HHS Public Access

Author manuscript

Psychiatr Serv. Author manuscript; available in PMC 2018 January 01.

Published in final edited form as:

Psychiatr Serv. 2017 January 01; 68(1): 48–55. doi:10.1176/appi.ps.201500290.

Prevalence of Alcohol Misuse and Follow-Up Care in a National Sample of OEF/OIF VA Patients With and Without TBI

Joel Grossbard, Ph.D.,
Department of Veterans Affairs (VA) Center of Excellence in Substance Abuse Treatment and Education, Puget Sound Health Care System, Seattle

Carol A. Malte, M.S.W.,
Department of Veterans Affairs (VA) Center of Excellence in Substance Abuse Treatment and Education, Puget Sound Health Care System, Seattle

Gwen Lapham, Ph.D., M.S.W.,
Group Health Research Institute, Seattle

Kathleen Pagulayan, Ph.D.,
Department of Psychiatry and Behavioral Sciences, University of Washington, Seattle

Aaron P. Turner, Ph.D.,
Department of Veterans Affairs (VA) Center of Excellence in Substance Abuse Treatment and Education, Puget Sound Health Care System, Seattle

Department of Rehabilitation Medicine, University of Washington, Seattle

Anna D. Rubinsky, Ph.D., M.S.,
Department of Veterans Affairs (VA) Center of Excellence in Substance Abuse Treatment and Education, Puget Sound Health Care System, Seattle

Seattle Center of Innovation for Veteran-Centered and Value-Driven Care, VA Health Services Research and Development (HSR&D), Seattle

Katharine A. Bradley, M.D., M.P.H.,
Group Health Research Institute, Seattle

Department of Health Services, University of Washington, Seattle

Andrew J. Saxon, M.D., and
Department of Veterans Affairs (VA) Center of Excellence in Substance Abuse Treatment and Education, Puget Sound Health Care System, Seattle

Department of Psychiatry and Behavioral Sciences, University of Washington, Seattle

Eric J. Hawkins, Ph.D.
Department of Veterans Affairs (VA) Center of Excellence in Substance Abuse Treatment and Education, Puget Sound Health Care System, Seattle

correspondence to Dr. Hawkins (eric.hawkins@va.gov).

Dr. Saxon reports receiving royalty payment as a section editor for UpToDate. The other authors report no financial relationships with commercial interests.

Department of Psychiatry and Behavioral Sciences, University of Washington, Seattle

Abstract

Objective—Information on prevalence and management of alcohol misuse among Afghanistan and Iraq veterans with traumatic brain injury (TBI) is limited. This study compared rates of alcohol misuse and follow-up care—brief intervention (BI) and addiction treatment—among Afghanistan and Iraq veterans with and without TBI receiving care from the Department of Veterans Affairs (VA).

Methods—The sample included veterans ages 18 and older screened with the Alcohol Use Disorders Identification Test alcohol consumption questions (AUDIT-C) in 2012 who received VA health care in the prior year (N=358,417). Overall and age-specific estimates of alcohol misuse (AUDIT-C score ≥5) were compared for men and women with and without TBI by logistic regression. BI and addiction treatment after screening were compared between groups by using multivariable logistic regression.

Results—Alcohol misuse was higher among men with TBI than among men without TBI (20.3%, 95% confidence interval [CI]=19.9–20.8, versus 16.4%, CI=16.3–16.6) and among women with TBI than among women without TBI (6.8%, CI = 5.8–8.1, versus 5.6%, CI=5.4–5.8); younger (age <30) patients with TBI had the highest rates. BI rates did not differ by TBI status (76.4%–80.2%). Addiction treatment rates for those with severe misuse were higher among those with TBI (men, 20.0%, CI=18.4–21.6, versus 15.4%, CI=14.9–15.9; women, 36.6%, CI=21.8–51.3, versus 21.1%, CI=18.2–24.0).

Conclusions—Alcohol misuse is common among Iraq and Afghanistan veterans with TBI, particularly young men. BI rates were high and did not vary by TBI status, although addiction treatment rates were higher among patients with TBI than among those without TBI.

Up to 40% of veterans of the conflicts in Afghanistan (Operation Enduring Freedom [OEF]) and Iraq (Operation Iraqi Freedom [OIF]) who are enrolled in the Department of Veterans Affairs (VA) health care system screen positive for alcohol misuse (1,2), which covers the spectrum from risky drinking to alcohol use disorder (3). Alcohol misuse affects health through direct harms on acute and chronic conditions and associations with self-care behaviors for conditions such as traumatic brain injury (TBI) (4–6).

Approximately 10%–15% of OEF/OIF veterans have sustained at least one TBI during their deployments (7,8), a significant percentage of whom report persisting post-concussive symptoms, even years postinjury (9,10). Most OEF/OIF patients with TBI have a comorbid psychiatric diagnosis (11) or chronic pain (9,12). Such conditions may increase risk of alcohol misuse, although prior research yielded inconsistent findings on the relationship between TBI and alcohol misuse. Two studies have found higher rates of alcohol misuse among OEF/OIF military personnel with TBI compared with those without TBI (13,14). Other research has found no association between postdeployment alcohol misuse and TBI after adjustment for posttraumatic stress disorder (PTSD) symptoms (15,16).

