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Causes, types and severity of injury among army soldiers hospitalized with alcohol comorbidity*

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Abstract

Aim— To examine the relationship between alcohol use and the cause, type and severity of hospitalized injuries.

Design/setting— We used the Total Army Injury and Health Outcomes Database (TAIHOD) to conduct cross-sectional analyses of the association between alcohol comorbidity and the cause, type and severity of soldiers' non-combat injuries requiring hospitalization.

Participants— Subjects were active-duty US army soldiers ($n = 211\,790$) hospitalized with a primary diagnosis of injury between 1980 and 2002.

Findings— Alcohol comorbidity was positively associated with hospitalized injuries resulting from fights and falls and negatively associated with sports injuries; positively associated with hospitalized cases of head injury, open wounds and poisonings and negatively associated with musculoskeletal injury; and, overall, associated with shorter length of stay. Controlling for demographic factors did not moderate the association between alcohol and cause, type or severity of injury.

Conclusion— Alcohol comorbidity is specifically associated with injuries related to impairment and antisocial behavior.

Keywords

Alcohol; head injuries; injury cause; injury severity; injury type; military; soldiers; sports injuries

INTRODUCTION

Acute alcohol exposure contributes to injury through impaired cognition, motor function, risk judgment or a combination of these effects. Chronic exposure may result in compromised cognitive function, depression or poor health, all of which could increase risk for injury, even in the absence of ingested alcohol. With few recent exceptions, however, the question of whether alcohol is associated differentially with injury cause, type and severity has received little attention in the literature.

Alcohol and injury cause

We identified two studies that examined associations between alcohol exposure and injury cause. Cherpitel found no association between acute alcohol exposure (assessed by

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breathalyzer) and cause of unintentional injury in a probability sample ($n = 1494$) of adult patients presenting at four California hospitals [1]. Swahn *et al.* used the National Longitudinal Study of Adolescent Health to examine the association between drinking practices and physical fighting, being injured in a fight or injuring others in a sample of adolescents ($n = 8885$). They found that, controlling for drinking frequency and binge drinking, those who reported drinking problems were more likely to engage in fighting than those who did not report problem drinking, suggesting an association of chronic alcohol abuse and aggressive behaviors, at least among young people [2].

Alcohol and injury type

Several recent studies have examined the relationship between alcohol use and type of injury. Watt *et al.* studied 593 patients (≥ 15 years of age) presenting with injury at an emergency department [3]. After controlling for relevant demographic, situational, substance use and risk-taking variables, they found no significant associations between acute alcohol exposure and injury type. In a study of 887 hospitalized trauma patients selected for multi-substance toxicological screening, Blondell *et al.* found no association between type of injury and alcohol, after controlling for cocaine exposure [4]. In contrast, when Savola *et al.* studied 385 consecutive admissions (> 16 –49 years of age) at a trauma center in Finland, alcohol dependency and binge drinking were significantly more frequent among head trauma patients than those with other injury types, and odds of head injury increased with increasing blood alcohol concentration (BAC) [5].

Alcohol and injury severity

Alcohol may also influence injury severity but, again, evidence is mixed. A few studies suggest a protective effect of alcohol. Albrecht-Anoschenko *et al.* studied 140 patients who had sustained head injuries after falling down stairs [6]. Patients classified as intoxicated (≥ 0.08 g% BAC) when presenting experienced significantly lower mortality (12.9%) than the non-intoxicated group (33.3%), controlling for age. In the aforementioned study, Savola *et al.* found no association between injury severity and BAC on admission [5]. In a study of 2724 young patients (12–25 years of age) treated in Pennsylvania trauma centers and tested for alcohol, Porter found no significant differences in mean Injury Severity Score (ISS) or death rate between alcohol positive and negative patients, although regression analyses revealed a slight, but significant, downward trend in ISS with increasing intoxication [7]. Honkanen & Smith studied 14 995 males presenting at a Helsinki emergency room, and found no differences in overall hospitalization rates for sober and intoxicated patients, but injuries resulting from car crashes and from falls down stairs were significantly more likely to result in hospitalization when alcohol was involved [8]. Spaite *et al.* found that in adult trauma center patients ($n = 350$) presenting with bicycle-related injuries, alcohol exposure was highly associated with greater injury severity, longer hospitalization and higher health care costs [9]. Similarly, Garrison *et al.* found that among 362 male patients with spinal cord injuries, those with cervical injuries were twice as likely as those without cervical injury to have been using alcohol when injured [10].

