
1980 and later	4546 (5.9)	331 (7.3)	271 (6.0)	1329 (29.2)	291 (6.4)	2324 (51.1)
Race/ethnicity						
White, non-Hispanic	53 589 (69.6)	3751 (7.0)	4200 (7.8)	26 553 (49.5)	3719 (6.9)	15 366 (28.7)
Black, non-Hispanic	10 601 (13.8)	586 (5.5)	620 (5.8)	4692 (44.3)	639 (6.0)	4064 (38.3)
Other	12 796 (16.6)	1173 (9.2)	841 (6.6)	6065 (47.4)	983 (7.7)	3734 (29.2)
Unknown	61 (0.1)				1 (1.6)	60 (98.4)
Service branch						
Army	36 481 (47.4)	3582 (9.8)	1486 (4.1)	17 953 (49.2)	2600 (7.1)	10 860 (29.8)
Air Force	22 357 (29.0)	1170 (5.2)	2980 (13.3)	10 408 (46.6)	1682 (7.5)	6117 (27.4)
Navy and Coast Guard	14 268 (18.5)	402 (2.8)	1004 (7.0)	7435 (52.1)	909 (6.4)	4518 (31.7)
Marine Corps	3941 (5.1)	356 (9.0)	191 (4.8)	1514 (38.4)	151 (3.8)	1729 (43.9)
Service component						
Active duty	43 890 (57.0)	3418 (7.8)	3457 (7.9)	19 738 (45.0)	3645 (8.3)	13 632 (31.1)
Reserve/National Guard	33 157 (43.0)	2092 (6.3)	2204 (6.6)	17 572 (53.0)	1697 (5.1)	9592 (28.9)
Cumulative deployment, d						
Nondeployed	53 659 (69.6)			37 310 (69.5)		16 349 (30.4)
1-180	8906 (11.6)	2359 (26.5)	3843 (43.2)			2704 (30.4)
181-270	3881 (5.0)	1292 (33.3)	1057 (27.2)			1532 (39.5)
>270	5259 (6.8)	1859 (35.3)	761 (14.5)			2639 (50.1)
Other ^d					5342	
History of mental disorders						
None	67 125 (87.1)	4920 (7.3)	5171 (7.7)	32 324 (48.2)	4855 (7.2)	19 855 (29.6)
Depression symptoms/diagnosis	4484 (5.8)	235 (5.2)	239 (5.3)	2388 (53.3)	232 (5.2)	1390 (31.0)
PTSD symptoms/diagnosis	1655 (2.2)	134 (8.1)	77 (4.7)	749 (45.3)	87 (5.3)	608 (36.7)
PTSD and depression symptoms/diagnosis	2516 (3.3)	136 (5.4)	105 (4.2)	1208 (48.0)	103 (4.1)	964 (38.3)
Other mental health disorder symptoms or self-reported psychiatric medication use	1267 (1.6)	85 (6.7)	69 (5.4)	641 (50.6)	65 (5.1)	407 (32.1)
Smoking status						
Nonsmoker	44 312 (57.5)	3202 (7.2)	3440 (7.8)	22 243 (50.2)	3043 (6.9)	12 384 (27.9)
Past smoker	18 275 (23.7)	1271 (7.0)	1306 (7.1)	9321 (51.0)	1222 (6.7)	5155 (28.2)
Current smoker	13 778 (17.9)	1037 (7.5)	915 (6.6)	5746 (41.7)	1037 (7.5)	5043 (36.6)
Unknown	682 (0.9)				40 (5.9)	642 (94.1)
History of potential alcohol dependence ^c						
No	62 789 (81.5)	4453 (7.1)	4625 (7.4)	30 567 (48.7)	4383 (7.0)	18 761 (29.9)
Yes	14 258 (18.5)	1057 (7.4)	1036 (7.3)	6743 (47.3)	959 (6.7)	4463 (31.3)

Abbreviation: PTSD, posttraumatic stress disorder.

^aPercentages in the first column were calculated as percentage of total baseline population and may not sum to 100 due to rounding. The percentages in the next 5 columns were calculated with the number in each cell as the numerator and the corresponding baseline number in each characteristic as the denominator.^bOf the 23 224 personnel who were excluded because of missing baseline or follow-up data, administrative records indicated that 6875 (30%) completed at least 1 deployment after their baseline survey but before February 14, 2006, the last day that follow-up surveys were accepted. However, information on combat exposure was not available from administrative records and therefore could be assessed only for personnel who responded to the follow-up survey.^cPotential alcohol dependence was derived by endorsement of at least 1 item from the CAGE questions at baseline.^{29,30}^dCumulative deployment length was not calculated for the 5342 individuals who were deployed before the baseline assessment or took the survey while deployed and were excluded from the study.