Alcohol use is associated with numerous negative outcomes among patients with TBI and, even in limited quantities, may impair recovery from TBI (7,17,18). TBI and alcohol misuse

are each individually associated with changes in brain structure and reduced cognitive abilities (19,20). Alcohol misuse, including heavy episodic drinking (six or more drinks on one occasion) (21), among younger veterans with TBI is concerning because heavy episodic drinking may adversely affect neurocognitive development (22). Further, alcohol misuse can increase the risk of recurrent TBI (23,24). Emerging evidence suggests that TBI is associated with greater risk of developing an alcohol use disorder (15,16). These findings suggest that early detection and intervention targeting alcohol misuse among veterans with TBI may promote postinjury recovery and prevention of chronic alcohol problems.

Alcohol screening and brief intervention (BI) are recommended by the U.S. Preventive Services Task Force (25) and deemed the third highest prevention priority for adults (26). BIs as brief as five to 15 minutes consisting of advice to drink within recommended limits reduce alcohol use (27). The VA implemented alcohol screening in 2003 and has since required annual administration of the Alcohol Use Disorders Identification Test alcohol consumption questions (AUDIT-C) to screen outpatients. In 2008, the VA implemented performance incentives and disseminated an electronic reminder to prompt providers to offer BI for outpatients who screen positive for alcohol misuse with AUDIT-C scores ≥5 (28). Further, the *VA/DoD Clinical Practice Guideline for Management of Substance Use Disorders* recommends that clinicians offer treatment referral to patients who have a diagnosis of or are at higher risk of (AUDIT-C score ≥8) an alcohol use disorder (29). Among OEF/OIF veterans with alcohol misuse identified by screening, 70%–80% had BI and 20%–40% were referred for addiction treatment (1,2). However, rates of subsequent attendance at addiction specialty care are unknown.

Rates of alcohol misuse and TBI are high among OEF/OIF veterans, and in combination, these conditions are associated with poorer medical, neurobehavioral, and life satisfaction outcomes (30). Although alcohol screening and BI for patients with TBI may reduce trauma recidivism and alcohol-related problems, results from a recent study among trauma centers suggest diminished effects among patients with TBI compared with those without TBI (31). To our knowledge, no study has examined the prevalence of alcohol misuse and documented follow-up care for alcohol misuse–BI and addiction treatment–among OEF/OIF VA patients with and without TBI. This study used national VA health care utilization data to estimate the gender-specific prevalence of alcohol misuse and heavy episodic drinking among OEF/OIF VA patients with and without TBI. Among OEF/OIF VA patients with alcohol misuse, the study also estimated and compared the gender-specific prevalence of documented BI and addiction treatment attendance for those with and without TBI. This information could help identify gaps in the delivery of care for this high-risk population.

METHODS

Data Source and Study Sample

This study used data from the VA Corporate Data Warehouse (CDW), a national data repository that includes clinical and administrative data for VA patients seen at all VA facilities, including patient-level data on demographic factors, clinical diagnoses, and alcohol screening and BI documented in the electronic medical record (EMR). Study

approval was obtained from the VA Puget Sound Health Care System Institutional Review Board.

Veterans ages 18 and older were eligible for study inclusion if they received alcohol screening with the AUDIT-C questionnaire in 2012, had documented OEF/OIF service determined by an OEF/OIF patient record flag available through the VA Decision Support System, and used outpatient or inpatient VA services (one or more visits) in the year before the date of the AUDIT-C.

Outcome Measures

Alcohol screening—Alcohol use was defined by scores on the AUDIT-C, a validated three-item screen for alcohol misuse (32–35). AUDIT-C items assess the frequency and quantity of typical drinking and the frequency of heavy episodic drinking. [A list of AUDIT-C items is included in an online supplement to this article.] AUDIT-C scores range from 0 to 12, with higher scores indicating greater severity (36,37). VA providers are prompted by an electronic reminder in the EMR to administer the AUDIT-C to all patients annually. VA provides incentives for administering BI for patients with AUDIT-C scores ≥5 to minimize the clinical burden of providing BI for false-positive screens. Therefore, AUDIT-C scores ≥5 were used as our dichotomous measure of any alcohol misuse.

To facilitate interpretation of AUDIT-C scores, the scores were categorized into four risk groups (37): nondrinkers (score of 0), low-level drinkers (score of 1–4), moderate alcohol misuse (score of 5–7), and severe alcohol misuse (score of 8–12). AUDIT-C item 3 was used to assess heavy episodic drinking, defined as reporting six or more drinks on a single occasion at least monthly.

Documented BI—Since 2008, documentation of BI, consisting of alcohol-related advice and feedback on health consequences of drinking, has been facilitated by a national electronic reminder in VA's EMR and is expected for outpatients who screen positive for alcohol misuse (AUDIT-C score ≥5) (28,38). We identified BI documented with the electronic reminder by using text data elements called "health factors" (HFs). HFs are generated when an electronic reminder is used to document VA care and can be extracted from the CDW. Although the BI electronic reminder is mandated nationally, facilities could edit HFs locally. We identified HFs reflecting advice or counseling regarding alcohol use in the 30 days before or after a positive screen and combined them into a single dichotomous measure of documented BI. Because the BI electronic reminder typically requires documentation of both advice and feedback, this measure was expected to be a good proxy for BI (38). A period before the alcohol screen date was included to accommodate various alcohol screening strategies employed in VA clinics. For example, some clinics administer screening questionnaires in a paper-and-pencil format during patient visits and enter questionnaire data into the medical record at a later date.

Documented addiction treatment attendance—Data on addiction treatment attendance in the VA was obtained by using outpatient clinic stop codes and defined as documented attendance at one or more visits in a VA addiction treatment clinic during the 90

days following the date of a positive screen. This measure did not include follow-up care for alcohol misuse in non-VA facilities.