Variations in alcohol measurements, study populations and type of injuries investigated make it difficult to draw conclusions from the literature about the extent to which alcohol affects the cause, type and severity of injury. More information is needed to understand more clearly the directions and strengths of these relationships.

This study explores associations between alcohol and the cause, type and severity of injuries among patients hospitalized for trauma. To examine these relationships, we identified all hospitalizations for US army personnel (1980–2002) with a non-combat injury diagnosis and determined whether there was a secondary diagnosis for alcohol comorbidity (either acute or

chronic alcohol exposure) in the treatment record. Army soldiers are an important population to study because non-combat injuries are leading causes of morbidity and mortality for the armed forces. Access to a comprehensive data set on injury hospitalizations for a large population, which includes coding for both cause and type of injury, provides a unique opportunity to explore the association between alcohol and the nature of injuries.

METHODS

Data source

Data come from the Total Army Injury and Health Outcomes Database (TAIHOD), a database linking health and administrative records for active-duty army personnel [11,12]. Sections of the TAIHOD used for this study include hospitalization data from the Army Individual Patient Data System and personnel records from the Defense Manpower Data Center which include demographic characteristics.

Active-duty soldiers, whether hospitalized in civilian or military facilities, receive a primary diagnosis [International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM)] and up to seven secondary diagnoses for a given hospitalization record. Injuries also receive additional codes indicating cause and place of injury using the NATO Standardized Agreement 2050 (STANAG). Unlike civilian injury cause coding (E-codes), the STANAG is comparatively comprehensive, using two separate variables to capture information on both intent and proximal cause (trauma code and injury code, respectively) [13,14].

Study design

The initial study population comprised all active-duty army soldiers hospitalized one or more times with a primary diagnosis of injury (ICD-9-CM 800–995) between 1 January 1980 and 31 December 2002. Patients presenting at an emergency room, or who died in the emergency room, but were not admitted for in-patient care, were not included for analysis. Injuries related to legal intervention and combat (identified using the STANAG trauma code) were excluded. We also excluded ethyl alcohol poisoning (ICD-9-CM 980.0) from our injury definition because of overlap with alcohol comorbidity. Other subcategories of poisoning were included.

We considered multiple hospitalizations as a single injury event when patients were admitted to one medical care facility and subsequently transferred to another facility for further treatment of the initial injury. Hospitalization records with complete transfer code data, and that occurred within 7 days of each other, were coded as transfers. In a few cases, because of missing or incomplete transfer codes, it was unclear whether a series of two or more hospitalizations were transfers or separate injury events. When soldiers had multiple qualifying injury hospitalization records occurring within a 2-day period with missing or ambiguous transfer data, the first hospitalization record was considered the initial visit and successive related records were considered transfers. Once transfer records were identified, a few remaining soldiers still had repeat injury events. In this case, one of the qualifying injury hospitalization events was selected randomly for analysis. Thus, an individual could not contribute multiple observations to the data set so potential bias was reduced and correlated error terms in multivariate models avoided. We did not determine whether a given injury event involved multiple injury types; we selected the primary injury diagnosis for analysis.

Measures

Demographic characteristics—Study population demographics included gender, age, education, marital status, rank and race. Age groups were based upon prior work indicating a non-linear association between age and alcohol consumption (< 21, 21–25, 26–30, 31–35, 36–

40 and > 40) [15]. We grouped enlisted soldiers by seniority: junior (E1–E4), mid-level (E5–E6) and senior (E7–E9). Officer ranks were combined for analysis due to small strata.

Alcohol comorbidity—An injury hospitalization was considered to have alcohol comorbidity when an alcohol-related diagnostic code appeared in a secondary diagnosis position of the initial injury hospitalization record, or an alcohol diagnosis appeared in any diagnostic position of the transfer hospital record. We combined all alcohol diagnoses because we could not determine whether those diagnosed with chronic abuse were acutely exposed to alcohol while presenting for medical care. We included alcohol diagnoses from six ICD categories: drugs/alcohol combination; alcohol psychosis; alcohol dependence syndrome; non-dependent alcohol abuse; chronic liver disease/cirrhosis; and other alcohol-related (details available from authors on request).

