Association between lifetime posttraumatic stress disorder and past year Alcohol Use Disorder among American Indians/Alaska Natives and non-Hispanic Whites

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Abstract

Background—Posttraumatic stress disorder (PTSD) and alcohol use disorder disproportionately impact certain populations including American Indians/Alaska Natives (AIAN). While PTSD and alcohol use disorder have been studied both separately and in tandem, less is known about the association in AIANs. The objective was to examine the association between lifetime PTSD and past year alcohol use disorder among AIANs and non-Hispanic Whites (NHW).

Methods—Data come from the 2012–2013 U.S. National Epidemiologic Survey on Alcohol and Related Conditions–III. We used logistic regression to estimate odds of AUD among adults with and without PTSD by race.

Results—19,705 participants, of whom 511 were AIAN and 19,194 were NHW, were included in this study. The percentage of PTSD among AIAN was 22.9% (n=117) compared to 11.7% (n=2,251) in NHW (*p*-value <0.0001). The percentage of past year alcohol use disorder among AIAN was 20.2% (n=103) compared to 14.2% (n=2,725) in NHW (*p*-value <0.0001). The percentage of comorbid past year alcohol use disorder with lifetime PTSD among AIAN was 6.5% (n=33) compared to 2.4% (n=457) in NHW (*p*-value <0.0001). Regarding the joint distribution of PTSD and AUD, AIAN men have greater than 3 times the percentage compared to NHW men (9.5% vs. 3.1%). When stratifying by race (after adjusting for age, sex, depression, and education), among AIAN, the odds of past year alcohol use disorder with (vs. without) lifetime PTSD were 1.76 (95% CI 1.07, 2.90) and among NHW, the odds were 1.59 (95% CI 1.41, 1.80).

Conclusions—PTSD is significantly associated with alcohol use disorder in the study populations. Despite a lack of pre-PTSD measures of alcohol use disorder, these findings show a trend indicating that American Indians and Alaska Natives exposed to PTSD are more burdened with alcohol use disorder compared to non-Hispanic Whites in the general U.S. population.

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DISCLOSURE OF POTENTIAL CONFLICTS OF INTEREST

The authors declare that they have no conflict of interest.

INTRODUCTION

Alcohol use disorder (AUD) increases risk of negative consequences for the individual and/or others; including physical, mental, as well as social and economic harms. The prevalence of lifetime AUD among U.S. adults in 2014 was 29.1% (Grant et al., 2015a). AUD leads not only to serious chronic health problems, but also can lead to injury and death (Stahre et al., 2014). Nearly 88,000 deaths per year are directly attributed to alcohol use, making it the third most preventable cause of death in the U.S. (Stahre et al., 2014). Disproportionately, lifetime AUD impacts vulnerable populations like younger (<65 age in years) and unmarried adults, those with lower incomes (< $70,000), and American Indians and Alaskan Natives (Landen et al., 2014, Hasin et al., 2007). Previous research using the 2001–2002 National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) Wave 1 data initially described estimates of past year AUD prevalence among American Indians and Alaskan Natives as the highest (12.1%) among all races/ethnicities (Hasin et al., 2007); broken down by gender among American Indian and Alaskan Natives, AUD estimates were 15.9% for males and 8.7% for females (Brave Heart et al., 2016).

Posttraumatic stress disorder (PTSD), which develops in response after a traumatic event or events, is associated with numerous medical conditions and is frequently chronic (Pietrzak et al., 2011a). In the general U.S. population, the prevalence of lifetime PTSD is 4.8% to 6.4% (Blanco et al., 2013, Pietrzak et al., 2011b). PTSD has been found to be more common among American Indian and Alaskan Native populations with estimates ranging from 16% to 24% (Aronson et al., 2016, Brockie et al., 2015, Beals et al., 2013). A recent review of literature on PTSD in American Indians and Alaskan Natives clearly indicates that American Indians and Alaskan Natives, both urban and rural, experience a substantially greater burden of PTSD and related symptoms than U.S. Whites (Bassett et al., 2014). Additionally, combat experience and interpersonal violence were consistently cited as leading causes of PTSD in American Indians and Alaskan Native (Bassett et al., 2014). Another recent population-level study of PTSD, using data from NESARC Wave 2, found that American Indians and Alaskan Natives represented 3.2% of all U.S. patients with full PTSD, as diagnosed by DSM-IV criteria. This proportion is nearly twice as much as 1.7%, which represents the total proportion of American Indians and Alaskan Natives in the U.S., according to the 2010 Census (Pietrzak et al., 2011a). However, one study found lower PTSD prevalence when stratified by sex and region; they argue that after trauma exposure, American Indians and Alaskan Natives develop PTSD at rates similar to other groups (Beals et al., 2013).

