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Authors

Miller, Mary

Freeman, Lindsey

Aranda, Amaya

et al.

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Prevalence and correlates of alcohol-induced blackout in a diverse sample of Veterans

Mary Beth Miller, Ph.D.[1,2], Lindsey K. Freeman, M.A.[1,2], Amaya Aranda[1,2], Sydney Shoemaker, M.A.[1], Delaney Sisk[1], Sofia Rubi, B.S.[1], Adam T. Everson, M.A.[1], Lisa Y. Flores, Ph.D.[2], Michael S. Williams, Ph.D.[3], Marjorie L. Dorimé-Williams, Ph.D.[3], Christina S. McCrae, Ph.D.[4], Brian Borsari, Ph.D.[5,6]

[1]Department of Psychiatry, University of Missouri, School of Medicine, 1 Hospital Dr DC067.00, Columbia, MO 65212, USA

[2]Department of Psychological Sciences, University of Missouri, College of Arts & Sciences, 210 McAlester Hall, Columbia, MO 65211, USA

[3]Department of Educational Leadership & Policy Analysis, University of Missouri, College of Education, 202 Hill Hall, Columbia, MO 65211, USA

[4]College of Nursing, University of South Florida, Tampa, FL

[5]Mental Health Service, San Francisco VA Health Care System, San Francisco, CA

[6]Department of Psychiatry and Behavioral Sciences, University of California San Francisco, San Francisco, CA

Abstract

Background: Alcohol-induced blackouts have been associated concurrently and prospectively with alcohol-related harm. Although rates of heavy drinking among military samples tend to be higher or comparable to rates among their civilian counterparts, the prevalence and correlates of blackout in this population are understudied.

Methods: Veterans (*N*=241, 29% female, 39% Black) reported on their alcohol consumption and mental health as part of a larger study on health-related research among Veterans. In this secondary analysis, we tested theoretically- and empirically-informed predictors (gender, drinking quantity, other drug use) and consequences [depression, Post Traumatic Stress Disorder (PTSD)] of alcohol-induced blackout. Given the diversity of the sample, potential roles of racial/ethnic discrimination and drinking to cope in alcohol-induced blackout were also tested.

Results: Past-year prevalence of alcohol-induced blackout was 53% among those who drank alcohol and 68% among those who screened positive for hazardous drinking. Everyday experience

Correspondence concerning this article should be addressed to Mary Beth Miller, Department of Psychiatry, 1 Hospital Drive DC067.00, Columbia, MO 65212. Phone: 573.882.1813. Fax: 573.884.1070. millmary@health.missouri.edu.

of racial discrimination was the strongest concurrent predictor of alcohol-induced blackout. Drinking quantity and use of other drugs were significant correlates only in bivariate models. Controlling for gender, race, drinking quantity, other drug use, and discrimination, blackout frequency was significantly associated with symptoms of depression, but not symptoms of PTSD. Both blackout and racial discrimination were associated with drinking to cope.

Conclusions: The prevalence and correlates of alcohol-induced blackout among Veterans are largely consistent with those documented in civilian and young adult populations. Among racially diverse groups, racial discrimination may be more strongly associated with mental health symptoms than alcohol consumption or acute alcohol consequences such as blackout.

Keywords

INTRODUCTION

One in every 14 Americans – 17.8 million people – has served in the United States military (U.S. Census Bureau, 2022). Veterans tend to drink more heavily than civilian populations and are disproportionately affected by Alcohol Use Disorder (AUD) (Panza et al., 2022). For example, in a recent study, 41% of Veterans screened positive for lifetime AUD compared to 29% of adults in the general population (Panza et al., 2022, Grant et al., 2015). Among Veterans, lifetime history of AUD is associated with significantly greater odds of other drug use disorders, suicide attempt, post-traumatic stress disorder (PTSD), major depressive disorder, and generalized anxiety (Fuehrlein et al., 2016). Thus, heavy alcohol use seems to be particularly burdensome among military service members and Veterans.

Despite data indicating increased risk of alcohol-related harm among Veterans, few studies have examined the prevalence and correlates of alcohol-induced blackout (subsequently referred to as "blackout") within this population. Blackouts occur when alcohol disrupts the brain's ability to consolidate memories in the hippocampus (White, 2003). This results in anterograde amnesia: intoxicated individuals are no longer able to form new long-term memories, but are still able to recall short-term memories and long-term memories that have already been consolidated (Wetherill and Fromme, 2016, White, 2003). In contrast to those who "pass out," individuals in a blackout remain conscious and continue interacting with their environment, maintaining their ability to have conversations, drive, and engage in sexual behaviors, despite high levels of intoxication (Wetherill and Fromme, 2016). Perhaps not surprisingly, then, blackouts have been linked to a variety of other alcohol-related consequences. After controlling for drinking quantity, blackouts have been associated with increased risk of missing school/work, doing something you regretted, arguing, and experiencing alcohol overdose (Hingson et al., 2016). Indeed, there is a dose-dependent association between blackouts and risk of injury, such that those reporting 6+ blackouts in their lifetime are 2.6 times more likely than those without a history of blackout to experience alcohol-related injury over the next 2 years (Mundt et al., 2012).