Injury cause—Using STANAG injury and trauma components, we identified injury causes that individually contributed $\geq 1\%$ of all the injuries in our population. These six most frequent causes of injury were: ingested poisoning (STANAG 700–709), excluding ethyl alcohol poisoning; sports (STANAG 200–239); driving personally owned motor vehicle (POV) [STANAG 100 (includes all privately owned vehicle crashes where injured person was the driver)]; driving any vehicle [STANAG 100 (passenger car driver), 105 (bicycle), 106 (motorcycle), 110 (military vehicle driver), 115 (military bicycle), 116 (military motorcycle)]; falls (STANAG 900–929); and non-combat-related assault [STANAG injury codes: 970–979 (fighting), or STANAG trauma code = 3 (intentional) with and injury cause code = 640–649, 560–569, 580–589, 590–599, or 980–989]. Combined, these causes accounted for 51% of all injuries in our data set.

Injury type—Injury type was classified according to the primary ICD-9-CM diagnosis between 800 and 995. Almost half (44%) of all injury diagnoses in our data set involved head or musculoskeletal injuries. We combined skull fractures (codes 800–805) and brain/concussion injuries (codes 850–854) to create a single Head Injury category. Similarly, we combined lower limb fractures (codes 820–829) and lower limb strains and sprains (codes 843–845) to create a single Lower Extremity Musculoskeletal Injury category.

Injury severity—Length of stay (LOS) was used as a surrogate measure for injury severity. LOS was calculated using hospital admission and discharge date, and included both initial and transfer hospitalizations where relevant.

Analyses

We analyzed, by alcohol comorbidity: study population demographics; the causes that contributed $\geq 1\%$ of all injury events; the 10 most common injury types among those with and without alcohol comorbidity; head injuries and musculoskeletal injuries; and injury severity. Logistic regression controlled for demographic characteristics and calculated risk estimates [odds ratios (OR)] associated with alcohol comorbidity for selected injury causes and types, relative to other injury causes and types. Mean LOS was compared by alcohol comorbidity and within certain specific injury causes and types.

Analyses were conducted in SAS, version 8.2 [16]. All analyses adhered to policies for the protection of human subjects as prescribed in Army Regulation 70–25, and with the provisions of 45 CFR 46. This study was approved by the Human Studies Research Review Board of the US Army Medical Research and Material Command.

RESULTS

Frequency of injuries

There were 211 790 hospitalization for injuries documented in the TAIHOD between 1 January 1980 and 31 December 2002. These included individuals who had ≥ 1 injury hospitalizations meeting inclusion criteria. Ninety per cent of individuals in the study population experienced only one injury hospitalization; 9% had two injury hospitalizations; and 1% had > 2 injury hospitalizations. Three per cent of injury hospitalizations involved a transfer.

Study population

Study population characteristics are shown in Table 1.

Alcohol comorbidity

Of the 211 790 injury hospitalizations, 4% had a secondary alcohol diagnosis at the initial visit. Of those with alcohol comorbidity at the initial visit, the majority (72.42%) had secondary diagnoses clearly indicating acute alcohol exposure; the remainder had diagnoses indicating possible chronic abuse, although many of these probably had acute alcohol exposure when admitted. Less than 1% (237) received alcohol-related diagnoses only when transferred (i.e. alcohol comorbidity was present only in the transfer record and not in the initial visit).

Study population characteristics by secondary alcohol diagnosis

Table 1 also shows the results of logistic regression models assessing the contribution of each patient characteristic to the likelihood of having alcohol comorbidity, controlling for the other demographics. Alcohol comorbidity was associated significantly with being male, older, unmarried, white, less-educated and lower-ranked.

Enlisted personnel were significantly more likely than commissioned officers to receive an alcohol diagnosis at the initial visit than at a transfer (OR = 6.40; 95% CI: 3.04–13.09) (data not shown). Conversely, injured commissioned officers were more likely than enlisted injured soldiers to have an alcohol diagnosis only in the transfer record and no alcohol diagnosis in the initial hospital record. Similarly, women were significantly more likely than men to have an alcohol diagnosis in the transfer visit only (OR = 2.23; 95% CI: 1.52–3.27) (data not shown).