Predictors and Covariates

TBI diagnostic status—Patients were classified as having TBI if an appropriate *ICD-9-CM* diagnosis was documented in the EMR between 365 days before and 30 days after the alcohol screen date. These *ICD-9-CM* codes (310.2, 800.00–800.99, 801.00–801.99, 803.00–803.99, 804.00–804.99, 850.00–850.99, 851.00–854.19, 905.0, 907.0, 950.1–950.3, 959.01, 959.09, and V15.52) are used by the VA for TBI surveillance (39,40). TBIs that were diagnosed outside the VA and not documented in the VA EMR were not captured in this study. We included a 30-day window following the alcohol screen date to ensure inclusion of patients who screened positive on the TBI electronic reminder at the time of alcohol screening but needed to complete the VA-mandated TBI comprehensive evaluation to determine whether they met diagnostic criteria for TBI (41).

Patient characteristics and medical facility—Covariates associated with the prevalence of alcohol misuse and TBI (42,43) and available from the CDW were selected. Sociodemographic factors included age, gender, marital status, race, ethnicity, and VA disability compensation. Clinical characteristics included psychiatric and substance use disorders (current and in remission), tobacco use disorder, and pain diagnoses based on *ICD-9-CM* codes documented between 365 days before and 30 days after the alcohol screen date. A variable noting the VA facility where screening occurred (of 138 medical facilities nationwide) was also included.

Data Analyses

All analyses were performed separately for men and women, because gender is associated with alcohol misuse. Descriptive statistics were generated for demographic and clinical characteristics of OEF/OIF patients with and without TBI. Unadjusted rates of alcohol use (AUDIT-C categories) and heavy episodic drinking were estimated among patients with and without TBI. Logistic regression was used to estimate age-specific (<30, 30–39, and ≥40) prevalence (95% confidence intervals [CIs]) of alcohol misuse (AUDIT-C score of ≥5), severe alcohol misuse (AUDIT-C score of ≥8), and heavy episodic drinking among patients with and without TBI. Unadjusted and adjusted logistic regression models including patients who screened positive for any alcohol misuse (AUDIT-C ≥5) and severe misuse (AUDIT-C ≥8) were used to compare documented receipt of BI and addiction treatment for patients with and without TBI. Covariates included in adjusted models were age, race, ethnicity, marital status, VA disability compensation, substance use and psychiatric disorders, and pain diagnosis. Medical facility was included as a grouping variable to account for intragroup correlation at the facility level.

RESULTS

Patient Characteristics

We identified 358,147 OEF/OIF VA patients (13.2% were women) eligible for this study, and of those 8.4% (N=30,197) had a documented TBI diagnosis (3.9% of women and 9.1%

of men). Most women and men with TBI were white and non-Hispanic (Table 1). The most common psychiatric disorders among women and men with TBI were PTSD and depression, and over 80% of women and men with TBI had a pain diagnosis.

Compared with patients without TBI, those with TBI were younger (age <30) and more likely to have ≥50% VA disability and psychiatric disorders and pain diagnoses ($p<.01$ for all). Women and men with TBI were approximately twice as likely as those without TBI to have an alcohol use disorder ($p<.01$) or a drug use disorder ($p<.01$). Most patients screened negative for alcohol misuse (AUDIT-C ≤5), regardless of TBI status. Rates of abstinence (AUDIT-C score of 0) were higher among women and men with TBI compared with those without TBI ($p<.01$).

Prevalence of Alcohol Misuse and Heavy Episodic Drinking

The overall prevalence of alcohol misuse (AUDIT-C ≥5) among women with TBI was 6.8% (CI=5.8–8.1) compared with 5.6% (CI=5.4–5.8) among women without TBI ($p<.05$). Among men, rates of alcohol misuse for those with and without TBI were 20.3% (CI=19.9–20.8) and 16.4% (CI=16.3–16.6), respectively ($p<.001$).

Age-specific estimates of alcohol misuse among women did not differ between those with and without TBI in any age group (Table 2). Estimates of heavy episodic drinking were significantly higher only among women ages 30–39 with TBI compared with those without TBI ($p<.05$). Among men, age-specific estimates of alcohol misuse and heavy episodic drinking were greater among those with TBI compared with those without TBI in each age group ($p<.001$). The prevalence of heavy episodic drinking and alcohol misuse was highest among both women and men younger than 30 with TBI.

Prevalence of Documented BI and Addiction Treatment

Table 3 presents unadjusted rates of documented BI and addiction treatment attendance. Among women with moderate and severe alcohol misuse, the unadjusted prevalence of BI was between 73% and 80% for those with and without TBI and did not significantly differ between groups. Similarly, in adjusted analyses (data not shown), rates of BI did not significantly differ between women with and without TBI. Among men with moderate and severe alcohol misuse, the unadjusted prevalence of BI was between 78% and 80% for those with and without TBI and did not significantly differ between groups. Consistent with findings for women, adjusted rates of BI for men with TBI and men without TBI did not significantly differ (data not shown).

Among both women and men, the highest rate of addiction treatment attendance was for those with TBI who screened positive for severe alcohol misuse; 36.6% of women and 20.0% of men had documented addiction treatment. Adjusted estimates of addiction treatment attendance were similar to unadjusted estimates, with higher rates of attendance observed for men and women with TBI compared with men ($p<.001$) and women ($p<.05$) without TBI (data not shown).