Few studies have documented rates of alcohol-induced blackout in military or Veteran samples. In a large sample of U.S. Air Force recruits (*N*=37,858), Taylor and colleagues

(2007) found that moderate drinkers had 3.2 higher odds and heavy drinkers had 7.9 higher odds of experiencing blackout relative to light drinkers; but they did not report the actual number or percentage of participants who experienced a blackout, so the prevalence of blackout in this sample is unclear. Chavez and colleagues (2012) surveyed 2,670 female outpatients at an urban Veterans Affairs (VA) facility and found that 18% of the total sample and 27% of past-year drinkers reported a blackout in the past year. This sample was limited to women, may include spouses/children of Veterans (as opposed to female Veterans), and excludes the ~60–80% of Veterans who choose not to utilize VA healthcare (Bagalman, 2014, Meffert et al., 2019). However, these estimates are consistent with data from a nation-wide sample of young adult Veterans who drink alcohol (18–34y, 26% reporting past-year blackout) (Miller et al., 2018). Thus, 1 in 4–5 Veterans who drink alcohol are expected to report past-year experience with alcohol-induced blackout. This is consistent with data in young adult (primarily college student) samples, where rates of blackout tend to be ~25% among those who drink and closer to 50% among those who drink heavily (Wetherill and Fromme, 2016).

Correlates of alcohol-induced blackout have been examined primarily among adolescents (Schuckit et al., 2015), college students (Wetherill and Fromme, 2016), and individuals with or at risk for AUD (Schuckit et al., 2017). The most direct and consistent predictor of alcohol-induced blackout is quick, heavy drinking that results in rapid increase in blood alcohol concentration, or BAC (Carpenter and Merrill, 2021, Wetherill and Fromme, 2016, Merrill et al., 2019). It follows, then, that behaviors associated with heavier/faster drinking (e.g., pregaming, drinking games, perceptions of heavier drinking among peers) increase the likelihood of blackout (Merrill et al., 2016), while behaviors that decrease drinking quantity/ speed (e.g., use of protective behavioral strategies) decrease the likelihood of blackout (Carey et al., 2022). Female bodies are at higher risk of blackout than male bodies because of biological differences in alcohol distribution and metabolism (e.g., body fat, body weight, and enzyme levels; White, 2003). However, studies are not consistent in documenting higher rates or likelihood of blackout among women versus men (Wetherill and Fromme, 2016, Merrill et al., 2019, Schuckit et al., 2015). Other drug use has also been found to compound alcohol-related memory impairment (Thoma et al., 2011, White, 2003) and has been associated with increased likelihood of blackout in event-level studies (Mallett et al., 2017). Thus, heavy drinking, sex, and other drug use are all expected to have direct influences on alcohol-induced blackout.

In terms of potential downstream effects (or "consequences") of blackout, blackouts are associated both concurrently and prospectively with other alcohol-related problems (Hingson et al., 2016, Wilhite and Fromme, 2015, Miller et al., 2020). They have also been linked to other mental health problems, including symptoms of depression (Miller et al., 2020, Voloshyna et al., 2018) and suicidal behaviors (Bae et al., 2015).

Despite the burgeoning research on blackouts, few studies have examined blackouts among Veterans, and even fewer have included diverse samples (of Veterans or civilians). People of Color tend to drink less often and in smaller quantities than European Americans (Vaeth et al., 2017, Witbrodt et al., 2014); and in one study, Latinx and Asian college students reported fewer alcohol-induced blackouts than European students (Schuckit et al., 2016).

However, a number of studies have found that Black and Latinx individuals experience more social consequences of drinking than European Americans (Witbrodt et al., 2014, Zapolski et al., 2014, Miles et al., 2019). According to Minority Stress Models (Meyer, 2003), socially oppressed groups face daily stressors (e.g., stereotyping, exclusion, and isolation) that can cascade into chronic stress and subsequent stress-related health problems. Discrimination, in particular, has been recognized as one type of traumatic stressor (Carter, 2007) that may place People of Color at higher risk of maladaptive coping behaviors, such as substance use. For example, Black Americans may find significant relief from coping-related alcohol use, and those who drink to cope are more likely to drink after perceiving a discriminatory experience (Gerrard et al., 2012, Jackson et al., 2010). Thus, experiences of discrimination may be a unique risk factor for alcohol-related problems such as blackout in racially diverse samples.