Table 2. Prevalence of Baseline, Follow-up, and New-Onset Alcohol Use of Active-Duty Millennium Cohort Participants Reporting Outcomes

Characteristic	No. (%) ^a								
	Heavy Weekly Drinkers			Binge Drinkers			≥1 Drinking-Related Problem		
	Baseline (n = 1950)	Follow-up (n = 2037)	New Onset (n = 1185)	Baseline (n = 12 606)	Follow-up (n = 12 323)	New Onset (n = 2836)	Baseline (n = 2516)	Follow-up (n = 1584)	New Onset (n = 889)
Deployment status									
Nondeployed	1396 (7.3)	1485 (7.7)	850 (4.8)	8828 (44.9)	8671 (44.1)	2092 (19.3)	1820 (9.3)	1165 (5.9)	645 (3.6)
Deployed without combat exposures	239 (7.1)	247 (7.4)	154 (4.9)	1811 (52.6)	1740 (50.6)	359 (22.0)	321 (9.3)	172 (5.0)	98 (3.2)
Deployed with combat exposures	315 (9.5)	305 (9.2)	181 (6.0)	1967 (57.6)	1912 (56.0)	385 (26.6)	375 (11.0)	247 (7.2)	146 (4.8)
Sex									
Male	1424 (7.4)	1530 (7.9)	877 (4.9)	10 446 (52.8)	10 221 (51.7)	2118 (22.7)	2058 (10.4)	1291 (6.5)	706 (4.0)
Female	526 (8.0)	507 (7.7)	308 (5.1)	2160 (32.0)	2102 (31.1)	718 (15.6)	458 (6.8)	293 (4.4)	183 (2.9)
Birth, y									
Before 1960	222 (5.8)	272 (7.2)	133 (3.7)	1189 (30.6)	1208 (31.1)	356 (13.2)	220 (5.7)	152 (3.9)	81 (2.2)
1960-1969	628 (5.6)	749 (6.7)	450 (4.3)	4928 (42.8)	4916 (42.7)	1260 (19.2)	757 (6.6)	442 (3.8)	271 (2.5)
1970-1979	921 (9.4)	857 (8.8)	506 (5.7)	5817 (58.0)	5476 (54.6)	1028 (24.4)	1321 (13.2)	815 (8.1)	449 (5.2)
1980 and later	179 (16.4)	159 (14.6)	96 (10.5)	672 (60.2)	723 (64.7)	192 (43.2)	218 (19.6)	175 (15.7)	88 (9.8)
Race/ethnicity									
White, non-Hispanic	1414 (8.4)	1506 (9.0)	865 (5.6)	8985 (52.4)	8687 (50.7)	1809 (22.2)	1821 (10.6)	1165 (6.8)	653 (4.3)
Black, non-Hispanic	175 (5.2)	156 (4.6)	95 (3.0)	934 (26.8)	1023 (29.4)	387 (15.2)	227 (6.5)	140 (4.0)	80 (2.5)
Other	361 (6.3)	375 (6.5)	225 (4.2)	2687 (45.4)	2613 (44.2)	640 (19.8)	468 (7.9)	279 (4.7)	156 (2.9)
Service branch									
Army	873 (8.5)	881 (8.6)	519 (5.5)	4978 (47.2)	4910 (46.6)	1148 (20.6)	998 (9.5)	699 (6.6)	390 (4.1)
Air Force	419 (5.2)	457 (5.7)	280 (3.7)	3567 (43.0)	3491 (42.1)	867 (18.4)	531 (6.4)	286 (3.5)	176 (2.3)
Navy and Coast Guard	486 (8.1)	513 (8.6)	282 (5.1)	3087 (50.8)	2974 (48.9)	661 (22.1)	732 (12.0)	414 (6.8)	220 (4.1)
Marine Corps	172 (10.8)	186 (11.7)	104 (7.3)	974 (60.1)	948 (58.5)	160 (24.8)	255 (15.7)	185 (11.4)	103 (7.6)
Cumulative deployment, d									
Nondeployed	1396 (7.3)	1485 (7.7)	850 (4.8)	8828 (44.9)	8671 (44.1)	2092 (19.3)	1820 (9.3)	1165 (5.9)	645 (3.6)
1-180	253 (6.9)	250 (6.8)	156 (4.6)	1981 (52.4)	1934 (51.1)	424 (23.5)	349 (9.3)	202 (5.4)	126 (3.7)
181-270	141 (9.6)	140 (9.5)	77 (5.8)	885 (58.5)	841 (55.6)	163 (26.0)	174 (11.5)	104 (6.9)	62 (4.6)
>270	160 (10.5)	162 (10.7)	102 (7.5)	912 (58.5)	877 (56.2)	157 (24.2)	173 (11.1)	113 (7.3)	56 (4.1)
History of mental disorders									
None	1591 (7.0)	1702 (7.5)	997 (4.7)	11 063 (47.3)	10 855 (46.5)	2465 (20.0)	1962 (8.4)	1236 (5.3)	723 (3.4)
Depression symptoms/ diagnosis	128 (9.1)	136 (9.7)	81 (6.3)	664 (46.1)	636 (44.1)	177 (22.8)	220 (15.3)	132 (9.2)	71 (5.8)
PTSD symptoms/ diagnosis	73 (14.3)	63 (12.4)	29 (6.7)	310 (59.3)	268 (51.2)	48 (22.5)	116 (22.2)	67 (12.8)	28 (6.9)
PTSD and depression symptoms/ diagnosis	115 (14.7)	100 (12.8)	58 (8.7)	389 (48.4)	377 (47.0)	101 (24.4)	168 (21.0)	120 (15.0)	54 (8.5)
Other mental health disorder symptoms or self-reported psychiatric medication use	43 (11.1)	36 (9.3)	20 (5.8)	180 (45.0)	187 (46.8)	45 (20.5)	50 (12.5)	29 (7.3)	13 (3.7)
Smoking status									
Nonsmoker	679 (4.4)	752 (4.8)	483 (3.2)	6207 (38.8)	6087 (38.1)	1654 (16.9)	1015 (6.4)	638 (4.0)	399 (2.7)
Past smoker	571 (9.3)	641 (10.4)	382 (6.8)	3485 (55.4)	3449 (54.8)	743 (26.5)	710 (11.3)	465 (7.4)	261 (4.7)
Current smoker	700 (16.9)	644 (15.5)	320 (9.3)	2914 (68.5)	2787 (65.5)	439 (32.7)	791 (18.6)	481 (11.3)	229 (6.6)
History of potential alcohol dependence ^b									
No	911 (4.3)	1095 (5.2)	768 (3.8)	8890 (40.9)	8911 (41.0)	2476 (19.3)	1091 (5.0)	776 (3.6)	568 (2.8)
Yes	1039 (22.1)	942 (20.0)	417 (11.4)	3716 (77.4)	3412 (71.0)	360 (33.1)	1425 (29.6)	808 (16.8)	321 (9.5)