Causes of injury by alcohol comorbidity

Table 2 compares six specific causes of injury to other injury causes by alcohol comorbidity, adjusting for demographics. Compared to other injury causes, alcohol comorbidity was associated with injuries resulting from ingesting poison, car crashes, falling and fighting and/or assault. Those without alcohol comorbidity were more likely to have sports injuries than injuries from other causes (Table 2).

Soldiers with poisoning injury ($n = 12\,672$) were significantly more likely to have alcohol comorbidity and were significantly more likely to be female, younger, less-educated, married and have lower rank, relative to soldiers with injuries from other causes. Soldiers with sports injuries ($n = 32\,659$) were significantly less likely to have alcohol comorbidity, and significantly more likely to be male, under age 41, better-educated, of higher rank, married, and a minority relative to soldiers with injuries from other causes. Soldiers injured as drivers of any type of vehicle ($n = 21\,806$) were significantly more likely to have alcohol comorbidity and significantly more likely to be male, younger, of higher rank and white, relative to soldiers with injuries from other causes. There were 11 003 soldiers in the subset of vehicular injuries that included only drivers of POVs. Controlling for demographics, soldiers with driving-POV-related injuries were significantly more likely to have alcohol comorbidity and significantly

more likely to be female, older (differences were only statistically significant for those aged 31–40), less-educated and non-white, relative to soldiers with injuries from other cause. Soldiers with fall-related injuries ($n = 25\,245$) were significantly more likely to have alcohol comorbidity and significantly more likely to be female, older, lower-ranked, single and white, relative to soldiers with injuries from other causes. Soldiers with injuries resulting from non-combat fights/assaults ($n = 17\,168$) were significantly more likely to have alcohol comorbidity than soldiers with injuries from other causes and were more likely to be male, younger, less-educated, single or no longer married, of lower rank and black (Table 2).

Injury types by alcohol comorbidity

Figure 1 shows the 10 most frequent injury types, and the distribution of alcohol comorbidity for each of the 10 types of injury. The most frequent injury type was brain injury (4.59% of all injuries), followed by ankle injuries (2.85% of all injuries). Alcohol comorbidity was more common among those with brain injury, concussion without coma and poisoning (10.63%, 7.42%, and 14.62%, respectively) and least commonly associated with sprains, knee dislocations and heat exhaustion (all < 1%).

Those with head injury ($n = 43\,766$), versus other types of injury, were significantly more likely to be male, younger, less-educated, single or no longer married, of lowest rank and white or Hispanic. Controlling for demographic covariates, soldiers with alcohol comorbidity were significantly more likely to have head injury than other injuries (OR = 1.70; 95% CI: 1.53–1.78) (Table 3).

Those with lower-extremity musculoskeletal injuries (48 282), compared to those with other injury types, were significantly more likely to be male and older. Education, rank and race were not associated strongly with risk for musculoskeletal injuries, relative to other injury types. Controlling for demographics, soldiers with alcohol comorbidity were significantly less likely to have lower-extremity musculoskeletal injuries (OR = 0.18; 95% CI: 0.16–0.20) (Table 3).

Injury severity by alcohol comorbidity

The average LOS for all injuries was 12.8 days (SD 30.66). Those with alcohol comorbidity had significantly shorter LOS (8.5 days; SD 28.30) than those without alcohol comorbidity (13.0 days; SD 30.75) ($P < 0.0001$). LOS varied by cause and type of injury and by alcohol comorbidity. By cause, those with alcohol comorbidity had shorter LOS for motor vehicle crashes ($P < 0.0001$, for both driving a personally owned vehicle and any vehicle), falls ($P < 0.005$) and fights/assaults ($P < 0.0001$), but longer LOS for poisonings ($P < 0.0001$). LOS was longer for sports injuries ($P = 0.2362$), but the difference was not statistically significant. By type of injury, those with alcohol comorbidity had shorter LOS for head injury ($P < 0.0001$), but longer for lower-extremity injuries ($P < 0.005$) (Table 4).

DISCUSSION

This report adds to a small and relatively recent literature on the relationship of alcohol to the nature of injury. This line of inquiry is important, because comparing alcohol involvement across injury cause, type and severity could enhance understanding of the behavioral and physical antecedents of various injuries and the biomechanics of trauma.