This study examined prevalence and correlates of blackout in a racially diverse sample of Veterans. First, based on existing research (Chavez et al., 2012, Miller et al., 2018, Wetherill and Fromme, 2016), we hypothesized that the past-year prevalence of blackout would be ~25% among those who drink alcohol and ~50% among those who drink heavily. We did not make hypotheses about prevalence across diverse racial/ethnic groups, given the dearth of research in this area. Second, we hypothesized that correlates of blackout would be consistent with those documented in previous research. Specifically, we proposed female gender, heavier drinking, and use of other drugs as concurrent "predictors" of blackout (Wetherill and Fromme, 2016, White, 2003) and symptoms of depression and PTSD as concurrent "consequences" of blackout (Miller et al., 2020, Voloshyna et al., 2018). Given the diversity of the sample and previous studies linking discrimination to alcohol use (Gilbert and Zemore, 2016), we also examined associations between racial discrimination and blackout, with drinking to cope as one potential pathway linking these experiences. Specifically, we hypothesized that racial discrimination would be associated with more frequent drinking to cope, which in turn would be associated with alcohol-induced blackout.

MATERIALS and METHODS

Participants and Procedure

Individuals who served in the United States military were recruited via Qualtrics survey panels to participate in a larger study on attitudes toward and priorities for health-related research among Veterans. Qualtrics sent an invitation with a link to the online survey to panelists who had identified as a member/Veteran of the United States military on their initial Qualtrics registration form. Veterans of Color were over-sampled (goal ~75% of the sample), as a primary goal of the parent study was to document research priorities among Veterans of Color. Interested panelists provided informed consent before completing the online survey. Participants received $5.69 to $7.31 in compensation, as outlined in their Qualtrics user agreement. The Institutional Review Board approved all procedures.

Of the 602 total respondents, 101 were excluded because they did not provide data beyond demographics, 118 provided non-sensical responses (e.g., "great product!"), 13 reported an implausible military history (e.g., returning from deployment before their year of birth), and 36 violated two out of three invalid response indicators (e.g., <10min completion time,

military occupational specialty that could not be verified, providing the same score on all items of a measure). Of the 334 who provided valid responses, 248 (74%) reported alcohol use in the past year. However, 7 preferred not to respond to illicit drug use items, so the final data analytic sample included 241 participants. Respondents who were included (n=241) did not differ significantly from those excluded (n=86) in terms of gender or military status (active duty, reserves/guard, or retired/discharged). Relative to those who were excluded, included participants were younger [40 vs 45y; t(120)=2.58, p=.01], more likely to be Black [80% vs 70% of other races; χ^2(1)=3.89, p=.049], and more likely to report service in the Army [79% Army vs. 68% other branches; χ^2(1)=5.71, p=.02]. There were no other group differences by race/ethnicity or military branch.

Measures

Demographics.—This study included assessment only of gender, not sex. Participants indicated if they identified as male, female, transgender, non-binary, other, or preferred not to respond. As noted in Table 1, only two participants chose an option other than male or female. Results were the same including and excluding these participants, so all participants were retained in analyses. Race/ethnicity was assessed by asking participants first to choose their race/ethnicity from the list of options presented in Table 1 and then to indicate (via open text response) the subgroup that best fits their ethnicity (e.g., Cuban, Mexican).

Alcohol use.—Participants completed the consumption items of the Alcohol Use Disorders Identification Test (AUDIT-C) (Saunders et al., 1993). First, they reported how often they drank in the past year on a scale from 0 (*never*) to 4 (*four or more times per week*). They then reported how many drinks they typically consume on a day that they consume alcohol. Traditionally, responses to this item are (0) 1 or 2 drinks, (1) 3 or 4 drinks, (2) 5 or 6 drinks, (3) 7 to 9 drinks, or (4) 10 or more drinks. Because we were interested in drinking quantity as a semi-continuous variable (and consistent with updates to this measure; see (Higgins-Biddle and Babor, 2018, Villarosa-Hurlocker et al., 2020), participants in this study indicated the number of drinks consumed in whole numbers up to 15 drinks. Those reporting "more than 15 drinks" (n=4) were recoded as having 16 drinks. Participants then reported how often they have 6 or more drinks on one occasion on a scale from 0 (*never*) to 4 (*daily or almost daily*). The AUDIT consumption items have been validated as a measure of hazardous drinking among Veterans (Crawford et al., 2013). Because blackouts tend to occur as a function of heavy, rapid drinking at the daily level (White, 2003), the second item (drinks per drinking day) was used in data analyses.

Alcohol-induced blackout.—Blackouts were assessed using the AUDIT blackout item. Specifically, participants indicated how often in the last year they were "unable to remember what happened the night before because you had been drinking." Response options ranged from 0 (*never*) to 4 (*daily or almost daily*). Although no studies have tested the reliability or validity of this single item in assessing alcohol-induced blackout, it has demonstrated face validity and correlates strongly with other blackout items in factor analyses (Miller et al., 2019, Boness et al., 2022).