Abbreviation: PTSD, posttraumatic stress disorder.

^aPercentages reported are the proportion of individuals within each characteristic subgroup who reported the outcome.^bPotential alcohol dependence was derived by endorsement of at least 1 item from the CAGE questions at baseline.^{29,30}

with a positive result on the CAGE questionnaire. Among Reserve/Guard personnel, baseline, follow-up, and new-onset prevalence of all outcomes was highest among those who were deployed with combat exposures, were younger, were Marines, had PTSD or PTSD and depression, were current smokers, and had a positive result on the CAGE questionnaire (TABLE 3).

In the model analyses of all 3 alcohol outcomes, the interaction term between deployment and service component was statistically significant ($P < .10$), whereas the interaction term between deployment and service branch was not, and thus the models were stratified only by active duty and Reserve/Guard status. Cumulative deployment length was collinear with deployment status and was removed from any modeling consideration. After assessing confounding, all covariates remained in the model because of the number of models and the lack of consistency between covariates that were candidates for removal.

Among active-duty personnel, deployment status was associated with binge drinking after adjustment (TABLE 4). Those deployed with combat exposures were at increased odds of new-onset binge drinking at follow-up (odds ratio [OR] = 1.31; 95% confidence interval [CI], 1.14-1.49). Women were 1.21 times more likely to report new-onset heavy weekly drinking (95% CI, 1.04-1.39), whereas they were significantly less likely to report new-onset or changes in binge drinking or alcohol-related problems. Those born after 1980 were at 6.72 increased odds of new-onset binge drinking (95% CI, 5.33-8.46) and 4.67 increased odds of new-onset alcohol-related problems (95% CI, 3.36-6.47). Those with PTSD and depression were at increased odds of new-onset and continued alcohol-related problems at follow-up. Current smokers and individuals with a positive CAGE result at baseline were at increased odds for new-onset and continuation of all 3 drinking outcomes.

Among Reserve/Guard personnel, deployment with combat exposures was

associated with increased odds of new onset of all 3 drinking outcomes compared with nondeployed personnel, with heavy weekly drinking (OR=1.63; 95% CI, 1.36-1.96) and alcohol-related problems (OR=1.63; 95% CI, 1.33-2.01) showing the strongest association (TABLE 5). The subgroups at risk for new-onset and continued alcohol problems were similar to those reported from the active duty models and included younger age, current smoking, and individuals with a positive CAGE result. Additionally, those reporting any mental health symptoms, diagnoses, or medication use were at significantly increased risk for new-onset alcohol-related problems at follow-up.

COMMENT

Alcohol misuse has been among the concerns reported by soldiers returning from deployment,¹⁰ yet research to date has not been able to quantify the relationship between alcohol problems and deployment. To our knowledge, this is the first study to prospectively investigate alcohol misuse in relation to deployment using 3 different metrics in a large population-based military cohort of both active-duty and Reserve/Guard personnel by documenting alcohol use patterns before and after deployment related to the wars in Iraq and Afghanistan. This study found a significantly increased risk for new-onset heavy weekly drinking, binge drinking, and other alcohol-related problems among Reserve/Guard personnel deployed with reported combat exposures compared with nondeployed Reserve/Guard personnel.

Increased alcohol outcomes among Reserve/Guard personnel deployed with combat exposures is concerning in light of increased reliance on Reserve/Guard forces supporting current operational requirements. This finding is consistent with a recently published study of soldiers returning from Iraq, in which endorsement of alcohol problems according to a 2-item alcohol screen in the newly implemented Post-

Deployment Health Reassessment was reported to be 11.8% for active duty and 15.0% for Reserve/Guard.¹⁰ A study examining the baseline prevalence of mental health in the Millennium Cohort showed that the weighted prevalence of alcohol-related problems, defined as endorsing one of 5 Patient Health Questionnaire measures, was lower in regular active-duty members (11.5%) compared with Reserve/Guard members (14.1%).⁶¹ Possible explanations for increased risk for new-onset drinking outcomes in Reserve/Guard members after deployment include inadequate training and preparation of civilian soldiers for the added stresses of combat exposures faced during deployment; increased stress among individuals and their families having to transition between military and civilian occupational settings; military unit cohesiveness; and reduced access to support services, including family services, health and physical fitness programs, and ongoing prevention programs in civilian communities.^{10,62}