Our findings indicate that injured hospitalized US army soldiers with and without alcohol comorbidity differed with respect to demographic characteristics, causes and types of non-combat injury, and average LOS for injury treatment. Although demographics influence both alcohol use and the propensity to engage in specific activities, with varying levels of injury

risk, multivariate analyses indicated an independent relationship between alcohol comorbidity and injury cause and type. Our findings are consistent with those of some previous studies, but not others. Outcome variation underscores the need for further research to determine whether the associations between alcohol and injury cause, type and severity are valid and to explain these variations across studies.

Our study design was cross-sectional and descriptive and should be viewed as hypothesis generating rather than explanatory. Thus, our findings engender speculation. For example, the finding of an association between alcohol comorbidity and head injury may be a consequence of alcohol risk for falls [17], assaults [18] and vehicular crashes [19]. Conversely, this association could be an artifact of clinical protocols (e.g. selective toxicology screening when neurological damage is evident or suspected). We believe, however, that the association is not confounded. When Savola *et al.* studied a series of injured patients, all of whom were tested for alcohol, they also found an association between alcohol and head injury, relative to other injury types [5].

The association between alcohol comorbidity and ingested poisonings could be explained by alcohol risk for suicide [20], either by affecting psychological status and/or increasing the toxicity of the lethal agent (e.g. medications). Also, evident or suspected poisoning may initiate selective screening for alcohol and thus bias the alcohol/poisoning association. We note, however, that alcohol comorbidity was also associated with open wounds of the wrist, another indicator of suicidal behaviors.

Sports injuries may be less likely to involve alcohol simply because drinking is incompatible with many (but not all) athletic activities. Thus the reduced comparative risk of alcohol for sports injuries may explain the reduced comparative risk for lower-extremity musculoskeletal injuries. Post-sports drinking may increase the risk for falls, fighting or vehicular crashes.

Why alcohol comorbidity was associated with shorter LOS is unclear and warrants further study to assess hypotheses regarding the biomechanics of injury events. A possible explanation is that alcohol comorbidity was associated with high mortality rates following admission to hospital, thereby cutting short the LOS of injured patients. However, the total number of deaths in our sample was very small (< 1%) and those with alcohol comorbidity were less likely than those without to die in hospital (0.25% versus 0.54%).

It is particularly interesting that alcohol was associated with shorter LOS for head injuries. Those with alcohol comorbidity may have had less serious head injuries than those without. For example, alcohol comorbidity was associated with risk for same-level falls which could yield less-severe head injuries than those resulting from falls from heights. However, even when head injury cause is held constant, alcohol appears protective. Honkanen & Smith found that among emergency room patients presenting with head injuries from same-level falls, intoxicated patients were significantly less likely than sober head/brain-injured patients to require hospitalization [8]. Similarly, Albrecht-Anoschenko *et al.* found that among head-injured patients who had fallen down stairs, mortality was less likely among intoxicated patients than sober patients [6]. The association between shorter LOS and alcohol comorbidity is open to speculation. Those intoxicated might be more relaxed during the injury event or they may be hurt during more minor aspects of an activity, before they can engage in more dangerous acts.

Strengths and limitations

This study uses a very large data set, drawn from a diverse, physically fit and relatively young population, treated in many locales, and encompassing the entire active-duty army population over a 20-year period. Active-duty service members have total health care coverage permitting

virtually total capture of all hospitalization records. There is relatively little missing information on demographic characteristics. The ability to identify and link hospitalizations allows us to distinguish between repeat injury events and transfers to continue care for the same injury event. This is an important strength of this database, in that it prevents over-counting events, bias and statistical problems. Finally, the military STANAG cause coding system provides much more detailed and complete cause-of-injury data than those currently available in most civilian electronic hospital databases.

