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Acute Alcohol Intoxication and Suicide Among U.S. Ethnic/ Racial Groups: Findings from the National Violent Death Reporting System

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Abstract

Background—To assess the prevalence and sociodemographic correlates of suicide involving acute alcohol intoxication among U.S. ethnic minorities.

Methods—Data were derived from the restricted 2003–2009 National Violent Death Reporting System (NVDRS). The study focused on the sociodemographic and toxicological information of 59,384 male and female suicide decedents for 16 states of the U.S. Acute alcohol intoxication was defined as having a blood alcohol content (BAC) ≥ 0.08 g/dl. Overall, 76% of decedents were tested for the presence of alcohol.

Results—The proportion of suicide decedents with a positive BAC ranged from 47% among American Indians/Alaska Natives (AIs/ANs) to 23% among Asians/Pacific Islanders (PIs). Average BAC was highest among AIs/ANs. Among those who were tested for BAC, the proportion of decedents legally intoxicated prior to suicide was: Blacks, 15%; AIs/ANs, 36%; Asians/PIs, 13%; Hispanics, 28%. Bivariate associations showed that most suicide decedents who were legally intoxicated were male, younger than 30 years of age, with a high school education, not married, non-veterans, lived in metropolitan areas, and used a firearm to complete suicide. However, with the exception of Whites, most of these associations became not statistically significant in multivariate analysis.

Conclusions—Alcohol use and legal intoxication prior to completing suicide are common among U.S. ethnic groups, especially among males and those who are younger than 30 years of age. The AI/AN group had the highest mean BAC, the highest rate of legal intoxication and decedents who were particularly young. Suicide prevention strategies should address alcohol use as a risk factor. Alcohol problems prevention strategies should focus on suicide as a consequence of alcohol use, especially among AI/AN youth and young adults.

Keywords

alcohol; intoxication; suicide; NVDRS; ethnicity

INTRODUCTION

Suicide is a major public health problem in the United States and around the world (Goldsmith et al., 2002; Nock et al., 2008). With more than 36,000 deaths, suicide ranked as the 10th leading overall cause of death in the United States as of 2009 (Centers for Disease Control and Prevention [CDC], 2011). The overall rate of suicide in the U.S. in 2009 was 11.77/100,000 (CDC, 2011). Data from 2002–2009 show that suicide rates were higher among American Indian/Alaska Natives (15.50/100,000) and Whites (16.16/100,000) than among Hispanics, Blacks, and Asians/Pacific Islanders (between 6 and 7/100,000) (CDC, 2011). National surveys also show that American Indians/Alaska Natives have a higher prevalence of individuals who report serious thoughts of suicide in the previous 12 months (7.5%) compared to Blacks (4.1%), Whites (4%), Asians (3.2%), Hispanics (2.4%), and Native Hawaiians/Pacific Islanders (4.6%) (Substance Abuse and Mental Health Services Administration [SAMHSA], 2012).

Ongoing difficulties with alcohol as exemplified by an alcohol use disorder (i.e., alcohol abuse, alcohol dependence) increase suicide risk (Cavanagh et al., 2003; Wilcox et al., 2004). Data from the 2010 National Survey on Drug Use and Health (NSDUH) show that adults aged 18 or older with past year alcohol or drug use disorders were about 4 times more likely than those without such disorders to report serious thoughts about suicide in the past year (12.2% vs. 3%) (Substance Abuse and Mental Health Services Administration, 2012). Adults with a substance use disorder were also more likely to report suicide plans (3.1% vs. 0.9%) and to attempt suicide compared with adults without substance use disorders (1.7% vs. 0.4%). Alcohol dependent individuals who come to clinical attention are approximately 9 times more likely to die by suicide than the general population (Wilcox et al., 2004). A meta-analysis of psychological autopsy studies worldwide concluded that alcohol use disorders confer increased risk and are second only to mood disorders as the most common condition among suicide decedents (Cavanagh et al., 2003).