Other demographic and military characteristics associated with changes in drinking behavior include younger age, sex, race/ethnicity, and service branch. Increased risk for alcohol problems in younger personnel is not surprising when it is compared with that of other young cohorts and reported high binge-drinking levels.⁶³ Interventions focused on drinking reduction in younger cohorts that have been effective should be considered in young military personnel before, during, and after deployment. Women were significantly more likely to start drinking heavily but less likely to start binge drinking or have alcohol-related problems compared with men, which may be due to women turning to drinking as a coping mechanism, whereas men may have a higher propensity for risk-taking behaviors.^{64,65} Sex-specific educational programs for interventions to reduce drinking may be considered. Our finding that whites were at increased risk for drinking outcomes compared with blacks or other races is consistent with past research.^{38,41,42} Active-duty

Table 3. Prevalence of Baseline, Follow-up, and New-Onset Alcohol Use of Reserve/Guard Millennium Cohort Participants Reporting Outcomes

Characteristic	No. (%) ^a								
	Heavy Weekly Drinkers			Binge Drinkers			>1 Drinking-Related Problem		
	Baseline (n = 1791)	Follow-up (n = 2022)	New Onset (n = 1075)	Baseline (n = 9216)	Follow-up (n = 9291)	New Onset (n = 2264)	Baseline (n = 2736)	Follow-up (n = 1735)	New Onset (n = 776)
Deployment status									
Nondeployed	1415 (8.3)	1566 (9.2)	801 (5.1)	6997 (39.9)	7105 (40.6)	1804 (17.1)	2099 (12.0)	1322 (7.6)	588 (3.8)
Deployed without combat exposures	193 (9.0)	201 (9.4)	110 (5.6)	1100 (50.0)	1078 (49.0)	212 (19.3)	320 (14.6)	166 (7.6)	62 (3.3)
Deployed with combat exposures	183 (9.0)	255 (12.5)	164 (8.8)	1119 (53.6)	1108 (53.0)	248 (25.6)	317 (15.2)	247 (11.9)	126 (7.1)
Sex									
Male	1227 (8.3)	1381 (9.4)	735 (5.4)	7279 (48.0)	7309 (48.2)	1561 (19.8)	2142 (14.2)	1372 (9.1)	584 (4.5)
Female	564 (8.7)	641 (9.9)	340 (5.8)	1937 (29.1)	1982 (29.8)	703 (14.9)	594 (9.0)	363 (5.5)	192 (3.2)
Birth, y									
Before 1960	630 (7.6)	732 (8.9)	334 (4.4)	2615 (30.8)	2683 (31.6)	742 (12.6)	711 (8.4)	454 (5.4)	214 (2.8)
1960-1969	586 (7.4)	679 (8.6)	367 (5.0)	3590 (44.3)	3649 (45.0)	928 (20.6)	953 (11.8)	590 (7.3)	269 (3.8)
1970-1979	464 (10.8)	470 (10.9)	271 (7.1)	2544 (57.8)	2430 (55.2)	450 (24.3)	886 (20.2)	554 (12.6)	227 (6.5)
1980 and later	111 (14.0)	141 (17.7)	103 (15.1)	467 (57.4)	529 (65.1)	144 (41.6)	186 (23.0)	137 (16.9)	66 (10.6)