DISCUSSION

This study used national VA health care utilization data to compare the prevalence of alcohol misuse, documented BI, and VA addiction treatment among OEF/OIF veterans with and without TBI. Our results indicate that alcohol misuse was common among OEF/OIF veterans with TBI, especially men, with 20% of men and 7% of women with TBI screening positive for alcohol misuse. The risk of screening positive for alcohol misuse was highest among younger men and women (age <30). The prevalence of documented BI for OEF/OIF men and women who screened positive was high (70% – 80%), regardless of TBI status. However, for men and women who screened positive, rates of documented VA addiction treatment were higher among TBI patients compared with those without TBI. Among those with severe alcohol misuse and TBI, approximately one in five men and one in three women attended one or more addiction treatment visits in the 90 days after their alcohol screen.

Consistent with prior studies of OEF/OIF veterans (11,44), this study found disproportionately high rates of concomitant pain and psychiatric and substance use disorders among men and women with TBI compared with those without TBI. Because most TBI patients had a PTSD or pain diagnosis, the higher estimates of VA addiction treatment for those with TBI may reflect more severe psychiatric comorbidity and greater use of VA health care services more generally. Given the small number of OEF/OIF women with both TBI and alcohol misuse, results for this group should be interpreted with caution. Nonetheless, this is the first study to report rates of VA addiction treatment attendance after alcohol screening among OEF/OIF veterans with and without TBI. Future research should assess these patients' engagement in VA addiction treatment through documentation of subsequent visits over a longer period.

Early recognition and management of alcohol misuse among young veterans with TBI are critical given research suggesting that alcohol use may impair neurologic recovery and magnify cognitive deficits among TBI patients (42). Although this study showed that alcohol use was common among OEF/OIF patients with TBI, it is important to note that 41% of women and 31% of men with TBI were abstinent from alcohol in the prior year. Although alcohol use may initially decline after injury, many people resume drinking at later periods (4,45). Examining changes in drinking in the context of TBI is beyond the scope of this study; however, the notably high rates of abstinence are encouraging. Studies are needed to evaluate how changes in drinking, including resolution of alcohol misuse, affect veterans' recovery from TBI.

Although it is critical that veterans with TBI and alcohol misuse receive timely assessment and symptom management, their treatment needs are poorly understood. It is unclear whether alcohol screening and BI methods need to be adapted to the cognitive deficits associated with TBI (46,47). One study found that the effectiveness of an alcohol BI to reduce hazardous drinking among trauma patients was significantly lower among patients with TBI than among those without TBI (31). Because previous evaluations of alcohol screening and BI have systematically neglected patients with more severe TBI symptoms, further research is needed to assess TBI patients' responsiveness to alcohol BI (48). Prospective studies are also needed to better understand short- and long-term health

outcomes among patients with alcohol misuse and TBI and psychiatric comorbidity, including suicide risk. In the general population, the risk of death by suicide for individuals with both TBI and alcohol misuse has been reported as being four times higher than among individuals without these conditions (49,50). Information on TBI and alcohol misuse and their association with psychiatric comorbidity and suicide risk among OEF/OIF women and men could inform delivery of targeted screening and intervention strategies for this important group of veterans.

This study had some limitations. The study used alcohol data for screening and follow-up care for alcohol misuse documented in VA patients' EMR. Prior research suggests that patients report higher rates of alcohol misuse on confidential surveys (9), and thus our results may underestimate the prevalence of alcohol misuse. Results of our analyses relied on documentation of BI without any assessment of the fidelity or quality of the intervention. Because medical facilities could modify HFs, we may not have identified all BI-related HFs; furthermore, some BIs may have been documented without HFs. In addition, this study relied on VA data, and thus any screening and follow-up interventions that occurred in non-VA care were not considered in the analyses. Nevertheless, this study describes alcohol screening and BI documented in patients' EMRs and available to clinicians, and we expect most BIs were documented with electronic reminders that generate HFs to ensure that medical facilities met performance measure requirements. Our analyses did not take into account either the time between TBI and alcohol screening or levels of TBI severity and their association with alcohol misuse. Because this study only captured *ICD-9* TBI diagnoses documented in the VA EMR within one year of the alcohol screen date, our results may have underidentified the prevalence of TBI.

CONCLUSIONS

Findings indicate that alcohol misuse and psychiatric problems were prevalent among OEF/OIF VA patients with TBI. The risk of alcohol misuse was found to be particularly high among younger women and men. It is encouraging that most patients who screened positive for alcohol misuse had documented BI, regardless of a TBI diagnosis. A significant minority of patients who screened positive did not have BI, and most patients with severe alcohol misuse did not attend VA addiction treatment in the 90 days following screening. Timely recognition and management of alcohol misuse among OEF/OIF veterans with TBI are critical to support reintegration and recovery and reduce the health burden of these conditions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

The research reported here was supported by VA Polytrauma and Blast-Related Injury Quality Enhancement Research Initiative (QLP 56-007), Veterans Health Administration; by the VA Center of Excellence in Substance Abuse Treatment and Education; by the National Institute on Alcohol Abuse and Alcoholism (grant 1R21AA02894-01A1); and by VA Clinical Sciences R&D Career Development Award Program (IK2 CX000516).

These organizations had no further role in study design; in the collection, analysis and interpretation of data; in the writing of the report; or in the decision to submit the manuscript for publication.