PTSD has been associated with AUD (Breslau et al., 1991, Kessler et al., 1995, Stewart, 1996). Among adults with AUD in treatment-seeking patients or clinical data, 30% to 59% meet current criteria for PTSD (Ralevski et al., 2014, Bonin et al., 2000). Among the U.S. general population, analyses using NESARC Wave 2 data suggest that lifetime PTSD and lifetime AUD comorbidity is around 1.6% (Blanco et al., 2013). Several mechanisms have been proposed for the relationship between PTSD and alcohol or other substance use disorders. The "susceptibility hypothesis" proposes individuals who have PTSD are more likely to develop alcohol use disorder (Chilcoat and Breslau, 1998). For instance, alcohol or substance abuse problems may interfere with the management of emotional effects of a

traumatic event and thus increase PTSD symptoms such as anxiety, arousal or avoidance (Chilcoat and Breslau, 1998). The "high-risk" hypothesis states that substance use or abuse may increase risk for exposure to traumatic events by placing the individual in situations with greater risk (Windle, 1994). Both of these hypotheses suggest that substance abuse influence PTSD risk. The "self-medicating hypothesis" suggests that an individual will drink to reduce the impact of PTSD symptoms, which leads to AUD (Leeies et al., 2010). Fetzner and colleagues, using data from the NESARC Wave 2, found elevated odds of AUD among individuals with PTSD experiencing childhood trauma and assaultive violence (Fetzner et al., 2011). However, others using 10-year prospective data have found that exposure to trauma was not predictive of subsequent onset of alcohol abuse and alcohol use disorder in either the presence or absence of PTSD (Breslau et al., 2003). The "common factors hypothesis" suggests that both PTSD and alcohol use or substance use disorder have common antecedents like prior traumatic event exposure (Breslau et al., 1997).

Mood, anxiety and personality disorders are also associated with PTSD. Individuals with mood, anxiety and personality disorders may be at greater risk of exposure to traumatic events and thus greater risk for developing PTSD (Breslau, 2009). Pre-existing psychiatric disorders, including antisocial behavior, affective disorder, schizophrenia, and anxiety disorders increase risk for exposure to a traumatic event or in the case of schizophrenia and anxiety disorders increase risk for PTSD (Cottler et al., 2001). Longitudinal studies are still needed to shed light on the causal mechanisms at work in the comorbidity patterns of PTSD.

Indeed, the relationship between mental disorders and substance/alcohol use disorders is complex, where traumatic experiences can lead to AUD or AUD can lead to increased risk of traumatic experiences, from which PTSD evolves. Here, we are examining only a small component of this dynamic-the association of PTSD as an exposure and AUD as an outcome. We focus on AUD because among American Indians and Alaska Natives, alcohol is the most frequently used substance and often the first. While multi-substance use, both in combination and sequentially has been demonstrated in an American Indian sample (Gilder et al., 2016), American Indians and Alaska Natives have higher rates of alcohol-related morbidity and mortality than other U.S. ethnic groups (Landen et al., 2014). In a recent study on veterans using NESARC-III data, when adjusting for other psychiatric disorders, associations between PTSD and substance use disorders were not significant (Smith et al., 2016). This suggests that substance use disorders and PTSD versus psychiatric disorders and PTSD have different shared factors underlying their associations (Awofala, 2013).

This study's objective is to examine the association between lifetime PTSD and past year AUD among American Indians and Alaska Natives compared to non-Hispanic Whites. Whereas PTSD and AUD have been studied both separately and in tandem, less is known about the association between PTSD and AUD in the American Indian and Alaska Native population. American Indian and Alaskan Native communities have a unique and recent history of repeated traumatic events including the forced removal of children via Indian boarding school policies, loss of ancestral homelands and prohibition of spiritual and cultural practices. Due to these historical traumas, American Indian and Alaskan Native communities presently experience a higher level of psychological distress and traumatic events compared to the general U.S. population (Evans-Campbell, 2008). Additionally,

children of parents with PTSD are more likely to develop PTSD themselves in their lifetime (Yehuda et al., 1998). Thus, we hypothesize that 1) PTSD will be associated with AUD and 2) this relationship will be stronger among American Indians and Alaska Natives compared to non-Hispanic Whites. We used data from a nationally representative survey to examine the relationship between PTSD and AUD and determine how this relationship varies by American Indians and Alaska Natives compared to non-Hispanic Whites.