Race/ethnicity									
White, non-Hispanic	1539 (9.1)	1744 (10.4)	910 (5.9)	7761 (44.9)	7738 (44.8)	1764 (18.5)	2296 (13.3)	1420 (8.2)	614 (4.1)
Black, non-Hispanic	115 (5.0)	117 (5.1)	66 (3.0)	547 (22.8)	633 (26.4)	265 (14.3)	167 (7.0)	129 (5.4)	70 (3.2)
Other	137 (6.7)	161 (7.8)	99 (5.2)	908 (42.5)	920 (43.1)	235 (19.1)	273 (12.8)	186 (8.7)	92 (4.9)
Service branch									
Army	1114 (9.2)	1199 (10.0)	639 (5.8)	5383 (43.3)	5480 (44.1)	1362 (19.3)	1670 (13.5)	1108 (8.9)	497 (4.6)
Air Force	438 (7.2)	539 (8.9)	285 (5.1)	2536 (40.8)	2531 (40.7)	594 (16.1)	665 (10.7)	381 (6.1)	173 (3.1)
Navy and Coast Guard	187 (7.0)	231 (8.7)	127 (5.1)	1054 (38.6)	1044 (38.2)	269 (16.0)	303 (11.1)	178 (6.5)	79 (3.3)
Marine Corps	52 (12.3)	53 (12.5)	24 (6.5)	243 (56.1)	236 (54.5)	39 (20.5)	98 (22.6)	68 (15.7)	27 (8.0)
Cumulative deployment, d									
Nondeployed	1415 (8.3)	1566 (9.2)	801 (5.1)	6997 (39.9)	7105 (40.6)	1804 (17.1)	2099 (12.0)	1322 (7.6)	588 (3.8)
1-180	203 (8.7)	233 (9.9)	132 (6.2)	1197 (49.8)	1184 (49.2)	244 (20.2)	323 (13.5)	194 (8.1)	88 (4.2)
181-270	87 (10.7)	92 (11.3)	57 (7.8)	430 (52.0)	443 (53.6)	101 (25.4)	132 (16.0)	89 (10.8)	39 (5.6)
>270	86 (8.4)	131 (12.8)	85 (9.0)	592 (56.0)	559 (52.9)	115 (24.7)	182 (17.3)	130 (12.4)	61 (7.0)
History of mental disorders									
None	1422 (7.7)	1691 (9.2)	926 (5.5)	7979 (42.2)	8058 (42.6)	1937 (17.7)	2162 (11.5)	1360 (7.2)	623 (3.7)
Depression symptoms/ diagnosis	164 (11.9)	153 (11.1)	67 (5.5)	548 (38.8)	564 (39.9)	162 (18.7)	253 (17.9)	158 (11.2)	65 (5.6)
PTSD symptoms/ diagnosis	62 (14.7)	50 (11.9)	23 (6.4)	216 (49.7)	208 (47.8)	56 (25.6)	103 (23.7)	62 (14.3)	27 (8.2)
PTSD and depression symptoms/diagnosis	100 (16.2)	88 (14.2)	39 (7.5)	307 (47.7)	298 (46.4)	67 (19.9)	157 (24.5)	111 (17.3)	41 (8.5)
Other mental health disorder symptoms or self-reported psychiatric medication use	43 (11.4)	40 (10.6)	20 (6.0)	166 (42.5)	163 (41.7)	42 (18.7)	61 (15.6)	44 (11.3)	20 (6.1)
Smoking status									
Nonsmoker	654 (5.3)	802 (6.4)	495 (4.2)	4562 (35.6)	4618 (36.0)	1275 (15.4)	1200 (9.4)	794 (6.2)	382 (3.3)
Past smoker	575 (10.6)	631 (11.6)	316 (6.5)	2637 (47.4)	2675 (48.1)	605 (20.7)	797 (14.3)	461 (8.3)	210 (4.4)
Current smoker	562 (16.9)	589 (17.7)	264 (9.6)	2017 (59.0)	1998 (58.4)	384 (27.4)	739 (21.7)	480 (14.1)	184 (6.9)
History of potential alcohol dependence ^b									
No	749 (4.3)	1042 (6.0)	700 (4.2)	6240 (35.0)	6491 (36.4)	1943 (16.8)	1250 (7.0)	864 (4.9)	515 (3.1)
Yes	1042 (26.7)	980 (25.1)	375 (13.1)	2976 (74.5)	2800 (70.1)	321 (31.4)	1486 (37.1)	871 (21.8)	261 (10.4)