Other drug use.—Other substance use was assessed using items from the National Survey on Drug Use and Health. Participants indicated (*yes/no*) if they had used cannabis, cocaine, heroin, hallucinogens, inhalants, methamphetamine, stimulants, sedatives, or non-prescription drugs (pain relievers, benzodiazepines, or cough/cold medicines) in the past year. "Other drug use" was a dichotomous variable, coded "yes" for use of any of these drugs and "no" for none.

Mental health symptoms.—The 2-item version of the Patient Health Questionnaire was used to assess symptoms of depression in the past 2 weeks (Kroenke et al., 2009). Participants rated how often they were "feeling down, depressed, or hopeless" and had "little interest or pleasure in doing things" on a scale from 0 (*not at all*) to 3 (*nearly every day*). Responses were summed to create a total score, with total scores ranging from 0–6. This scale has demonstrated validity in identifying symptoms of depression in primary care settings, with scores 3 considered a positive screen for depression (Kroenke et al., 2009).

Symptoms of PTSD were assessed using the 4-item version of the PTSD Checklist for DSM-5 (Price et al., 2016). On a scale from 0 (*not at all*) to 4 (*extremely*), participants who previously reported experiencing a traumatic event in their lifetime rated how much they had been troubled by four symptoms of PTSD (e.g., "avoiding external reminders of the stressful experience") in the last month. Responses of the four items were summed to create a total symptom severity score (range 0–16), with scores 10 indicative of a positive screen for PTSD symptoms. The 4-item version of the PTSD Checklist has similar diagnostic utility when compared to the PCL-5 and has demonstrated validity in identifying symptoms of PTSD among adults and combat Veterans (Price et al., 2016).

Discrimination.—Racial discrimination was assessed using the 9-item Everyday Discrimination Scale (Williams et al., 1997). Consistent with the one-stage attribution version of the scale (Shariff-Marco et al., 2011), participants indicated how often in their day-to-day lives they experience discrimination, such as being treated with less courtesy or respect than other people, "because of your race/ethnicity." Response options range from 0 (*never*) to 5 (*almost every day*), and responses were summed to create a total score (range 0–45). This measure has demonstrated validity in assessing discrimination (Shariff-Marco et al., 2011).

Substance use coping.—Use of alcohol/other drugs to cope with stress was measured using the alcohol/drug use coping items from the Brief COPE (Carver, 1997). Participants indicated how often they "use alcohol or other drugs to make myself feel better" and "use alcohol or other drugs to help me get through it" on a scale from 0 (*I don't do this at all*) to 3 (*I've been doing this a lot*), with total scores ranging from 0 to 6. This measure has been used in previous studies of military/Veteran coping (Romero et al., 2020), and the substance use subscale demonstrated strong internal consistency in this sample (α .85).

Data Screening and Analysis Plan

Data were screened for missing values, and outcome variables were screened for outliers and normality prior to analysis. Missing data for drinking quantity (*n*=1), discrimination

(n=2), depression (n=1), and substance use coping (n=3) were replaced with the sample mean; no other variables were missing values. No outliers were identified. Skewness and kurtosis estimates for all outcome variables were within the acceptable range (all   1) (Kline, 2011). However, given the number of zeros in the blackout frequency variable, 'blackout' was modeled as a dichotomous outcome (0=no blackout, 1=any blackout).

Descriptive statistics were used to examine the prevalence of blackout in the full sample, among those screening positive for hazardous drinking on the AUDIT-C (scores   4/5 for women/men; Crawford et al., 2013), and across racial/ethnic groups. For parsimony, proposed "predictors" of alcohol-induced blackout were tested in the cross-sectional mediation model examining the indirect effect of everyday experiences with discrimination (EDS total score) on likelihood of alcohol-induced blackout (yes/no blackout occurrence) through drinking to cope with stress (Brief COPE drug use subscale score). Mediation was tested using bootstrapped joint significance tests for indirect effects (Hayes, 2013). We used 95% confidence intervals with 5,000 sampling estimates. Given the cross-sectional nature of the data, we also tested a "control" mediation model linking alcohol-induced blackout to discrimination through drinking to cope, with the hypothesis that it would *not* be significant. Gender (0=all other genders, 1=female), race (0=non-Hispanic White, 1=Person of Color), drinking quantity (drinks per drinking day), and other drug use (0=none, 1=any) were included as covariates in both models. Results for the dichotomous blackout outcome are depicted in log-odds, which was transformed to an odds ratio by exponentiating the value.