METHODS AND MATERIALS

Data Source and Study Population

NESARC-III is the fourth national survey conducted by the National Institute on Alcohol Abuse and Alcoholism (NIAAA). The objectives and measures are similar to the prior three NIAAA national surveys (1988 Alcohol Supplement of the National Household Interview Survey, the 1991–1992 National Longitudinal Alcohol Epidemiologic Survey, the 2001– 2002 Wave 1 NESARC, and the 2004–2005 Wave 2 NESARC follow-up). The NESARC-III includes data from a random sample of the non-institutionalized population 18 years and older living in households and select non-institutionalized group quarters (e.g., group homes, workers' dormitories) in the contiguous U.S., Alaska, and Hawaii from April 2012 through June 2013. The Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS-5) was used to collect information on alcohol use, disorders and related physical and mental disabilities. The overall response proportion of the NESARC-III was 60.1% (Grant et al., 2014). The final sample size was 36,309. The Institutional Review Board of the Pacific Institute for Research and Evaluation approved this paper's analysis of deidentified data. NIAAA Intramural staff and this paper's authors created and signed a Data Use Agreement for this purpose.

We retrospectively identified participants from the total NESARC-III population who completed information on past year alcohol and information on PTSD. Fewer than 5% of the data on all covariates of interest were missing. NESARC-III staff handled missing data on age and race/ethnicity (1.1%) with use of imputation. To be eligible for this study, participants had to have complete information on past year alcohol use, lifetime PTSD, and race. Since our research question was race specific, we further restricted our population to those who identified as either American Indians and Alaska Natives or non-Hispanic Whites. Blacks and Hispanics were oversampled in the design phase of the survey. American Indians and Alaska Natives were not oversampled and thus survey weights for undercoverage of American Indians and Alaska Natives in the sampling frame were not included and not used in the analysis. From the original sample we excluded 16,604 all other race participants (Black, Asian, Hispanic, any race); our study's final sample size was 19,705.

Exposure Variable

Lifetime PTSD was assessed by the AUDADIS-5, a fully structured interview designed to assess alcohol, drug and mental disorders according to Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5) criteria in clinical and general population settings (Hasin et al., 2015). Diagnostic criteria for a positive PTSD diagnosis include reported exposure to actual or threatened death, serious injury or sexual violence, by directly

experiencing, witnessing, learning or being repeatedly exposed to traumatic events (Criterion A) and symptom clusters (intrusion [Criterion B], avoidance [Criterion C], negative alterations in cognitions [Criterion D] and mood and alterations in arousal and reactivity [Criterion E], causing impairment or distress for 1 month). Specifically, we used a broadly defined variable constructed by NIAAA psychiatric epidemiologists for lifetime DSM-5 PTSD consistent with the definition of clusters above, with or without impairment or distress, and with or without a less than 1-month duration of symptoms (National Institute on Alcohol Abuse and Alcoholism, 2015). This assessment required at least 2 subcriteria to meet Criterion D and Criterion E, yielding a broadly defined PTSD diagnosis (a narrowly defined PTSD diagnosis requires 3 subcriteria to meet Criterion D and Criterion E and at least 1 month impairment or distress). We employed this broad diagnostic definition to capture more mild cases of PTSD. Milder cases warrant inclusion due to the lower sample of American Indians and Alaskan Natives. Lifetime PTSD was a dichotomous variable (yes/no) based on NESARC-III coding. The intraclass correlation coefficient and 95% confidence interval (CI) for the concordance of AUDADIS-5 and DSM-5 on dimensional measures for all symptoms combined PTSD was 0.69 and 0.62–0.75, respectively; this intraclass correlation coefficient can be considered fair to strong (Hasin et al., 2015).

Outcome Variable

Past year AUD was assessed by the AUDADIS-5. Past year AUD was selected over lifetime AUD because AUD in the past year from the interview date is more likely to have occurred after lifetime PTSD. While overlap within the past year is still possible, a more recent period of reference improves temporality of exposure and outcome. Past year AUD diagnoses requires at least 2 of 11 DSM-5 criteria to be present during the time period 12 months prior to the current interview (American Psychiatric Association, 2013). The DSM-5 integrates alcohol abuse and dependence, previously distinct disorders in the DSM-IV, into a single disorder: AUD, with mild, moderate and severe sub-classifications. Here, past year AUD was coded as a dichotomous variable: any severity levels AUD vs. no AUD. The Kappa statistic and standard error for the test-retest reliability of AUDADIS-5 DSM-5 for AUD was 0.62 and 0.03, respectively (with a test-retest prevalence of 31.41/24.35, respectively) (Grant et al., 2015b); Kappa estimates of 0.61–0.80 can be considered within a substantial reliability range.