References

1. Grossbard JR, Hawkins EJ, Lapham GT, et al. Follow-up care for alcohol misuse among OEF/OIF veterans with and without alcohol use disorders and posttraumatic stress disorder. Journal of Substance Abuse Treatment. 2013; 45:409–415. [PubMed: 23906670]
2. Hawkins EJ, Lapham GT, Kivlahan DR, et al. Recognition and management of alcohol misuse in OEF/OIF and other veterans in the VA: a cross-sectional study. Drug and Alcohol Dependence. 2010; 109:147–153. [PubMed: 20167440]
3. Whitlock EP, Polen MR, Green CA, et al. Behavioral counseling interventions in primary care to reduce risky/harmful alcohol use by adults: a summary of the evidence for the US Preventive Services Task Force. Annals of Internal Medicine. 2004; 140:557–568. [PubMed: 15068985]
4. Bombardier CH, Temkin NR, Machamer J, et al. The natural history of drinking and alcohol-related problems after traumatic brain injury. Archives of Physical Medicine and Rehabilitation. 2003; 84:185–191. [PubMed: 12601648]
5. Opreanu RC, Kuhn D, Basson MD. Influence of alcohol on mortality in traumatic brain injury. Journal of the American College of Surgeons. 2010; 210:997–1007. [PubMed: 20510810]
6. Ponsford J, Tweedly L, Lee N, et al. Who responds better? Factors influencing a positive response to brief alcohol interventions for individuals with traumatic brain injury. Journal of Head Trauma Rehabilitation. 2012; 27:342–348. [PubMed: 22955099]
7. Hoge CW, McGurk D, Thomas JL, et al. Mild traumatic brain injury in US soldiers returning from Iraq. New England Journal of Medicine. 2008; 358:453–463. [PubMed: 18234750]
8. Terrio H, Brenner LA, Ivins BJ, et al. Traumatic brain injury screening: preliminary findings in a US Army brigade combat team. Journal of Head Trauma Rehabilitation. 2009; 24:14–23. [PubMed: 19158592]
9. Lew HL, Otis JD, Tun C, et al. Prevalence of chronic pain, posttraumatic stress disorder, and persistent postconcussive symptoms in OIF/OEF veterans: polytrauma clinical triad. Journal of Rehabilitation Research and Development. 2009; 46:697–702. [PubMed: 20104399]
10. Morissette SB, Woodward M, Kimbrel NA, et al. Deployment-related TBI, persistent postconcussive symptoms, PTSD, and depression in OEF/OIF veterans. Rehabilitation Psychology. 2011; 56:340–350. [PubMed: 22121940]
11. Heltemes KJ, Dougherty AL, MacGregor AJ, et al. Alcohol abuse disorders among US service members with mild traumatic brain injury. Military Medicine. 2011; 176:147–150. [PubMed: 21366075]
12. Taylor BC, Hagel EM, Carlson KF, et al. Prevalence and costs of co-occurring traumatic brain injury with and without psychiatric disturbance and pain among Afghanistan and Iraq war veteran VA users. Medical Care. 2012; 50:342–346. [PubMed: 22228249]
13. Rona RJ, Jones M, Fear NT, et al. Mild traumatic brain injury in UK military personnel returning from Afghanistan and Iraq: cohort and cross-sectional analyses. Journal of Head Trauma Rehabilitation. 2012; 27:33–44. [PubMed: 22241066]
14. Adams RS, Larson MJ, Corrigan JD, et al. Frequent binge drinking after combat-acquired traumatic brain injury among active duty military personnel with a past year combat deployment. Journal of Head Trauma Rehabilitation. 2012; 27:349–360. [PubMed: 22955100]
15. Polusny MA, Kehle SM, Nelson NW, et al. Longitudinal effects of mild traumatic brain injury and posttraumatic stress disorder comorbidity on postdeployment outcomes in National Guard soldiers deployed to Iraq. Archives of General Psychiatry. 2011; 68:79–89. [PubMed: 21199967]
16. Miles SR, Graham DP, Teng EJ. Examining the influence of mild traumatic brain injury and posttraumatic stress disorder on alcohol use disorder in OEF/OIF veterans. Military Medicine. 2015; 180:45–52. [PubMed: 25562857]
17. Heltemes KJ, Holbrook TL, Macgregor AJ, et al. Blast-related mild traumatic brain injury is associated with a decline in self-rated health amongst US military personnel. Injury. 2012; 43:1990–1995. [PubMed: 21855064]