Besides chronic excessive alcohol use, acute use of alcohol preceding suicidal behavior is also highly prevalent. A median of 37% of suicide decedents (range 10% to 69%) and 40% of non-lethal suicide attempters (range 10% to 73%) had used alcohol prior to the event (Cherpitel et al., 2004). In fact, acute use of alcohol in larger quantities, such as that leading to intoxication, confers greater risk for suicide attempt than regular patterns of alcohol use (Powell et al., 2001; Borges et al., 2004; Branas et al., 2011). Case-crossover data comparing risk associated with acute and chronic alcohol use on other types of injuries show similar results (Vinson et al., 2003a; Vinson et al., 2003b), indicating that acute use of alcohol is a potent independent risk factor over and above any risk conferred by alcohol use pattern. Unfortunately, most of the existing research on acute alcohol use and suicide is limited and mainly provides a demographic description of suicide decedents. Yet, information on acute alcohol consumption immediately prior to suicide would be invaluable if suicides among drinkers are to be reduced. Newly available data from the National

Violent Death Reporting System (NVDRS), which are analyzed herein, can be used to address this issue.

Ethnicity is an important factor associated with alcohol use, abuse and dependence, and consequently suicidal behavior. Twelve-month data on drinkers from the 2001–2002 National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) show a higher proportion of heavier drinkers (more than 1 drink per day for women and more than 2 for men) among American Indians/Alaska Natives (12.7%) than among Whites (11.3%), Blacks (8.7%), Asians/Native Hawaiians/Pacific Islanders (4.7%) and Hispanics (7%) (Chen et al., 2006). American Indians/Alaska Natives also have higher rates of drinkers who exceed daily and weekly safe limits, and drinkers who binge (Chen et al., 2006). Overall, considering indicators of levels of alcohol consumption such as heavier drinking, safe limits and binge, American Indians/Alaska Natives are consistently at the top in terms of excessive alcohol use, followed by Whites, then Blacks, Hispanics and Asians/Native Hawaiians/Pacific Islanders. The one exception is for rates of binge drinking, which show Hispanics in second place following American Indians/Alaska Natives. Results from the 2010 NSDUH are in general agreement with these NESARC findings (SAMHSA, 2012). Other data from the NESARC show that American Indians/Alaska Natives have the highest 12-month prevalence rates of alcohol use disorders (alcohol abuse and dependence; 12.1%), followed by Whites (8.9%), Hispanics (7.9%), Blacks (6.9%) and Asians (4.5%) (Grant et al., 2004; Hasin et al., 2007). Certain consequences of alcohol consumption (i.e., drinking and driving) are also higher among minority groups such as American Indians/Alaska Natives and Hispanics (Chartier et al., in press), while drinking-related intimate partner violence is higher among Blacks (Caetano et al., 2000), and fetal alcohol syndrome is higher among Blacks and American Indians/Alaska Natives (CDC, 2002; Russo et al., 2004).

Thus, it is not surprising that the association between suicide and alcohol varies across ethnic groups in the United States. Karch et al. (2006), using 2004 NVDRS data for 13 states in the United States, showed that alcohol was present in the blood of 40.3% of Hispanic suicide decedents. Proportions for other ethnic groups studied were 34% for Whites, 25.6% for Blacks, and 28.4% for “Other” ethnicity. The average blood alcohol content (BAC) was .14 for Hispanics, .13 for Whites and “Other” ethnicity, and .10 for Blacks. Data for 2005–2006 on alcohol and suicide from the NVDRS show similar variations in suicide rates and alcohol across ethnic groups. The rates of alcohol dependence among suicide decedents were 21% among American Indians/Alaska Natives, 17.4% among Hispanics, 16.3% among Whites, 7.3% among Asians/Pacific Islanders and 6.8% among Blacks. The proportion of decedents with a positive alcohol test was highest among American Indians/Alaska Natives (45.5%), followed by Hispanics (39.2%), Whites (33.6%), Blacks (24.9%) and Asians/Pacific Islanders (22.9%) (CDC, 2009). A third analysis of NVDRS data from 2003 to 2009 by Kaplan et al. (2012) showed that the prevalence of alcohol intoxication (BAC $\geq$ 0.08 g/dl) among American Indian/Alaska Native men (40.8%) was about 2 times higher than among Blacks (16.9%), Asians/Pacific Islanders (14.3%), Whites (23.9%) and 1.4 times higher than among Hispanics (29.8%). Among women, the prevalence of intoxication was about 2 to 3 times higher among American Indians/Alaska Natives (32.9%) compared to Whites (17.3%), Blacks (10.6%), Asians/Pacific Islanders (10.4%), and 1.4 times higher than among Hispanics (22.8%). With the effects of sociodemographic factors and suicide method controlled for in the analysis, American Indian/Alaska Native suicide decedents remained about 2 times more likely than Whites to be intoxicated prior to committing suicide.