Potential Effect Measure Modifiers/Confounding Covariates

Sociodemographic variables included sex, race (White, non-Hispanic and American Indian/Alaska Native, non Hispanic), marital status (married, widowed, divorced/separated and never married), education (less than high school, high school or GED, and some college/college graduate/graduate work), age (<24, 25–34, 35–44, 45–54, 55–64, and >65), and income (USD $10,000, $10,000–$24,999, $25,000–$49,999, and $50,000).

Other diagnostic variables included as covariates were lifetime major depressive disorder and lifetime generalized anxiety disorder. These variables were assessed by the AUDADIS-5. We coded and model marital status, education, and age as disjoint indictor variables.

Statistical analyses

First, we reported frequencies and percentages or medians with interquartile range for all participant demographic and diagnostic characteristics stratified by race. Second, we assessed confounding. Potential confounders were selected based on previous literature and availability in the data including race, marital status, education, age, sex, income, lifetime major depressive disorder, and lifetime generalized anxiety disorder. For each of these potential confounders, we looked at their relationships with both the exposure and the outcome. Our full model included age, marital status, education, race, sex, income, lifetime major depressive disorder, and lifetime generalized anxiety disorder, and the interactions of lifetime major depressive disorder and PTSD, lifetime generalized anxiety disorder and PTSD, education and PTSD, and sex and PTSD. Based on associations commonly seen in this literature, we considered strong associations to be an odds ratio greater than 2 or less than 0.5. Those with strong associations were included in the reduced, final model. Our final model included age, race, sex, lifetime major depressive disorder, and education.

Third, we used logistic regression models to estimate the odds ratio for the association between lifetime PTSD and past year AUD and then examined this association by race. From the full model, we removed one variable or interaction at a time. We assessed an *a priori* change in the estimate of <5% to be dropped. Our final model adjusted for age, sex, major depressive disorder and education, and was stratified by race (American Indians and Alaska Natives vs. non-Hispanic Whites). Interaction in the stratified analysis was further evaluated by calculating the interaction contrast ratio (ICR), a measure of departure from additive effects. We used regression analysis to calculate the ICR and the 95% confidence intervals around the ICR. All analyses were conducted with SAS statistical package, version 9.3, (SAS Institute, Inc., Cary, North Carolina).

RESULTS

Descriptive Statistics

Our analytic study included 19,705 participants, of whom 511 were American Indian and Alaska Native and 19,194 were non-Hispanic White. Participants' median age was 49 years old. The sample characteristics between American Indians and Alaska Natives and non-Hispanic Whites were similar in regards to age, sex and lifetime anxiety. Findings of racial differences were significant: compared to non-Hispanic Whites, American Indians and Alaska Natives had half the proportion of both having a college/graduate degree and a personal income greater than $50,000, yet American Indians and Alaska Natives had about double the proportion of PTSD ($p < 0.0001$). Statistically significant differences between American Indians and Alaska Natives and non-Hispanic Whites were also shown in regards to lifetime depression ($p < 0.05$), martial status ($p < 0.01$) and education ($p < 0.0001$) (Table 1).

The percentage of past year AUD among American Indians and Alaska Natives was 20.2% (n=103) compared to 14.2% (n=2,725) in non-Hispanic Whites. Among American Indians and Alaska Natives, the percentage with comorbid lifetime PTSD and past year AUD was 6.5% (n=33) compared to 2.4% (n=457) in non-Hispanic Whites. Among American Indians

and Alaska Natives, the percentage with comorbid lifetime generalized anxiety disorder and past year AUD was 3.9% (n=20) compared to 1.7% (n=332) in non-Hispanic Whites. Among American Indians and Alaska Natives, the percentage with comorbid lifetime major depressive disorder and past year AUD was 7.1% (n=36) compared to 4.3% (n=825) in non-Hispanic Whites. All differences are statistically significant ($p < 0.0001$).

Individuals with past year AUD, regardless of race, have higher prevalence of lifetime PTSD, generalized anxiety disorder and lifetime major depressive disorder. Among American Indians and Alaska Natives, a significantly higher percentage of individuals with past year AUD had lifetime PTSD (32.0% vs. 20.6%) ($p < 0.05$), lifetime generalized anxiety disorder (19.4% vs. 9.3%) ($p < 0.001$) and had never been married (38.8% vs. 21.6%) ($p < 0.01$) compared to those without past year AUD. Among non-Hispanic Whites, those with past year AUD had a significantly higher percentage lifetime PTSD compared to those without past year AUD (16.8% vs. 10.9%) ($p < 0.05$). Similarly, among non-Hispanic Whites, a significantly higher percentage of individuals with past year AUD had a lifetime generalized anxiety disorder, lifetime major depressive disorder, were men and were never married compared to those without past year AUD ($p < 0.0001$) (Table 2).