18. Adams RS, Corrigan JD, Larson MJ. Alcohol use after combat-acquired traumatic brain injury: what we know and don't know. Journal of Social Work Practice in the Addictions. 2012; 12:28–51. [PubMed: 22485074]
19. Shu IW, Onton JA, O'Connell RM, et al. Combat veterans with comorbid PTSD and mild TBI exhibit a greater inhibitory processing ERP from the dorsal anterior cingulate cortex. Psychiatry Research. 2014; 224:58–66. [PubMed: 25150386]
20. Jorge RE. Neuropsychiatric consequences of traumatic brain injury: a review of recent findings. Current Opinion in Psychiatry. 2005; 18:289–299. [PubMed: 16639154]
21. Bradley KA, McDonell MB, Bush K, et al. The AUDIT alcohol consumption questions: reliability, validity, and responsiveness to change in older male primary care patients. Alcoholism, Clinical and Experimental Research. 1998; 22:1842–1849.
22. Mashhoon Y, Czerkawski C, Crowley DJ, et al. Binge alcohol consumption in emerging adults: anterior cingulate cortical "thinness" is associated with alcohol use patterns. Alcoholism, Clinical and Experimental Research. 2014; 38:1955–1964.
23. Winqvist S, Luukinen H, Jokelainen J, et al. Recurrent traumatic brain injury is predicted by the index injury occurring under the influence of alcohol. Brain Injury. 2008; 22:780–785. [PubMed: 18787988]
24. Corrigan JD. Substance abuse as a mediating factor in outcome from traumatic brain injury. Archives of Physical Medicine and Rehabilitation. 1995; 76:302–309. [PubMed: 7717829]
25. Jonas DE, Garbutt JC, Amick HR, et al. Behavioral counseling after screening for alcohol misuse in primary care: a systematic review and meta-analysis for the US Preventive Services Task Force. Annals of Internal Medicine. 2012; 157:645–654. [PubMed: 23007881]
26. Solberg LI, Maciosek MV, Edwards NM. Primary care intervention to reduce alcohol misuse ranking its health impact and cost effectiveness. American Journal of Preventive Medicine. 2008; 34:143–152. [PubMed: 18201645]
27. Helping Patients, Who, Drink Too, Much. A Clinician's Guide. Bethesda, Md: National Institute on Alcohol Abuse and Alcoholism; 2007.
28. Lapham GT, Achtmeyer CE, Williams EC, et al. Increased documented brief alcohol interventions with a performance measure and electronic decision support. Medical Care. 2012; 50:179–187. [PubMed: 20881876]
29. VA/DoD Clinical Practice Guideline for Management of Substance Use Disorders, Version 3. Washington, DC: Management of Substance Use Disorders Work Group, US Department of Veteran Affairs & US Department of Defense; 2015.
30. Olson-Madden JH, Brenner LA, Matarazzo BB, et al. Identification and treatment of TBI and co-occurring psychiatric symptoms among OEF/OIF/OND veterans seeking mental health services within the State of Colorado: establishing consensus for best practices. Community Mental Health Journal. 2013; 49:220–229. [PubMed: 23325070]
31. Zatzick D, Donovan DM, Jurkovich G, et al. Disseminating alcohol screening and brief intervention at trauma centers: a policyrelevant cluster randomized effectiveness trial. Addiction. 2014; 109:754–765. [PubMed: 24450612]
32. Bradley KA, Bush KR, Epler AJ, et al. Two brief alcohol-screening tests from the Alcohol Use Disorders Identification Test (AUDIT): validation in a female Veterans Affairs patient population. Archives of Internal Medicine. 2003; 163:821–829. [PubMed: 12695273]
33. Bradley KA, DeBenedetti AF, Volk RJ, et al. AUDIT-C as a brief screen for alcohol misuse in primary care. Alcoholism, Clinical and Experimental Research. 2007; 31:1208–1217.
34. Bush K, Kivlahan DR, McDonell MB, et al. The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. Ambulatory Care Quality Improvement Project (ACQUIP) Alcohol Use Disorders Identification Test. Archives of Internal Medicine. 1998; 158:1789–1795. [PubMed: 9738608]
35. Dawson DA, Grant BF, Stinson FS, et al. Effectiveness of the derived Alcohol Use Disorders Identification Test (AUDIT-C) in screening for alcohol use disorders and risk drinking in the US general population. Alcoholism, Clinical and Experimental Research. 2005; 29:844–854.

36. Bradley KA, Kivlahan DR, Zhou XH, et al. Using alcohol screening results and treatment history to assess the severity of at-risk drinking in Veterans Affairs primary care patients. Alcoholism, Clinical and Experimental Research. 2004; 28:448–455.
37. Rubinsky AD, Kivlahan DR, Volk RJ, et al. Estimating risk of alcohol dependence using alcohol screening scores. Drug and Alcohol Dependence. 2010; 108:29–36. [PubMed: 20042299]
38. Williams EC, Rubinsky AD, Chavez LJ, et al. An early evaluation of implementation of brief intervention for unhealthy alcohol use in the US Veterans Health Administration. Addiction. 2014; 109:1472–1481. [PubMed: 24773590]
39. Carlson KF, Barnes JE, Hagel EM, et al. Sensitivity and specificity of traumatic brain injury diagnosis codes in United States Department of Veterans Affairs administrative data. Brain Injury. 2013; 27:640–650. [PubMed: 23514276]
40. Taylor BC, Sayer NA. Annual reports on Department of Veterans Affairs healthcare utilization among Iraq and Afghanistan War Veterans with traumatic brain injury and comorbidities to inform policy, research, and practice. Journal of Rehabilitation Research and Development. 2014; 51:vii–viii.
41. Scholten JD, Sayer NA, Vanderploeg RD, et al. Analysis of US Veterans Health Administration comprehensive evaluations for traumatic brain injury in Operation Enduring Freedom and Operation Iraqi Freedom Veterans. Brain Injury. 2012; 26:1177–1184. [PubMed: 22646489]
42. Kaner EF, Heather N, Brodie J, et al. Patient and practitioner characteristics predict brief alcohol intervention in primary care. British Journal of General Practice. 2001; 51:822–827. [PubMed: 11677706]
43. Volk RJ, Steinbauer JR, Cantor SB. Patient factors influencing variation in the use of preventive interventions for alcohol abuse by primary care physicians. Journal of Studies on Alcohol. 1996; 57:203–209. [PubMed: 8683970]
44. Polusny MA, Erbes CR, Murdoch M, et al. Prospective risk factors for new-onset post-traumatic stress disorder in National Guard soldiers deployed to Iraq. Psychological Medicine. 2011; 41:687–698. [PubMed: 21144108]
45. Ponsford J, Whelan-Goodinson R, Bahar-Fuchs A. Alcohol and drug use following traumatic brain injury: a prospective study. Brain Injury. 2007; 21:1385–1392. [PubMed: 18066940]
46. Sander AM, Bogner J, Nick TG, et al. A randomized controlled trial of brief intervention for problem alcohol use in persons with traumatic brain injury. Journal of Head Trauma Rehabilitation. 2012; 27:319–330. [PubMed: 22955097]
47. Ponsford J, Tweedly L, Taffe J. The relationship between alcohol and cognitive functioning following traumatic brain injury. Journal of Clinical and Experimental Neuropsychology. 2013; 35:103–112. [PubMed: 23339581]
48. Corrigan JD, Bogner J, Hungerford DW, et al. Screening and brief intervention for substance misuse among patients with traumatic brain injury. Journal of Trauma. 2010; 69:722–726. [PubMed: 20838145]
49. Teasdale TW, Engberg AW. Suicide after traumatic brain injury: a population study. Journal of Neurology, Neurosurgery, and Psychiatry. 2001; 71:436–440.
50. Mainio A, Kyllonen T, Viilo K, et al. Traumatic brain injury, psychiatric disorders and suicide: a population-based study of suicide victims during the years 1988–2004 in Northern Finland. Brain Injury. 2007; 21:851–855. [PubMed: 17676442]