An important limitation of our study is that data came only from those hospitalized for injury. Thus, our findings cannot be generalized to all injury events. Moreover, our population was predominately male and young, thus generalizability of findings to other populations is unknown. Analyses of alcohol comorbidity as a risk for specific injury types and causes are relative to other injury types and causes. Thus, an $OR > 1$ for alcohol comorbidity means that other injury categories must have an $OR < 1$, but this does not mean that alcohol is not a risk for these other injury types and causes. For example, sports injuries were less likely than all other injury causes to be associated with alcohol comorbidity, but drinking is none the less a likely risk for sports injuries. Provider reluctance to screen or document alcohol comorbidity in women and officers could lead to under-counting alcohol exposure and bias with regard to associations between alcohol and demographics and the nature of injury (assuming that women and officers are at risk for different injuries than enlisted males). While these possible effects may be mitigated by the capture and linking of initial and transfer records, we cannot completely eliminate this potential confounder.

Our analyses could not distinguish between chronic and acute alcohol exposure. The diagnosis of alcohol comorbidity could indicate that the presenting patient evidenced: acute alcohol exposure with history of drinking problems; acute alcohol exposure, without history of drinking problems; or no acute exposure to alcohol, but a history of drinking problems. Accordingly, some individuals with alcohol comorbidity may have been sober at the time of the injury event. None the less, we assume that most of the time alcohol comorbidity signifies evidence of acute exposure. Moreover, the imprecision of the alcohol comorbidity diagnosis would weaken the relationship between alcohol and the outcomes we studied. Our findings were robust.

CONCLUSIONS

We conclude that alcohol comorbidity is specifically associated with injuries related to impairment and antisocial behavior.

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Figure 1.
Top 10 injury diagnoses and percentage with and without alcohol comorbidity

Table 1

Demographic characteristics of army soldiers hospitalized for injury, 1980–2002, total and stratified by presence of secondary alcohol diagnosis: adjusted odds of alcohol comorbidity, controlling for other demographics.

Characteristics	Total %	Secondary alcohol diagnosis		OR	95% CI
		Yes	No		
Gender [*]					
Male (<i>n</i> = 193 660)	91.44	4.5%	95.5%	1.13	1.04–1.22
Female (<i>n</i> = 18 036)	8.52	3.8%	96.2%	1.00	—
Age [†]					
< 21 (<i>n</i> = 62 486)	29.50	4.6	95.4%	0.44	0.35–0.55
21–25 (<i>n</i> = 83 336)	39.35	4.9%	95.1%	0.58	0.51–0.78
26–30 (<i>n</i> = 33 801)	15.96	3.8%	96.2%	0.63	0.51–0.78
31–35 (<i>n</i> = 17 891)	8.45	3.4%	96.6%	0.73	0.58–0.90
36–40 (<i>n</i> = 9358)	4.42	3.1%	96.9%	0.85	0.68–1.10
41+ (<i>n</i> = 4443)	2.10	2.6%	97.4%	1.00	—
Education [‡]					
< High school (<i>n</i> = 17 947)	8.47	6.0%	94.0%	1.98	1.75–2.25
High school (<i>n</i> = 166 306)	78.52	4.6%	95.6%	1.57	1.41–1.74
≥ Some college (<i>n</i> = 25 332)	11.95	1.9%	98.1%	1.00	—
Marital status [§]					
Married (<i>n</i> = 84 664)	39.98	3.7%	96.3%	1.00	—
Single (<i>n</i> = 120 484)	56.89	4.9%	95.1%	1.17	1.11–1.23
Separated, divorced or widowed (<i>n</i> = 4062)	1.92	5.5%	94.5%	1.49	1.29–1.71
Rank [¶]					
Junior enlisted, E1–E4 (<i>n</i> = 146 216)	69.04	5.1%	94.9%	7.66	5.85–10.03
Middle enlisted, E5–E6 (<i>n</i> = 42 353)	19.98	3.5%	96.5%	4.86	3.71–6.37
Senior enlisted, E7–E9 (<i>n</i> = 9404)	4.44	2.8%	97.2%	3.16	2.37–4.23
Warrant (<i>n</i> = 1888)	0.89	1.2%	98.8%	1.70	1.01–2.84
Officer (<i>n</i> = 11 912)	5.62	0.6%	99.4%	1.00	—
Race ^{**}					
White (<i>n</i> = 142 881)	67.46	4.8%	95.2%	1.51	1.43–1.59
Black (<i>n</i> = 51 194)	24.17	3.3%	96.7%	1.00	—
Hispanic (<i>n</i> = 8729)	4.12	4.5%	95.5%	1.40	1.25–1.57
Other (<i>n</i> = 8724)	4.12	4.8%	95.2%	1.47	1.31–1.64

^{*} 94 missing information on gender;

[†] 475 missing information on age;

[‡] 2205 missing information on education;

[§] 2580 missing information on marital status;

[¶] 39 missing information on rank;

^{**} 262 missing information on race.