American Indian and Alaska Native men have over two times the prevalence of lifetime PTSD compared to non-Hispanic White men (17.1% vs. 7.7%) Regarding the joint distribution of PTSD and AUD, American Indian and Alaska Native men have greater than 3 times the percentage compared to non-Hispanic White men (9.5% vs. 3.1%). Among women, the patterns were similar with American Indians and Alaska Natives having a higher percentage of lifetime PTSD and AUD compared to non-Hispanic Whites. American Indian and Alaska Native women have nearly twice the percentage of lifetime PTSD compared to non-Hispanic White women (26.9% vs. 14.9%) and nearly twice the percentage of AUD compared to non-Hispanic White women (17.6% vs. 10.7%). Regarding the joint distribution of lifetime PTSD and AUD, American Indian and Alaska Native women have slightly greater than twice the proportion compared to non-Hispanic White women (4.3% vs. 1.8%). Table 3 shows the distribution of lifetime PTSD, AUD and the joint distribution of lifetime PTSD and AUD by sex and race.

Lifetime PTSD and past year AUD, overall and stratified by race

Overall, the unadjusted, crude odds of AUD in the past year among those with lifetime PTSD were 1.67 (95% CI 1.50, 1.87) times the odds of AUD in the past year among those without lifetime PTSD. After adjusting for age, race, sex, lifetime depression, and education the odds of AUD in the past year among those with lifetime PTSD were 1.60 (95% CI 1.42, 1.80) times the odds of AUD in the past year among those without lifetime PTSD.

After adjusting for age, sex, lifetime depression, and education the odds of AUD in the past year among American Indians and Alaska Natives with lifetime PTSD were 1.76 (95% CI 1.07, 2.90) times the odds of AUD in the past year in American Indians and Alaska Natives without lifetime PTSD. The adjusted odds of AUD in the past year among non-Hispanic Whites with lifetime PTSD were 1.59 (95% CI 1.41, 1.80) times the odds of AUD in the past year in non-Hispanic Whites without lifetime PTSD. The estimated odds ratios were above the null; the magnitude among American Indians and Alaska Natives was slightly higher

(OR = 1.76) than non-Hispanic Whites (OR = 1.59): ICR= 0.41, 95% CI −1.4, 2.22 (Table 4). However, a likelihood ratio test comparing models with and without an interaction term indicated that adding the interaction did not improve the fit of the model at an alpha level of 0.05 (χ^2= 0.145, p = 0.70).

The ICR showed that the observed odds for the joint exposure of being an American Indian/Alaska Native and PTSD (OR = 2.31) were greater than the expected additive effects of lifetime PTSD and being an American Indian/Alaska Native independently (ICR= 0.41, 95% CI −1.4, 2.22). This analysis suggests synergy on an additive and multiplicative scale; individuals who are American Indian/Alaska Native with PTSD have greater odds of AUD compared to individuals who are American Indian/Alaska Native without PTSD and non-Hispanic Whites with PTSD (Table 5).

DISCUSSION

To our knowledge this is the first study to examine the association between PTSD and AUD among American Indians and Alaska Natives compared to non-Hispanic Whites using a large population-based nationally representative sample. The intent of our findings is largely to describe this phenomenon among American Indians and Alaska Natives that is currently absent in the literature. Our key findings indicates that American Indian and Alaska Native women compared to all other groups (American Indian and Alaska Native men and non-Hispanic White women and men) have the greatest prevalence of lifetime PTSD. American Indian and Alaska Native men have the highest prevalence of joint exposure to both PTSD and AUD by a great extent, compared to American Indian and Alaska Native women and non-Hispanic White men and women (9.5% vs. 4.3%, 1.1% and 1.8% respectively). We hypothesized that 1) PTSD would be associated with increased AUD and 2) that this association would be stronger in American Indians and Alaska Natives compared to non-Hispanic Whites. Our primary hypothesis was confirmed. After adjusting for age, race, sex, lifetime depression, and education, lifetime PTSD was significantly associated with past year AUD. After adjusting for age, race, sex, lifetime depression, and education, the odds of past year AUD with PTSD were increased in American Indians and Alaska Natives compared to non-Hispanic Whites. These findings show that American Indian and Alaska Native populations exposed to PTSD have a greater burden of AUD trend compared to non-Hispanic Whites in a general U.S. population.