Hierarchical linear regression was used to model symptoms of depression (PHQ2 total score) and PTSD (PCL4 total score) as concurrent "consequences" of blackout. Specifically, covariates (gender, race, drinking quantity, other drug use, and everyday experiences of racial discrimination) were modeled as predictors of mental health symptoms in Step 1, and blackout frequency (total AUDIT score) was added as a predictor in Step 2. Models for depression and PTSD symptoms were conducted separately.

RESULTS

Prevalence.

Descriptive data for the full sample and as a function of blackout are depicted in Table 1. Of the 241 participants included, 115 (48%) screened positive for "hazardous" drinking on the AUDIT-C. Past-year prevalence of blackout was 53% (n=127/241) among those reporting any alcohol use and 68% (n=78/115) among heavier drinkers. Prevalence of blackout ranged from 50–67% across racial/ethnic groups (see Table 1).

Proposed "predictors" of blackout.

Although drinking quantity and other drug use demonstrated significant bivariate correlations with blackout (see Table 2), neither of these were significantly associated with odds of blackout in the mediation model (see Table 3). Everyday experiences of discrimination were positively associated with drinking to cope (a=0.05, SE=0.01, 95% CI=0.03, 0.06), and drinking to cope was associated with increased odds of alcohol-induced blackout (log-odds for b=0.47, SE=0.11; 95% CI=0.25, 0.70). Discrimination had a direct

effect on odds of blackout (c'=0.05, *SE*=0.01; 95% CI=0.02, 0.08) and an indirect effect through drinking to cope (*ab*=0.02, *SE*=0.01; 95% CI=0.01, 0.04).

In the "control" model (which we hypothesized would be non-significant), alcohol-induced blackout was significantly associated with drinking to cope (*a*=1.25, *SE*=0.20; 95% CI=0.86, 1.63), and drinking to cope was positively associated with everyday experiences of discrimination (*b*=2.13, *SE*=0.50; 95% CI=1.14, 3.12). Blackout had a direct effect on experiences of discrimination (c'=6.09, *SE*=1.63; 95% CI=2.87, 9.31) and an indirect effect through drinking to cope (*ab*=2.66, *SE*=0.94; 95% CI=1.04, 4.71).

Proposed "consequences" of blackout.

Step 1 of the model predicting symptoms of depression was significant, with drinking quantity, other drug use, and experiences with racial discrimination accounting for ~31% of the variance in depressive symptoms [$F_{(5, 233)}$=22.25, p<.001, Adj. R^2=0.31; see Table 4]. In Step 2 of the model, past-year blackout frequency added uniquely to the prediction of symptoms of depression, such that every 1-unit increase in blackout frequency was associated with 0.28 greater symptoms of depression [$F_{(6, 232)}$=20.63, p=.003, Adj. R^2=0.33; see Table 4].

Step 1 of the model predicting PTSD symptoms was also significant; however, everyday experiences of discrimination was the only significant predictor in this model [$F_{(5, 233)}$=11.79, p<.001, Adj. R^2=0.18; see Table 4]. In Step 2, past-year blackout frequency did not account for unique variance in PTSD symptoms [$F_{(6, 234)}$=10.19, p<.001, Adj. R^2=0.19; see Table 2].

DISCUSSION

This study examined the prevalence and correlates of alcohol-induced blackouts in a racially diverse sample of Veterans. Although a vast literature has documented alcohol-related harm among Veterans (Panza et al., 2022, Fuehrlein et al., 2016), few studies have examined the prevalence and correlates of blackouts in this population – and even fewer in racially (or gender) diverse samples. Rates of alcohol use (74%) and hazardous drinking (34%) in this sample were consistent with those in larger, representative samples of Veterans, where alcohol use ranges 55–80% and hazardous use ranges 26–46% (Williams et al., 2012, Calhoun et al., 2008, Fuehrlein et al., 2016). However, the past-year prevalence of alcohol-induced blackout was higher than hypothesized, at 53% among those who drink and 63% among those who screened positive for hazardous drinking. Rates of blackout varied across racial/ethnic groups. However, the groups with higher prevalence (e.g., 63% of multiracial and 60% of Native American participants) were also those with smaller sample sizes (*n*=8 multiracial and *n*=15 Native American). Given this trend, we estimate the true past-year prevalence of blackout is between 50–60% among drinkers of various races and ethnicities.

In contrast to findings regarding prevalence, correlates of blackout in this sample were largely consistent with those hypothesized. For example, both drinking quantity and other drug use were significantly associated with blackout in bivariate models. This is consistent

with data in young adult and college student samples and provides further evidence that variables associated with increase in BAC are linked to blackout (Wetherill and Fromme, 2016, Carpenter and Merrill, 2021, Merrill et al., 2019). However, gender was not associated with blackout frequency in this sample. Previous studies have been inconsistent in demonstrating sex differences in alcohol-induced blackout (Wetherill and Fromme, 2016). We speculate that gender norms/roles contribute to this inconsistency across studies, as female bodies should be higher risk (White, 2003) but men historically tend to drink more heavily than women (Pedersen et al., 2016). However, the underrepresentation of women relative to men in this sample may also have contributed to this lack of significant effect.