Abbreviation: PTSD, posttraumatic stress disorder.

^aPercentages reported are the proportion of individuals within each characteristic subgroup that reported the outcome.^bPotential alcohol dependence was derived by endorsement of at least 1 item from the CAGE questions at baseline.^{29,30}

Marines were also found to be at increased odds of continuing to binge drink after deployment, as well as to experience new-onset alcohol-related problems. Marines may represent another group that should be targeted for inter-

ventions because the Hoge et al⁹ study also showed a higher likelihood of alcohol misuse among Marines than Army personnel after deployment.

Individuals with previous mental health or alcohol problems were at sig-

nificantly increased risk for changes in drinking behavior. Among CAGE/alcohol-positive individuals at baseline, risk for new-onset and continued drinking at follow-up was high for all 3 outcomes, potentially representing

Table 4. Adjusted Odds of New-Onset and Continued Alcohol Outcomes Among Active-Duty Millennium Cohort Participants From Baseline to Follow-up

Characteristic	OR (95% CI) ^a					
	Heavy Weekly Drinking (n = 25 901)		Binge Drinking (n = 26 536)		Alcohol-Related Problems (n = 26 519)	
	New Onset at Follow-up (n = 23 951)	Continued at Follow-up (n = 1950)	New Onset at Follow-up (n = 13 930)	Continued at Follow-up (n = 12 606)	New Onset at Follow-up (n = 24 003)	Continued at Follow-up (n = 2516)
Deployment status						
Nondeployed	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Deployed without combat exposures	1.11 (0.92-1.33)	0.81 (0.60-1.09)	1.07 (0.94-1.22)	1.08 (0.95-1.22)	0.85 (0.68-1.06)	0.88 (0.66-1.18)
Deployed with combat exposures	1.12 (0.94-1.33)	0.86 (0.66-1.13)	1.31 (1.14-1.49)	1.07 (0.95-1.21)	1.03 (0.85-1.26)	0.84 (0.64-1.09)
Sex						
Male	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Female	1.21 (1.04-1.39)	0.81 (0.65-1.01)	0.57 (0.52-0.63)	0.52 (0.47-0.58)	0.69 (0.58-0.83)	0.71 (0.55-0.91)
Birth, y						
Before 1960	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
1960-1969	1.13 (0.92-1.38)	0.56 (0.40-0.77)	1.67 (1.47-1.90)	1.17 (1.02-1.36)	1.15 (0.89-1.48)	0.66 (0.47-0.92)
1970-1979	1.39 (1.14-1.70)	0.37 (0.27-0.51)	2.55 (2.22-2.92)	1.41 (1.22-1.63)	2.40 (1.87-3.07)	0.84 (0.61-1.16)
1980 and later	2.41 (1.81-3.22)	0.34 (0.22-0.52)	6.72 (5.33-8.46)	1.79 (1.41-2.27)	4.67 (3.36-6.47)	1.45 (0.95-2.20)
Race/ethnicity						
White, non-Hispanic	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Black, non-Hispanic	0.60 (0.48-0.75)	0.65 (0.46-0.92)	0.74 (0.65-0.85)	0.70 (0.60-0.82)	0.71 (0.56-0.91)	1.00 (0.72-1.38)
Other	0.78 (0.66-0.91)	0.87 (0.68-1.13)	0.99 (0.88-1.11)	0.89 (0.80-0.99)	0.72 (0.59-0.87)	0.92 (0.72-1.17)
Service branch ^b						
Army	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Air Force	0.65 (0.55-0.76)	1.02 (0.79-1.33)	0.87 (0.78-0.97)	0.93 (0.83-1.04)	0.58 (0.48-0.71)	0.66 (0.50-0.86)
Navy and Coast Guard	0.83 (0.71-0.97)	1.11 (0.87-1.42)	1.08 (0.95-1.21)	0.95 (0.84-1.06)	0.95 (0.80-1.14)	0.83 (0.66-1.05)
Marine Corps	1.11 (0.89-1.40)	1.23 (0.87-1.73)	1.06 (0.86-1.29)	1.20 (1.00-1.44)	1.48 (1.17-1.88)	0.97 (0.72-1.32)
History of mental disorders ^b						
None	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Depression symptoms/diagnosis	1.06 (0.83-1.35)	0.93 (0.63-1.37)	1.18 (0.98-1.42)	0.75 (0.63-0.90)	1.67 (1.28-2.17)	1.02 (0.73-1.41)
PTSD symptoms/diagnosis	0.95 (0.64-1.40)	1.02 (0.63-1.66)	0.93 (0.67-1.31)	0.64 (0.49-0.82)	1.43 (0.95-2.14)	1.14 (0.75-1.72)
PTSD and depression symptoms/diagnosis	1.30 (0.98-1.74)	0.67 (0.44-1.01)	1.07 (0.84-1.36)	0.71 (0.56-0.89)	2.18 (1.61-2.95)	1.48 (1.05-2.09)
Other mental health disorder symptoms or self-reported psychiatric medication use	1.05 (0.66-1.67)	0.64 (0.34-1.23)	1.07 (0.76-1.51)	1.18 (0.82-1.71)	1.06 (0.60-1.88)	1.21 (0.65-2.25)
Smoking status ^b						
Nonsmoker	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Past smoker	1.94 (1.68-2.24)	1.20 (0.95-1.51)	1.79 (1.61-1.99)	1.37 (1.24-1.52)	1.53 (1.30-1.81)	1.23 (0.98-1.53)
Current smoker	2.43 (2.08-2.83)	1.45 (1.16-1.82)	2.20 (1.92-2.50)	1.60 (1.43-1.79)	1.85 (1.55-2.20)	1.30 (1.05-1.62)
History of potential alcohol dependence ^{b,c}						
No	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Yes	2.84 (2.50-3.23)	1.72 (1.42-2.08)	2.01 (1.74-2.31)	1.75 (1.59-1.93)	3.19 (2.75-3.69)	2.10 (1.73-2.54)

Abbreviations: CI, confidence interval; OR, odds ratio; PTSD, posttraumatic stress disorder.

^aOdds ratios and associated 95% CIs were adjusted for all other variables in the table.

^bCharacteristic reported at baseline assessment.

^cPotential alcohol dependence was derived by endorsement of at least 1 item from the CAGE questions at baseline.^{29,30}

vulnerability toward drinking in these individuals. Those with baseline symptoms of depression or PTSD and depression were also at increased risk for new-onset alcohol-related problems in active duty and Reserve/

Guard. Among Reserve/Guard, the risk for new-onset alcohol-related problems was significant for those with any report of mental health symptoms or medication use, possibly because of the difficulties of work and family respon-

sibilities that shift quickly. Research has suggested that PTSD is associated with changes in alcohol consumption⁵ and that alcohol misuse is comorbid with several mental health disorders.⁵⁶ However, it is difficult to separate any clear

Table 5. Adjusted Odds of New-Onset and Continued Alcohol Outcomes Among Reserve/Guard Millennium Cohort Participants From Baseline to Follow-up