Overall, our results indicate a significantly higher association of AUD in individuals with PTSD in both American Indians and Alaska Natives and non-Hispanic Whites. The magnitude of the association was slightly higher in American Indians and Alaska Natives compared to non-Hispanic Whites and the ICR indicated a synergistic effect where individuals who were American Indian/Alaska Native with PTSD had a higher risk of AUD. A likelihood ratio test indicated that the association by race was not statistically significant. However, the burden of both PTSD and AUD was much higher in American Indians and Alaska Natives compared to non-Hispanic Whites. While the effect of PTSD on AUD might not be much greater in this population, the higher burden of both these conditions highlights the need to intervene in this population. Interventions targeting PTSD may help reduce a portion of AUD in AIAN populations.

The high prevalence of PTSD in American Indians and Alaska Natives compared to non-Hispanic Whites is consistent with previous literature that American Indians and Alaska Natives have a higher risk of experiencing traumatic life events and developing PTSD compared to any other racial group (Bassett et al., 2014). Repeated historical assaults to American Indian and Alaska Native communities have included introduction of novel diseases, forced relocation, forced removal of children via Indian boarding school policies, and prohibition of spiritual and cultural practices (Evans-Campbell, 2008). The response to the sum of these past events has amounted to psychological distress through historical trauma (Whitbeck et al., 2004). Conceptualizing historical psychological distress in response to these historical events has increased in American Indian and Alaska Native community research (Ehlers et al., 2013a, Denham, 2008). One conceptualization offered is the effects of historical losses experienced by American Indians and Alaska Natives are not limited to one catastrophic period in history, but are ongoing and contemporarily present (Whitbeck et al., 2004, Whitbeck et al., 2009). Children of parents with PTSD are more likely to develop PTSD in their lifetime (Yehuda et al., 1998).

In addition to effects of historical trauma, American Indians and Alaska Natives experience more immediate traumatic events, witness traumas to loved ones, and are victims of physical violence compared to the overall U.S. population (Manson et al., 2005, Beals et al., 2005). American Indians and Alaska Natives experience overall violence, aggravated assault, simple assault and serious violent crimes at rates higher than those for whites, blacks and Asians (Rennison, 2001). Also, included in this national sample are American Indian and Alaska Native and non-Hispanic White U.S. veterans. Data also from NESARC-III found that American Indian and Alaska Natives have the highest prevalence (24.1%) of lifetime DSM-5 PTSD compared to all other race/ethnicities (White, Black, Asian and Hispanic) (Smith et al., 2016). These specific traumas may compound the psychological distresses mentioned above.

A related additional factor facing American Indian and Alaska Native communities is the historical use of alcohol. While alcohol use varies by tribe, American Indians and Alaska Natives as a whole suffer higher rates of alcohol dependence than the general US population (Ehlers et al., 2013b). Previous studies have examined the comorbidity of PTSD and AUD in American Indian communities (Ehlers et al., 2013b, Boyd-Ball et al., 2006, Deters et al., 2006). However, less is known about the causal role of PTSD on AUD. While these results are not definitive in causality of PTSD on AUD, we examined the association of PTSD on AUD building upon previous literature on the comorbidity of PTSD and AUD with other health outcomes.

Since we have no pre-PTSD measures of AUD in this population it greatly impedes the strength of interpretation of results. It is possible that those with a history of poor mental health and/or alcohol problems may be more vulnerable to traumatic events (Mueser et al., 2004). Thus, pre-existing conditions may contribute to the observed elevated levels of AUD in American Indians and Alaska Natives exposed to traumatic events; the amount it may contribute is not measured and is unknown. However, given the unique history of American Indian and Alaska Native tribes, some collective group level information on traumatic events

relating to loss of land, forced migration, boarding schools, etc. may be less hard to predict compared to individual-level PTSD exposure.

The estimated odds ratios of AUD presented here show that both American Indians and Alaska Natives and non-Hispanic Whites exposed to lifetime PTSD were above the null and elevated. Stratified estimates indicated that among American Indians and Alaska Natives lifetime PTSD had a greater association with AUD than in non-Hispanic whites. This was supported by a positive ICR, which indicated that race and lifetime PTSD work synergistically to further increase risk of AUD. However, the likelihood ratio test for the interaction was non-significant, indicating the association of lifetime PTSD and AUD does not differ across levels of race. We expect that given small American Indian and Alaska Native sample size, we were not adequately powered to detect a difference although evidence does point to an increased risk in this population.