The purpose of the present study was to assess the prevalence and the sociodemographic correlates of suicide with acute alcohol intoxication among Whites and all major U.S. ethnic and racial groups: Blacks, Asians/Pacific Islanders, Hispanics, and American Indians/Alaska

Natives. Previous studies have identified the close association between alcohol use and suicide in general (e.g., Lamis and Malone, 2012; Kaplan et al., 2012), and alcohol use among specific ethnic minority groups such as American Indians/Alaska Natives (e.g., May et al., 2002; Olson and Wahab, 2006). Other studies have analyzed alcohol use and suicide in more than one ethnic group, but these either do not cover all ethnic groups in the United States (e.g., Karch et al., 2006; Stahre and Simon, 2010) or analyze data for 1 state only (Sutocky et al., 1993; May et al., 2002; Stahre and Simon, 2010). Specifically, the aims of the present research were to (a) estimate the prevalence of BAC ≥ 0.08 g/dl among suicide decedents (which is consistent with driving while intoxicated laws in many states; U.S. Department of Transportation, 2011) and (b) examine the sociodemographic factors associated with acute alcohol intoxication among suicide decedents.

MATERIALS AND METHODS

Data Source

The NVDRS is a state-based surveillance system that provides information on violent deaths for 16 participating states (Alaska, Colorado, Georgia, Kentucky, Maryland, Massachusetts, New Jersey, New Mexico, North Carolina, Oklahoma, Oregon, South Carolina, Rhode Island, Utah, Virginia, and Wisconsin). Data are gathered from coroner/medical examiner (C/ME) records, police reports, death certificates, toxicology laboratories, crime laboratories, and Alcohol, Tobacco, Firearms and Explosives (ATF) firearm trace reports. Information on acute alcohol use is based on toxicological analyses of decedents as part of the C/ME investigation. Suicide decedents were identified as those with death certificates that listed International Classification of Diseases, 10th Revision codes X60-84 or Y87.0. The data analyzed here cover 59,384 persons who died by suicide in the 16 NVDRS states during 2003–2009.

Measures

Blood Alcohol Content (BAC): Overall, 76% of decedents were tested for the presence of alcohol. Across racial/ethnic groups, BAC testing was conducted in 79.7% of White decedents, 86.3% of Blacks, 70.5% of AIs/ANs, 84.7% of Asians/PIs, and 87.4% of Hispanics. Blacks, Asian/PIs, and Hispanics were more likely to be tested, ($p < .001$) than Whites. AIs/ANs were less likely to be tested than Whites ($p < .001$). Hispanics, Blacks, and Asians were not significantly different from one another. Blood alcohol levels were coded in terms of weight by volume, and then classified as < 0.08 g/dl or ≥ 0.08 g/dl.

Sociodemographic variables: These were obtained from death certificates and included gender, age group (< 21 , 21–29, 30–39, 40–49, ≥ 50), race/ethnicity (White, Black, American Indian/Alaska Native (AI/AN), Asian/Pacific Islander (PI), and Hispanic), educational attainment ($\leq$ high school, $>$ high school) and metropolitan status. Of note, educational attainment, which is voluntary information, was missing for more than 90% of the decedents in Rhode Island and Georgia; thus, a category for “missing” was included to retain these two states. Other states were missing less than 10%. Counties of death were assigned a rural-urban continuum code based on a classification system developed by the U.S. Department of Agriculture Economic Research Service (United States Department of Agriculture, 2003). The continuum contains 9 categories and characterizes metropolitan counties by population size and non-metropolitan counties by degree of urbanization and adjacency to metropolitan areas. The categories range from “1” (counties in metropolitan areas of 1 million population or more) to “9” (completely rural counties or those with less than 2,500 urban population, not adjacent to a metropolitan area). The 9 categories were then collapsed into 2 categories: metropolitan (codes 1 through 3) and non-metropolitan (codes 4 through 9).