Characteristic	OR (95% CI) ^a					
	Heavy Weekly Drinking (n = 21 211)		Binge Drinking (n = 21 812)		Alcohol-Related Problems (n = 21 761)	
	New Onset at Follow-up (n = 19 420)	Continued at Follow-up (n = 17 91)	New Onset at Follow-up (n = 12 596)	Continued at Follow-up (n = 9216)	New Onset at Follow-up (n = 19 025)	Continued at Follow-up (n = 2736)
Deployment status						
Nondeployed	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Deployed without combat exposures	1.09 (0.88-1.36)	0.66 (0.48-0.91)	1.10 (0.93-1.30)	1.12 (0.95-1.32)	0.88 (0.67-1.16)	0.96 (0.73-1.25)
Deployed with combat exposures	1.63 (1.36-1.96)	0.97 (0.70-1.34)	1.46 (1.24-1.71)	0.95 (0.81-1.11)	1.63 (1.33-2.01)	1.11 (0.86-1.43)
Sex						
Male	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Female	1.22 (1.06-1.41)	1.24 (1.00-1.55)	0.62 (0.55-0.68)	0.49 (0.43-0.55)	0.66 (0.55-0.79)	0.65 (0.53-0.81)
Birth, y						
Before 1960	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
1960-1969	1.14 (0.98-1.34)	0.68 (0.54-0.87)	2.00 (1.80-2.24)	1.24 (1.10-1.40)	1.44 (1.19-1.73)	0.99 (0.80-1.23)
1970-1979	1.56 (1.32-1.86)	0.43 (0.33-0.56)	2.69 (2.34-3.09)	1.49 (1.30-1.70)	2.55 (2.09-3.12)	1.16 (0.93-1.45)
1980 and later	3.74 (2.90-4.83)	0.27 (0.17-0.43)	6.90 (5.42-8.79)	2.27 (1.74-2.97)	4.82 (3.53-6.57)	1.33 (0.93-1.90)
Race/ethnicity						
White, non-Hispanic	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Black, non-Hispanic	0.54 (0.42-0.70)	0.62 (0.42-0.92)	0.80 (0.69-0.92)	0.65 (0.54-0.79)	0.92 (0.71-1.19)	0.96 (0.68-1.34)
Other	0.89 (0.71-1.10)	0.72 (0.50-1.04)	1.04 (0.89-1.22)	0.96 (0.81-1.13)	1.29 (1.03-1.63)	0.95 (0.73-1.25)
Service branch ^b						
Army	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Air Force	1.00 (0.85-1.17)	1.31 (1.02-1.67)	0.91 (0.81-1.02)	1.03 (0.91-1.16)	0.85 (0.70-1.03)	0.85 (0.69-1.05)
Navy and Coast Guard	1.01 (0.82-1.23)	1.07 (0.77-1.48)	0.91 (0.78-1.05)	0.88 (0.76-1.03)	0.85 (0.66-1.09)	0.86 (0.65-1.12)
Marine Corps	0.91 (0.59-1.41)	1.48 (0.83-2.63)	0.86 (0.59-1.24)	1.09 (0.78-1.53)	1.39 (0.91-2.12)	1.14 (0.74-1.73)
History of mental disorders ^b						
None	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Depression symptoms/diagnosis	0.82 (0.63-1.07)	0.74 (0.52-1.04)	1.09 (0.91-1.32)	0.88 (0.72-1.08)	1.56 (1.18-2.05)	1.15 (0.87-1.53)
PTSD symptoms/diagnosis	0.89 (0.58-1.39)	0.54 (0.32-0.92)	1.32 (0.95-1.82)	0.65 (0.48-0.89)	1.90 (1.25-2.87)	0.94 (0.61-1.45)
PTSD and depression symptoms/diagnosis	1.15 (0.81-1.62)	0.76 (0.50-1.16)	1.08 (0.81-1.43)	0.85 (0.65-1.12)	2.33 (1.66-3.28)	1.41 (1.01-1.97)
Other mental health disorder symptoms or self-reported psychiatric medication use	0.98 (0.61-1.56)	0.61 (0.33-1.14)	1.19 (0.84-1.68)	0.81 (0.57-1.16)	1.85 (1.15-2.96)	1.20 (0.70-2.04)
Smoking status ^b						
Nonsmoker	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Past smoker	1.51 (1.30-1.76)	1.28 (1.01-1.62)	1.58 (1.41-1.77)	1.37 (1.21-1.54)	1.31 (1.10-1.57)	0.85 (0.70-1.04)
Current smoker	2.16 (1.84-2.54)	1.79 (1.41-2.28)	2.13 (1.85-2.44)	1.49 (1.31-1.70)	1.88 (1.56-2.27)	1.21 (1.00-1.47)
History of potential alcohol dependence ^{b,c}						
No	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Yes	3.34 (2.91-3.83)	1.69 (1.38-2.06)	2.30 (1.98-2.66)	1.87 (1.67-2.10)	3.44 (2.93-4.03)	1.78 (1.51-2.10)

Abbreviations: CI, confidence interval; OR, odds ratio; PTSD, posttraumatic stress disorder.

^aOdds ratios and associated 95% CIs were adjusted for all other variables in the table.

^bCharacteristic reported at baseline assessment.

^cPotential alcohol dependence was derived by endorsement of at least 1 item from the CAGE questions.^{29,30}

causal pathways because the etiology of these disorders is likely intertwined.

Unfortunately, a simple solution to mitigating the effects of these comorbidities among military personnel has yet to be discovered, and research has identified difficulties in reducing stigma and barriers to care.⁸⁻¹⁰ A recent report showed that although the military has reduced smoking and other drug use, progress remains slow on reduction in heavy drinking.⁶⁶ Continued screening using such items as the Post-Deployment Health Reassessment, given 3 to 6 months after deployment, will help to identify at-risk individuals who may need to seek treatment. As Milliken et al¹⁰ suggested, it is important that the military establish policies endorsing “confidentiality” and “self-referral” for optimal effectiveness. A potentially interesting strategy to aid problem drinkers is self-help, Web-based intervention.⁶⁷ This method was tested in a controlled trial, showed efficacy in drinking reduction, and could be promising for use among military personnel because of perceived privacy of a Web-based tool. Another potential strategy to reduce drinking involves assessing “drinking motivation type (experimenters, thrill seekers, multireasoners, and relaxers)” and then targeting interventions according to a person’s profile.⁶⁸ Finally, a technique called the brief negotiated interview, proposed by Fernandez et al,⁶⁹ uses a “method designed to enhance a patient’s motivation to change, rooted in the principles of motivational interviewing.” This method might be useful for the military in settings in which one-on-one interaction is feasible because development of rapport with the individual is a key to this method.