TABLE 1

Characteristics of OEF/OIF patients in the Department of Veterans Affairs (VA) with and without traumatic brain injury (TBI)[a]

	Women (N=47,411)				Men (N=310,736)			
	TBI (N=1,836)		No TBI (N=45,575)		TBI (N=28,361)		No TBI (N=282,375)	
Characteristic	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Age								
<30	727	39.6	16,363	35.9	12,518	44.2	95,920	34.0
30–39	648	35.3	16,554	36.3	9,592	33.8	90,600	32.1
≥40	461	25.1	12,658	27.8	6,251	22.0	95,855	33.9
Race								
Black	427	23.2	13,352	29.3	2,977	10.5	42,508	15.1
White	1,151	62.6	24,954	54.8	21,417	75.5	194,759	68.9
American Indian	20	1.1	486	1.1	331	1.2	2,181	.8
Asian/Pacific Islander	56	3.1	1,372	3.0	745	2.6	8,349	3.0
Multiracial	34	1.9	773	1.7	387	1.4	3,240	1.1
Missing	148	8.1	4,638	10.2	2,504	8.8	31,338	11.1
Ethnicity								
Hispanic	240	13.1	4,885	10.7	3,584	12.5	31,362	11.1
Non-Hispanic	1,521	82.8	37,857	83.1	23,431	82.6	231,069	81.8
Missing	75	4.1	2,833	6.2	1,382	4.9	19,944	7.1
Married	583	31.8	14,702	32.3	14,318	50.5	142,406	50.4
VA disability compensation ≥50%	912	49.7	13,791	30.3	15,184	53.5	92,397	32.7
Tobacco use disorder	296	16.1	5,863	12.9	7,364	26.0	54,986	19.5
Other substance use disorder								
Alcohol	194	10.6	2,466	5.4	5,685	20.0	32,007	11.3
Drug	117	6.4	1,316	2.9	3,453	12.2	16,073	5.7
Psychiatric disorder								
PTSD	1,172	63.8	11,981	26.3	20,935	73.8	94,771	33.6
Depression	962	52.4	15,042	33.0	12,085	42.6	70,340	24.9
Anxiety (excludes PTSD)	591	32.2	8,841	19.4	7,403	26.1	44,708	15.8
Bipolar	92	5.0	1,593	3.5	1,134	4.0	5,984	2.1

	Women (N=47,411)				Men (N=310,736)			
	TBI (N=1,836)		No TBI (N=45,575)		TBI (N=28,361)		No TBI (N=282,375)	
Characteristic	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Psychotic spectrum	38	2.1	448	1.0	691	2.4	3,551	1.3
N of psychiatric disorders								
0	339	18.5	22,632	49.7	4,626	16.3	144,764	51.3
1	495	27.0	11,005	24.1	9,596	33.8	71,498	25.3
2	659	35.8	8,994	19.7	9,965	35.2	50,942	18.0
≥3	343	18.7	2,944	6.5	4,174	14.7	15,171	5.4
Addiction treatment (past 30 days)[b]	32	1.7	383	.8	1,010	3.6	5,200	1.8
Pain diagnosis[c]	1,588	86.5	28,996	63.6	23,818	84.0	178,454	63.2
Charlson Comorbidity Index[d]								
0	1,494	81.4	39,359	86.4	24,418	86.1	246,230	87.2
≥1	342	18.6	6,216	13.6	3,943	13.9	36,145	12.8
Monthly heavy episodic drinking[e]	165	9.0	2,962	6.5	6,920	24.4	49,980	17.7
AUDIT-C risk groups								
Negative screen								
Nondrinker (score of 0)	746	40.6	16,425	36.0	8,790	31.0	75,595	26.8
Low-level drinker (score of 1–4)	964	52.6	26,602	58.4	13,794	48.7	160,353	56.8
Positive screen								
Moderate alcohol misuse (score of 5–7)	85	4.6	1,799	4.0	3,302	11.6	28,885	10.2
Severe alcohol misuse (score of 8–12)	41	2.2	749	1.6	2,475	8.7	17,542	6.2

[a] OEF, Operation Enduring Freedom;OIF, Operation Iraqi Freedom. All patients were screened with the Alcohol Use Disorders Identification Test alcohol consumption questions (AUDIT-C) between January 1 and December 31, 2012. Proportion tests comparing patients with and without TBI were unadjusted. Except for marital status, all comparisons were significant ($p<.01$) for both women and men.