Table 2

Alcohol and cause of injury—variation in role of alcohol as comorbidity for different causes of injury: the odds of alcohol comorbidity for selected causes of injury controlling for demographic characteristics, all army injury hospitalizations 1980–2002.

Characteristic	Poison OR (95% CI)	Sports OR (95% CI)	Driver private vehicle OR (95% CI)	Driver all vehicle OR (95% CI)	Falls OR (95% CI)	Fighting/assault OR (95% CI)
Alcohol comorbidity						
Yes	5.37 (5.08–5.67)	0.04 (0.04–0.06)	2.16 (2.01–2.32)	1.42 (1.33–1.51)	1.13 (1.06–1.20)	2.58 (2.44–2.73)
No	1.00	1.00	1.00	1.00	1.00	1.00
Gender						
Male	0.22 (0.21–0.23)	2.09 (1.98–2.20)	0.92 (0.86–0.99)	1.28 (1.21–1.36)	0.74 (0.71–0.78)	2.38 (2.20–2.58)
Female	1.00	1.00	1.00	1.00	1.00	1.00
Age						
< 21	1.93 (1.53–2.44)	1.20 (1.09–1.33)	0.93 (0.79–1.09)	1.14 (1.00–1.28)	0.44 (0.39–0.48)	1.52 (1.20–1.94)
21–25	1.18 (0.94–1.49)	1.50 (1.37–1.65)	1.06 (0.91–1.24)	1.29 (1.15–1.45)	0.41 (0.37–0.45)	1.72 (1.35–2.18)
26–30	1.07 (0.85–1.34)	1.54 (1.41–1.69)	0.88 (0.76–1.02)	1.12 (1.00–1.26)	0.48 (0.44–0.53)	1.53 (1.21–1.94)
31–35	1.08 (0.86–1.36)	1.50 (1.37–1.64)	0.85 (0.74–0.99)	1.02 (0.91–1.15)	0.56 (0.51–0.62)	1.31 (1.04–1.67)
36–40	1.13 (0.89–1.44)	1.30 (1.19–1.43)	0.83 (0.71–0.97)	1.02 (0.90–1.15)	0.65 (0.58–0.71)	1.33 (1.04–1.70)
41+	1.00	1.00	1.00	1.00	1.00	1.00
Education						
< High school	1.52 (1.36–1.69)	0.55 (0.51–0.59)	0.94 (0.84–1.06)	1.08 (1.00–1.17)	1.01 (0.94–1.09)	1.95 (1.78–2.14)
High school	1.14 (1.05–1.25)	0.82 (0.78–0.86)	1.12 (1.03–1.21)	1.10 (1.03–1.17)	0.95 (0.90–1.01)	1.26 (1.16–1.37)
≥ Some college	1.00	1.00	1.00	1.00	1.00	1.00
Marital status						
Married	1.00	1.00	1.00	1.00	1.00	1.00
Single	0.68 (0.65–0.72)	0.93 (0.90–0.96)	0.95 (0.90–1.00)	1.04 (1.00–1.08)	1.14 (1.10–1.17)	1.36 (1.31–1.42)
Separated, divorced or widowed	0.83 (0.72–0.96)	1.04 (0.96–1.14)	1.11 (0.97–1.27)	1.09 (0.98–1.20)	1.06 (0.96–1.17)	1.33 (1.16–1.52)
Rank						
Junior enlisted, E1–E4	4.02 (3.32–4.89)	0.44 (0.41–0.47)	0.88 (0.78–1.00)	0.97 (0.88–1.06)	1.66 (1.52–1.81)	4.39 (3.65–5.28)
Middle enlisted, E5–E6	2.31 (1.90–2.80)	0.55 (0.52–0.58)	1.13 (1.00–1.28)	1.37 (1.25–1.50)	1.31 (1.20–1.43)	2.96 (2.46–3.57)
Senior enlisted, E7–E9	2.00 (1.60–2.51)	0.61 (0.56–0.66)	1.12 (0.97–1.30)	1.37 (1.23–1.53)	1.23 (1.12–1.36)	2.06 (1.66–2.57)
Warrant	1.05 (0.65–1.71)	0.66 (0.58–0.75)	0.87 (0.66–1.15)	1.26 (1.05–1.51)	1.15 (0.97–1.36)	1.11 (0.71–1.75)
Officer	1.00	1.00	1.00	1.00	1.00	1.00
Race						
White	1.00	1.00	1.00	1.00	1.00	1.00
Black	0.99 (0.95–1.04)	1.90 (1.85–1.96)	1.33 (1.27–1.39)	0.80 (0.77–0.82)	0.68 (0.66–0.70)	1.19 (1.14–1.23)
Hispanic	0.99 (0.90–1.09)	1.08 (1.02–1.15)	1.24 (1.13–1.37)	0.87 (0.81–0.94)	0.95 (0.89–1.02)	1.07 (0.99–1.16)
Other	0.95 (0.86–1.05)	1.07 (1.00–1.14)	1.01 (0.97–1.27)	0.82 (0.76–0.88)	0.93 (0.87–0.99)	1.13 (1.04–1.22)