Everyday experiences of racial discrimination were also linked to alcohol-induced blackout, more strongly than drinking quantity. We tested drinking to cope as one potential pathway to explain this association, based on theoretical and empirical data linking discrimination to drinking to cope (Meyer, 2003, Carter, 2007) and drinking to cope with alcohol-induced blackout (Merrill and Read, 2010). However, the "control" model we tested that was designed to be non-significant was also significant. This was unexpected, from a theoretical perspective, and indicates that these cross-sectional findings are insufficient to determine the order in which these experiences occurred. Specifically, it is unclear if racial discrimination leads to drinking to cope, perhaps the experience of blackout leads to drinking to cope, or perhaps some unmeasured variable (e.g., trauma, socioeconomic status) is driving all of these associations. Data from this study tell us only that these experiences tend to occur together.

Clinical Implications

Blackouts are robust and prospective predictors of other alcohol-related harm (e.g., physical injury, sexual re-victimization, interpersonal problems, depression) (Mundt et al., 2012, Valenstein-Mah et al., 2015, Merrill et al., 2019, Wilhite and Fromme, 2015, Miller et al., 2019, Miller et al., 2020). From a clinical perspective, better understanding of the correlates of blackout may help inform and tailor intervention efforts. Data from this study suggest that racial discrimination and drinking to cope may be especially relevant for blackout in diverse samples of Veterans, in which case screening for and preventing these experiences becomes a priority. The Veterans Health Administration (VA) prompts and incentivizes annual alcohol screening for patients using the AUDIT-C (Bradley et al., 2006). Data from this study suggest that 2 out of 3 Veterans who screen positive for heavy drinking on the AUDIT-C will report a past-year history of alcohol-induced blackout. Given that brief alcohol interventions are more effective for Veterans with a history of blackout than those without (Miller et al., 2018), it may be useful for providers to screen for blackouts when asking about drinking quantity/frequency, and brief interventions may be especially worthwhile for Veterans who endorse alcohol-induced blackout. Such screening and brief intervention efforts may be especially relevant for active duty military/service members, as rates of blackout were significantly higher among participants in this group. Continued efforts to train and foster providers' competence in delivering brief alcohol interventions are needed to reduce alcohol-related harm among Veterans (Bachrach et al., 2018). Given the potential role of discrimination in alcohol-induced blackout among Veterans of Color, competence in multicultural counseling is also recommended.

Limitations

Several methodological limitations should be considered when interpreting results. First, data are cross-sectional. Such data are appropriate for documenting rates of and co-occurrence among health conditions. However, cross-sectional mediation models often fail to replicate longitudinally (Maxwell et al., 2011, O'Laughlin et al., 2018), so the cross-sectional associations documented between discrimination, drinking to cope, and alcohol-induced blackout may not persist over time. Second, we did not assess sex assigned at birth, which is expected to be more directly associated with blackout than gender (White, 2003); and we did not assess non-coping motives for drinking. "Enhancement motives," such as drinking to get drunk or because it makes you feel good, have also been linked to blackout styles of drinking (Merrill and Read, 2010) and tend to be prevalent among Veterans (McDevitt-Murphy et al., 2015). Thus, future research in this area may need to consider motives beyond coping. Third, we revised the response options for item 2 of the AUDIT. It seems unlikely that this modification significantly impacted the psychometric properties of the scale, given comparable performance between the original response options and updated versions that use discrete drink options (e.g., the USAUDIT) (Villarosa-Hurlocker et al., 2020). However, the reliability and validity of these exact response options has not been tested. We also used the version of the Everyday Discrimination Scale that asks specifically about discrimination "because of your race/ethnicity," which does change the way individuals respond to these items (see Shariff-Marco et al., 2011 for more details).

Although the diverse sample of Veterans is a strength, the sample was limited in important ways as well. Specifically, the sample is not representative of Veterans more broadly, as this study was designed to oversample Veterans of Color. Participants in this sample were also more likely to be female, younger, and more educated than Veterans across the United States (U.S. Census Bureau, 2022). We were also underpowered to provide strong estimates of the prevalence of blackout across racial/ethnic groups or to document differential associations between discrimination and blackout across racial/ethnic groups. Racial discrimination has been linked to alcohol use in studies of Black, Latinx, and multiracial adults (López et al., 2020, Gilbert and Zemore, 2016, Nalven et al., 2021). However, Native Americans, Asians, and Pacific Islanders are underrepresented in this literature (Gilbert and Zemore, 2016); studies comparing associations across racial/ethnic groups are rare (Nalven et al., 2021); and we are unaware of studies linking discrimination and alcohol use across diverse military/ Veteran samples. Given the diversity of the United States military and the strong association between discrimination and blackout documented here, we encourage future research in this area.