Limitations

When evaluating these findings several accompanying limitations must also be considered. First, the cross-sectional study design prevents causal inference and the ability to adjust for time-varying confounders. Second, we presented adjusted odds ratios as our point estimate. When using cross-sectional data with a common outcome, odds ratios may overestimate the association. Thus, we also estimated the prevalence ratios (PR) (analyses not presented), which were slightly more conservative estimates. As with the adjusted odds ratios, the adjusted prevalence ratios were significant and our conclusions remained the same. Third, the current analysis included a relatively small sample of American Indians and Alaska Natives, which may limit the power to detect significant differences, as suggested by wider confidence intervals. Fourth, American Indians and Alaska Natives is an aggregated group from hundreds of tribes that may mask many important differences in culture and experience relating to PTSD and AUD. This is a limitation of the dataset where specific tribal affiliation is not collected and where overall American Indian and Alaska Native participation is low. Fifth, given that the study's information is collected by interviews, recall bias and interviewer bias cannot be overlooked, which would bias the estimates downward, particularly with the lifetime exposure questions. However, the retest-test of the NESARC is reliable (Grant et al., 2015b). Lastly, the diagnoses of PTSD and AUD were not made by clinicians, but by trained interviewers using a fully structured interview. However, these overestimations are expected to be non-differential by race. Similarly, an additional problem with studies investigating PTSD and AUD are how the exposure is defined in the population. Many studies have defined PTSD as one-dimensional construct or have focused investigations in military, treatment-seeking or single institutional populations. Here, the exposure is defined as a more robust multi-dimensional measure of PTSD. Nonetheless, this study provides novel and important information about PTSD and AUD among the American Indian and Alaska Native population using data from the general U.S. population.

Conclusions

These results suggest a need for screening and interventions for PTSD in tribal government programs and in American Indian and Alaska Native health services that may help reduce

the increased risks for AUD among American Indians and Alaska Natives. Studies that include measures of trauma caused by losses in culture and its chronic effects as well as childhood and youth traumas specific to American Indian and Alaska Native populations, and measures of AUD before traumatic event exposure are needed to more conclusively assess the relationship between PTSD and AUD within subgroups of American Indians and Alaska Natives as well as other ethnic/racial minority groups.

Acknowledgments

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Table 1

Baseline characteristics of sample of participants (n=19,705) aged 18 years and older from the National Epidemiologic Survey on Alcohol and Related Conditions-III (NESARC-III), by race[a]

Characteristic	AIAN *n* = 511		NHW *n* = 19,194	
Lifetime PTSD				
Yes	117	22.9	2,251	11.7
Lifetime GAD				
Yes	58	11.4	1,794	9.4
Lifetime MDD				
Yes	145	28.4	4,661	24.3
Age, years, *median (quartiles)*	46	(33,57)	49	(33,62)
Sex				
Women	301	58.9	10,639	55.4
Men	210	41.1	8,555	44.6
Personal Income				
US $50,000	64	12.5	4,634	24.1
US $25,000–49,999	109	21.3	5,184	27.0
US $10,000–24,999	191	37.4	5,513	28.7
US $10,000	147	28.8	3,863	20.1
Marital Status				
Married/Living with someone as if married	229	44.8	9,752	50.8
Widowed	38	7.4	1,736	9.0
Separated/divorced	116	22.7	3,704	19.3
Never married	128	25.1	4,002	20.9
Education				
College of graduate degree	76	14.9	5,963	31.1
Some college	212	41.5	6,670	34.7
High school/general educational development	145	28.4	4,835	25.2
< High school	78	15.2	1,726	9.0

Abbreviations: PTSD, Posttraumatic Stress Disorder; GAD, Generalized Anxiety Disorder; MDD, Major Depressive Disorder; AIAN, American Indian and Alaska Native; NHW, non-Hispanic White

[a] Frequency and percentage, unless otherwise noted

Table 2

Baseline characteristics of sample of participants (n=19,705) aged 18 years and older from the National Epidemiologic Survey on Alcohol and Related Conditions–III (NESARC–III), by race and Alcohol Use Disorder[a]