Table 3

Alcohol and type of Injury—variation in role of alcohol as comorbidity for different types of injury: the odds of alcohol comorbidity among soldiers with head injury versus other injury and for lower-extremity injuries versus other injuries controlling for demographic characteristics, all army injury hospitalizations 1980–2002.

Characteristics	Head injury		Lower-extremity injury	
	OR	95% CI	OR	95% CI
Alcohol comorbidity				
Yes	1.70	1.53–1.78	0.18	0.16–0.20
No	1.00	—	1.00	—
Gender				
Male	1.32	1.26–1.38	1.37	1.32–1.43
Female	1.00	—	1.00	—
Age				
< 21	1.45	1.31–1.61	0.69	0.64–0.75
21–25	1.47	1.33–1.63	0.84	0.78–0.91
26–30	1.27	1.15–1.40	0.99	0.92–1.06
31–35	1.08	0.98–1.20	1.07	0.99–1.15
36–40	0.99	0.89–1.11	1.06	0.98–1.15
41+	1.00	—	1.00	—
Education				
< High school	1.09	1.03–1.15	0.77	0.73–0.82
High school	0.96	0.91–1.00	0.96	0.92–1.00
≥ Some college	1.00	—	1.00	—
Marital status				
Married	1.00	—	1.00	—
Single	1.24	1.21–1.28	1.06	1.04–1.09
Separated, divorced or widowed	1.14	1.05–1.24	1.04	0.96–1.12
Rank				
Junior enlisted, E1–E4	1.24	1.15–1.33	0.59	0.56–0.63
Middle enlisted, E5–E6	1.19	1.11–1.28	0.70	0.66–0.74
Senior enlisted, E7–E9	1.07	0.98–1.17	0.82	0.76–0.88
Warrant	1.21	1.04–1.41	0.82	0.76–0.88
Officer	1.00	—	1.00	—
Race				
White	1.14	1.11–1.17	0.96	0.93–0.98
Black	1.00	—	1.00	—
Hispanic	1.13	1.07–1.21	0.97	0.92–1.02
Other	1.08	1.02–1.15	0.96	0.90–1.01

Table 4
Length of stay by cause and major type of injury for those with and without secondary alcohol diagnoses among army soldiers hospitalized for injury, 1980–2002.

Injury category	Secondary alcohol diagnosis		No secondary alcohol diagnosis		P-value	Total days
	Mean days	Total Days	Mean days	Total days		
All causes and types	8.5	79 257	13.0	2 635 460		< 0.0001
Poison ingestion	7.6	15 808	5.96	63 162		< 0.0001
Sports	21.0	1470	12.7	412 526		0.2362
Driver of personally owned vehicle	10.2	9429	18.0	181 671		< 0.0001
Driver of any vehicle	11.1	14 388	20.0	405 090		< 0.0001
Falls	10.3	13 031	14.1	339 065		0.0007
Fighting/assault	4.9	8678	12.7	195 413		< 0.0001
Head injury	9.1	26 368	15.3	623 980		< 0.0001
Lower extremity injury	29.6	13 831	20.5	981 452		0.0009