Conclusion

One in every 2 to 3 Veterans who drinks alcohol reports experiencing an alcohol-induced blackout in the past 12 months. This rate of blackout is somewhat higher than rates reported in civilian and young adult samples; however, correlates of blackout are largely consistent across studies (Wetherill and Fromme, 2016). Specifically, heavier drinking, use of other drugs, and symptoms of depression are all associated with increased odds and frequency of blackouts. In diverse samples, racial discrimination may be more strongly associated with

mental health symptoms than alcohol consumption or acute alcohol consequences such as blackout.

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Table 1.

Characteristics of participants who report drinking in the past year (N=241).

Descriptive variable	Total (*N*=241)	No blackout (*n*=114)	Blackout (*n*=127)	χ^2 / *t* (df)
Age, *M* (*SD*)	40.1 (13.1)	44.1 (15.4)	36.4 (9.1)	4.6 (180)
Gender, *n* (%)	---	---	---	---
Female	70 (29%)	31 (44%)	39 (56%)	0.4 (1)
Male	169 (70%)	83 (49%)	86 (51%)	0.7 (1)
Non-binary	2 (<1%)	0 (0%)	2 (100%)	---
Sexual Orientation, *n* (%)	---	---	---	---
Straight or heterosexual	217 (90%)	104 (48%)	113 (52%)	0.3 (1)
Lesbian or gay	9 (4%)	6 (67%)	3 (33%)	1.4 (1)
Bisexual	13 (5%)	4 (31%)	9 (69%)	1.5 (1)
Queer, pansexual, or questioning	2 (1%)	0 (0%)	2 (100%)	1.8 (1)
Race/Ethnicity, *n* (%)	---	---	---	---
American Indian or Alaska Native	15 (6%)	6 (40%)	9 (60%)	0.3 (1)
Asian or Asian American	27 (11%)	12 (44%)	15 (56%)	0.1 (1)
Black or African American	93 (39%)	43 (46%)	50 (54%)	0.1 (1)
Hispanic or Latino/a/x	30 (12%)	15 (50%)	15 (50%)	0.1 (1)
Multiracial or Multi-ethnic	8 (3%)	3 (38%)	5 (63%)	0.3 (1)
Native Hawaiian or Pacific Islander	2 (<1%)	2 (100%)	0 (0%)	2.2 (1)
White, Caucasian, or European	63 (26%)	32 (51%)	31 (49%)	0.4 (1)
Other	3 (1%)	1 (33%)	2 (67%)	0.2 (1)
Military affiliation, *n* (%)	---	---	---	---
Active duty	53 (22%)	11 (21%)	42 (79%)	19.2 (1) [*]
Reserves/guard	48 (20%)	17 (35%)	31 (65%)	3.4 (1)
Separated/discharged/retired	140 (58%)	86 (61%)	54 (39%)	26.7 (1) [*]
Branch of service, *n* (%)	---	---	---	---
Air Force	38 (16%)	17 (45%)	21 (55%)	0.1 (1)
Army	137 (57%)	71 (52%)	66 (48%)	2.6 (1)
Coast Guard	14 (6%)	3 (21%)	11 (79%)	4.0 (1) [*]
Marines	27 (11%)	11 (41%)	16 (59%)	0.5 (1)
Navy	25 (10%)	12 (48%)	13 (52%)	<0.1 (1)
Any blackout, *n* (%)	127 (53%)	---	---	---
Never	114 (47%)	114 (100%)	0 (0%)	---
Less than monthly	52 (22%)	0 (0%)	52 (41%)	---
Monthly	31 (13%)	0 (0%)	31 (24%)	---
Weekly	24 (10%)	0 (0%)	24 (19%)	---
Daily or almost daily	20 (8%)	0 (0%)	20 (16%)	---
Drinks per drinking day, *M* (*SD*)	3.2 (2.8)	2.5 (2.4)	3.9 (3.1)	3.8 (231) [*]
Other drug use, *n* (%)	161 (67%)	39 (33%)	80 (67%)	19.9 (1) [*]
Symptoms of depression, *M* (*SD*)	2.1 (1.9)	2.7 (3.1)	5.7 (3.6)	6.8 (239) [*]

Descriptive variable	Total (N=241)	No blackout (n=114)	Blackout (n=127)	χ^2 / t (df)
Symptoms of PTSD, M (SD)	4.9 (6.4)	3.0 (6.2)	6.6 (7.0)	4.5 (231)[*]
Racial discrimination, M (SD)	14.6 (13.1)	8.6 (9.8)	20.0 (13.4)	7.5 (229)[*]
Alcohol/drug use coping, M (SD)	2.3 (2.0)	1.2 (1.6)	3.2 (1.8)	8.7 (239)[*]

Note. Blackout drinking in the past year.