Characteristic	AIAN (n = 511)					NHW (n = 19,194)				
	No AUD	(%)	AUD	(%)	p-value	No AUD	(%)	AUD	(%)	p-value
Lifetime PTSD					<0.05					<0.0001
Yes	84	(20.6)	33	(32.0)		1,794	(10.9)	457	(16.8)	
Lifetime GAD					<0.001					<0.0001
Yes	38	(9.3)	20	(19.4)		1,462	(8.9)	332	(12.2)	
Lifetime MDD					NS					<0.0001
Yes	109	(26.7)	36	(35.0)		3,836	(23.3)	825	(30.3)	
Age, years, *median (quartiles)*	48	*(34, 58)*	35	*(24, 49)*		51	*(36, 64)*	34	*(26, 48)*	
Sex					NS					<0.0001
Women	248	(60.8)	53	(51.5)		9,499	(57.7)	1,140	(41.8)	
Personal Income					NS					NS
US $50,000	56	(13.7)	8	(7.8)		3,949	(24.0)	685	(25.1)	
US $25,000–49,999	87	(21.3)	22	(21.4)		4,422	(26.9)	762	(28.0)	
US $10,000–24,999	153	(37.5)	38	(36.9)		4,776	(29.0)	737	(27.1)	
US $10,000	112	(27.5)	35	(34.0)		3,322	(20.2)	541	(19.9)	
Marital Status					<0.01					<0.0001
Married/Living with someone	190	(46.6)	39	(37.9)		8,709	(52.9)	1,043	(38.3)	
Widowed	35	(8.6)	3	(2.9)		1,683	(10.2)	53	(1.9)	
Separated/divorced	95	(23.3)	21	(20.4)		3,138	(19.1)	566	(20.8)	
Never married	88	(21.6)	40	(38.8)		2,939	(17.9)	1,063	(39.0)	
Education					NS					<0.0001
College of graduate degree	67	(16.4)	9	(8.7)		5,129	(31.1)	834	(30.6)	
Some college	167	(40.9)	45	(43.7)		5,614	(34.1)	1,056	(38.8)	
High school/GED	108	(26.5)	37	(35.9)		4,202	(25.5)	633	(23.2)	
Less than High school	66	(16.2)	12	(11.7)		1,524	(9.3)	202	(7.4)	

Abbreviations: PTSD, Posttraumatic Stress Disorder; GAD, Generalized Anxiety Disorder; MDD, Major Depressive Disorder; GED, General Education Development; AIAN, American Indian and Alaska Native; NHW, non-Hispanic White; NS, non-significant

^{a}Frequency and percentage, unless otherwise noted

Table 3

Joint distribution of AUD and PTSD and sex, stratified by AIAN and NHW

	AIAN				NHW			
	Men (%) (*n* = 210)		Women (%) (*n* = 301)		Men (%) (*n* = 8,555)		Women (%) (*n* = 10,639)	
Lifetime PTSD	36	(17.1)	81	(26.9)	662	(7.7)	1,589	(14.9)
Past year AUD	50	(23.8)	53	(17.6)	1,585	(18.5)	1,140	(10.7)
Both PTSD and AUD	20	(9.5)	13	(4.3)	269	(3.1)	188	(1.8)

Abbreviations: AUD, Alcohol Use Disorder; PTSD, Posttraumatic Stress Disorder; AIAN, American Indian and Alaska Native; NHW, non-Hispanic White

Table 4

The estimated adjusted odds ratios (aOR) and 95% confidence intervals for the association of lifetime PTSD and AUD by race[1]

	AIAN		NHW	
	aOR	(95% CI)	aOR	(95% CI)
Lifetime PTSD and past year AUD	1.76	(1.07, 2.90)	1.59	(1.41, 1.80)

[1]Stratified model = ln $(AUD) = \beta_0 + \beta_1(PTSD) + \beta_2(age) + \beta_3(race) + \beta_4(education) + \beta_5(sex) + \beta_6(MDD) + \beta_7(PTSD*race)$

Abbreviations: AUD, Alcohol Use Disorder; PTSD, Posttraumatic Stress Disorder; MDD, Major Depressive Disorder; AIAN, American Indian and Alaska Native; NHW, non-Hispanic White, CI, confidence interval

Table 5

Departure form additive effects of race and PTSD on AUD[a]

	NHW		AIAN	
	OR	**(95% CI)**	**OR**	**(95% CI)**
No PTSD	1		1.31	(1.0, 1.73)
PTSD	1.59	(1.41, 1.80)	2.31	(1.51, 3.53)
ICR = 0.41 (95% CI: −1.4, 2.22) on the additive scale				

[a] Analysis adjusted for age, race, education, sex, and depression

Abbreviations: AUD, Alcohol Use Disorder; PTSD, Posttraumatic Stress Disorder; AIAN, American Indian and Alaska Native; NHW, non-Hispanic White, CI, confidence interval