Our study has several possible limitations. The Millennium Cohort may not be representative of the military as a whole or those who are deployed. However, thorough evaluations of possible biases suggest the cohort is a representative sample of military personnel, as measured by demographic and mental health characteristics and reli-

able health and exposure reporting.^{18,61,70-74} Nondeployed individuals may not have deployed because they were unfit owing to health status, which means our comparison group may have been less healthy than our deployed groups, potentially biasing our results toward the null. Another important limitation is that the authors did not collect information on the circumstances under which the participants took the survey. Therefore, the various circumstances under which responses were reported, such as anxiety before war, may have influenced response. However, because both binge drinking and alcohol-related problems were related to behaviors during the past year, the effect of differing circumstances was likely minimal. Additionally, the average amount of time between returning home from deployment and completing the follow-up survey was 1 year, making it difficult to determine both short- and long-term effects of deployment on alcohol use. Self-reported data are subject to recall bias, and the actual number of drinks consumed in the past week may be difficult for participants to easily remember.^{75,76} Measures of binge drinking also differed slightly between baseline and follow-up assessments. Although the core text of the questions (“5 or more drinks” in 1 day or on 1 occasion) was nearly identical, the response options were presented differently. Another potential limitation is that both questionnaires identify overall alcohol consumption, which has been shown to underestimate actual consumption compared with beverage-specific consumption questions.⁷⁵ It is also possible that military personnel are less likely to endorse alcohol-related questions because of concern that acknowledging risky behavior could hinder career progression. However, other studies have found that self-reported weekly alcohol consumption measures, even when service members know the survey is not anonymous, demonstrate good criterion-related validity.³¹ Finally, although we collected data on several known and theoretical

confounders, we did not have information on other drug use.

Despite these limitations, our study has important strengths. The Millennium Cohort has the advantage of being systematically drawn from all branches and components of the US military, yielding a large sample size with statistical power to detect meaningful differences among subgroups of this population. Additionally, data on quantity of drinking are strengthened by the use of different metrics (weekly drinking, daily drinking, and alcohol problems) to capture this information. Moreover, these data longitudinally measure heavy drinking, binge drinking, and drinking-related problems, independent of the timing of deployment, providing prospective insight into these outcomes and any relationship to military deployment in a large population-based sample. Further, alcohol use has been suggested as one possible explanation for previously unexplained increases in injury mortality subsequent to deployment.⁷⁷ Finally, although self-reported alcohol consumption may not be a perfect measure, other epidemiologic studies have found these measurements to be generally reliable.^{78,79}

In conclusion, our study found that combat deployment in support of the wars in Iraq and Afghanistan was significantly associated with new-onset heavy weekly drinking, binge drinking, and other alcohol-related problems among Reserve/Guard and younger personnel after return from deployment. These results are the first to prospectively quantify changes in alcohol use in relation to recent combat deployments. Interventions should focus on at-risk groups, including Reserve/Guard personnel, younger individuals, and those with previous or existing mental health disorders. Further prospective analyses using Millennium Cohort data will evaluate timing, duration, and comorbidity of alcohol misuse and other-alcohol related problems, better defining the long-term effect of military combat deployments on these important health outcomes.

Author Contributions: Ms Jacobson had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Jacobson, Ryan, Hooper, Smith, Amoroso, Boyko, Gackstetter, Wells, Bell.

Acquisition of data: Ryan, Smith, Amoroso.

Analysis and interpretation of data: Jacobson, Ryan, Smith, Amoroso, Boyko, Bell.

Drafting of the manuscript: Jacobson, Hooper, Smith, Amoroso, Wells, Bell.

Critical revision of the manuscript for important intellectual content: Jacobson, Ryan, Hooper, Smith, Amoroso, Boyko, Gackstetter, Bell.

Statistical analysis: Jacobson, Boyko.

Obtained funding: Ryan.

Administrative, technical, or material support: Ryan, Smith, Gackstetter, Wells.

Study supervision: Ryan, Smith.

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14. ABSTRACT (maximum 200 words)

Background: Concern has grown over the health of US service members returning from deployment in support of the war in Afghanistan. High rates of alcohol misuse after deployment have been reported among personnel returning from past conflicts, but data focusing on alcohol misuse after returning from the current conflicts are lacking.

Methods: The Millennium Cohort Study is a population-based, longitudinal study designed to evaluate any long-term effects of deployment. Our analyses included 48 481 participants with complete outcome and demographic data who also completed both baseline and follow-up surveys. Outcomes were new-onset of heavy weekly drinking, potential binge drinking, and other alcohol-related problems.

Results: Men and women who were deployed and reported combat exposures were significantly more likely to experience alcohol outcomes compared with nondeployed personnel.

Conclusions: Deployment with combat-related exposures appears to increase the risk of new-onset of heavy weekly drinking, and other alcohol-related problems. Continued prospective analyses of these data are essential to understand how deployment influences short- and long-term alcohol use patterns.

14. SUBJECT TERMS
alcohol drinking, military personnel, military medicine, prospective studies

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