[*] p < .05.   Equal variance not assumed. M=mean. n=number. SD=standard deviation.

Table 2

Correlation matrix for variables of interest (N=241).

	POC	DDD	Drug use	EDS	PHQ	PCL	Coping	BO freq.	BO Y/N
1. Female gender (Y/N)	0.09	−0.01	0.04	0.08	0.12	0.03	0.10	0.05	0.04
2. Person of color (Y/N)	---	−0.21*	−0.10	0.11	0.06	0.03	−0.07	−0.08	0.04
3. Drink per day (DDD)		---	0.24*	0.21*	0.30*	0.16*	0.43*	0.32*	0.23*
4. Other drug use (Y/N)			---	0.20*	0.26*	0.15*	0.41*	0.23*	0.25*
5. Discrimination (EDS)				---	0.52*	0.43*	0.50*	0.55*	0.43*
6. Depression (PHQ)					---	0.50*	0.60*	0.50*	0.41*
7. PTSD (PCL)						---	0.35*	0.33*	0.28*
8. Substance use coping							---	0.56*	0.49*
9. Blackout frequency								---	0.79*
9. Blackout (Y/N)									---

Note.

*
$p<.05$. POC=Person of Color. BO=blackout. EDS=Everyday Discrimination Scale. Freq=frequency. PCL=PTSD Checklist. PHQ=Patient Health Questionnaire-9. Y/N=dichotomous variable coded yes/no.

Table 3

Cross-sectional mediation models testing associations between discrimination, substance use coping, and odds of blackout among Veterans who drink (N=241).

	Outcome: Blackout (Y/N)		
	Log Odds (*SE*)	Odds Ratio	*p*
Discrimination > Coping > Blackout			
Intercept	−1.83 (0.44)	0.16	<.001
Female gender	−0.18 (0.34)	0.84	.60
Person of color	0.23 (0.38)	1.26	.55
Drinks per drinking day	0.05 (0.07)	1.05	.50
Other drug use	−0.11 (0.37)	0.90	.76
Discrimination	0.05 (0.01)	1.05	<.001
Substance use coping (*b*-path)	0.47 (0.11)	1.60	<.001
Direct effect (*c'*-path)	0.05 (0.01)	1.05	<.001
Indirect (mediated) effect	0.02 (0.01)	1.02	<.05

	Outcome: Discrimination		
Blackout > Coping > Discrimination	*B* (*SE*)	β	*p*
Intercept	1.65 (1.89)	---	.38
Female gender	0.45 (1.58)	0.02	.78
Person of color	4.20 (1.66)	0.14	.01
Drinks per drinking day	0.06 (0.28)	0.02	.84
Other drug use	3.06 (1.71)	0.12	.08
Blackout (yes/no)	6.09 (1.63)	0.46	<.001
Substance use coping (*b*-path)	2.13 (0.50)	0.32	<.001
Direct effect (*c'*-path)	6.09 (1.63)	---	<.001
Indirect (mediated) effect	2.66 (0.94)	---	<.05

Note. SE=standard error. Y/N=yes/no.

Table 4

Regression model examining concurrent 'consequences' of blackout among Veterans reporting past-year alcohol use (N=241).

	Outcome: Depression Symptoms			Outcome: PTSD Symptoms		
	B (SE)	β	*p*	*B* (SE)	β	*p*
Step 1						
Intercept	0.32 (0.27)	---	.24	0.93 (0.99)	---	.35
Female gender	0.08 (0.23)	0.02	.75	−0.20 (0.84)	−0.01	.82
Person of color	0.27 (0.25)	0.06	.28	0.24 (0.90)	0.02	.79
Drinks per drinking day	0.12 (0.04)	0.18	.003	0.11 (0.14)	0.05	.42
Other drug use	0.79 (0.23)	0.21	<.001	1.57 (0.83)	0.12	.06
Discrimination	0.06 (0.01)	0.38	<.001	0.18 (0.03)	0.37	<.001
Step 2						
Intercept	0.28 (0.27)	---	.30	0.85 (0.99)	---	.85
Female gender	0.07 (0.23)	0.02	.29	−0.21 (0.84)	−0.02	.80
Person of color	0.33 (0.24)	0.08	.17	0.36 (0.90)	0.03	.69
Drinks per drinking day	0.10 (0.04)	0.14	.02	0.07 (0.14)	0.03	.61
Other drug use	0.71 (0.23)	0.19	.002	1.42 (0.84)	0.11	.09
Discrimination	0.04 (0.01)	0.28	<.001	0.16 (0.04)	0.33	<.001
Blackout	0.28 (0.10)	0.20	.003	0.49 (0.36)	0.10	.17

Note. B represents unstandardized and β represents standardized coefficients.