[b] Determined by documentation of clinic stop codes indicating one or more visits to a VA addiction treatment clinic during the 30 days prior to and including the AUDIT-C screen date.

[c] *ICD-9-CM* pain diagnoses:, back pain, 721.3X–721.9X, 722.2X, 722.30, 722.70, 722.80, 722.90, 722.32, 722.72, 722.82, 722.92, 722.33, 722.73, 722.83, 722.93, 724.XX, 737.1, 737.3, 738.4, 738.5, 739.2, 739.3, 739.4, 756.10, 756.11, 756.12, 756.13, 756.19, 805.4, 805.8, 839.2, 839.42, 846, 846.0, 847.1, 847.3, 847.2, and 847.9;neck pain, 721.0X, 721.1X, 722.0X, 722.31, 722.71, 722.81, 722.91, 723.XX, 839.0, 839.1, and 847.0; arthritis/joint pain, 710–720 and 725–740;and headache/migraine, 346.X, 307.81, 784.0, and 784.92

[d] A score ≥1 indicates the presence of a comorbid general medical condition.

[e] Six or more drinks on one occasion at least monthly

TABLE 2

Age-specific prevalence of heavy episodic drinking and alcohol misuse among OEF/OIF patients in the Department of Veterans Affairs with and without traumatic brain injury (TBI)[a]

	Women (N=47,411)					Men (N=310,736)				
	TBI (N=1,836)		No TBI (N=45,575)			TBI (N=28,361)		No TBI (N=282,375)		
Variable and age	**%**	**95% CI**	**%**	**95% CI**	**p**	**%**	**95% CI**	**%**	**95% CI**	**p**
Heavy episodic drinking[b]										
<30	10.1	7.7–13.1	8.0	7.5–8.5	ns	28.5	27.6–29.4	23.1	22.8–23.4	<.001
30–39	8.9	6.5–12.4	5.9	5.5–6.4	<.05	22.3	21.3–23.4	17.7	17.4–18.0	<.001
≥40	6.9	4.3–10.8	5.0	4.6–5.6	ns	17.8	16.6–19.0	11.5	11.2–11.7	<.001
AUDIT-C ≥5 (moderate misuse)										
<30	8.3	6.5–10.5	7.2	6.8–7.6	ns	25.4	24.6–26.1	22.6	22.3–22.8	<.001
30–39	6.0	4.4–8.1	5.1	4.8–5.5	ns	18.2	17.4–19.0	16.3	16.1–16.6	<.001
≥40	5.9	4.0–8.4	4.1	3.8–4.4	ns	13.7	12.9–14.6	10.4	10.2–10.6	<.001
AUDIT-C ≥8 (severe misuse)										
<30	3.2	2.1–4.7	2.1	1.9–2.4	ns	11.1	10.5–11.6	8.7	8.5–8.9	<.001
30–39	1.9	1.1–3.2	1.5	1.3–1.7	ns	7.7	7.2–8.3	6.3	6.1–6.4	<.001
≥40	1.3	.6–2.9	1.2	1.0–1.4	ns	5.6	5.0–6.2	3.7	3.6–3.8	<.001

[a] OEF, Operation Enduring Freedom;OIF, Operation Iraqi Freedom. All patients were screened with the Alcohol Use Disorders Identification Test alcohol consumption questions (AUDIT-C) between January 1 and December 31, 2012. Analytic samples for the AUDIT-C moderate and severe groups are not mutually exclusive.

[b] Six or more drinks on one occasion

TABLE 3

Unadjusted prevalence of documented brief intervention and addiction treatment among OEF/OIF patients in the Department of Veterans Affairs with and without traumatic brain injury (TBI) who screened positive for alcohol misuse[a]

	Women (N=2,674)					Men (N=52,204)				
	TBI (N=126)		No TBI (N=2,548)			TBI (N=5,777)		No TBI (N=46,427)		
Variable	**%**	**95% CI**	**%**	**95% CI**	**p**	**%**	**95% CI**	**%**	**95% CI**	**p**
Documented brief intervention										
AUDIT-C ≥5 (moderate misuse)	80.2	73.2–87.1	76.4	74.8–78.1	ns	78.3	77.3–79.4	78.4	78.0–78.7	ns
AUDIT-C ≥8 (severe misuse)	73.2	60.0–86.7	77.4	74.4–80.4	ns	80.1	78.5–81.7	79.2	78.6–79.8	ns
Documented addiction treatment[b]										
AUDIT-C ≥5 (moderate misuse)	19.0	12.2–25.9	10.4	9.2–11.5	<.01	13.8	12.9–14.7	8.8	8.5–9.1	<.001
AUDIT-C ≥8 (severe misuse)	36.6	21.8–51.3	21.1	18.2–24.0	<.05	20.0	18.4–21.6	15.4	14.9–15.9	<.001

[a]OEF, Operation Enduring Freedom;OIF, Operation Iraqi Freedom. All patients were screened with the Alcohol Use Disorders Identification Test alcohol consumption questions (AUDIT-C) between January 1 and December 31, 2012. Analytic samples for the AUDIT-C moderate and severe groups are not mutually exclusive.

[b]Determined by documentation of clinic stop codes indicating one or more visits to a Department of Veterans Affairs addiction treatment clinic in the 90 days following their AUDIT-C screen date.