Statistical Analysis

Bivariate and multivariate (logistic regression) analyses were conducted. The sociodemographic characteristics of suicide decedents and of decedents with BAC ≥ 0.08 are described. Pearson chi-square tests in Tables 1 and 3 assessed the significant differences in the distribution of decedents for each sociodemographic variable across ethnic groups. Significance tests in Table 2 were conducted with Tukey's Post-hoc test within analysis of variance. Multiple logistic regression analyses were then used to examine the independent effect of discrete sociodemographic factors on the odds of intoxication (BAC ≥ 0.08 g/dl) at the time of death by suicide. The first model involved all ethnic groups combined (not shown). This model examined main effects for several variables of interest (the same shown in Table 4) and also tested interaction effects between ethnicity and gender, ethnicity and age, and ethnicity and suicide methods. This was followed by ethnic-specific models, which are shown in Table 4.

RESULTS

Sociodemographic Characteristics of Suicide Decedents

The distributions of decedents in the categories of each sociodemographic variable were significantly different across ethnic groups (Table 1). In general, suicide decedents were mostly male. Whites and Asians/PIs had a higher proportion of suicide decedents aged 50 and older. In contrast, the AI/AN group had a higher proportion of suicide decedents who were younger (about 50% are younger than 30 years of age). The decedents generally had high school or lower education, except for Asians/PIs. Most were not married and non-veterans. Among Asians/PIs, however, decedents who were married and not married were more equally balanced, and the proportion of veterans was lower than in the other groups. Most decedents lived in urban areas, with exception of those in the AI/AN group. Most decedents used firearms to complete suicide, with the exception of Asians/PIs and Hispanics. In these 2 groups, the most frequent method of suicide was by hanging or suffocation.

Blood Alcohol Level among Suicide Decedents

The percent of suicide decedents who tested positive for alcohol with a positive BAC was: Whites, 33%; Blacks, 26%; AIs/ANs, 47%; Asians/PIs, 23%; Hispanics, 38%. Also, among those tested, 22% of the White suicide decedents were legally intoxicated (BAC ≥ 0.08). The overall prevalence of tested decedents at or above the 0.08 level in the other ethnic groups was: Blacks, 15%; AIs/ANs, 36%; Asians/PIs, 13%; Hispanics, 28%.

Mean BAC level among suicide decedents who tested positive for alcohol in the blood was higher than that required for legal intoxication among the overwhelming majority of age groups, independent of ethnicity (Table 2). There were several statistically significant differences in mean BAC across ethnic groups, especially across the three youngest age groups in the Table. The means for BACs in the age group 50 years of age and older were not different across ethnic groups. Among Whites, average BAC among suicide decedents with a positive BAC did not vary much across age groups. The same is true for Blacks and Hispanics. Among AIs/ANs, the mean BAC was higher than in other ethnic groups in each age group, with the highest average in the 30–39 age group. The mean BAC in this latter age group was about 2 times higher than the mean BAC in the same age group among Blacks and Asians/PIs. Among AIs/ANs, the mean BACs in all age groups with exception of those 50 years of age and older were 2 times higher than the BAC level required for legal intoxication.

Sociodemographic Characteristics of Suicide Decedents with BACs ≥ 0.08 g/dl

Data in Table 3 are for suicide decedents who were tested for alcohol and who had BAC at or above 0.08 g/dl. As in Table 1, the distribution of decedents in the categories of each sociodemographic variable in Table 3 was significantly different across ethnic groups. Males were over-represented among those with legal intoxication prior to completing suicide in all ethnic groups. Among White and Asian/PI decedents who were acutely intoxicated, the proportions of decedents in the youngest age group were lower than in other race/ethnicity groups. Among AIs/ANs, nearly half (48%) of suicide decedents who were acutely intoxicated were younger than 30 years of age. Across all ethnic groups, legal intoxication was more common among decedents with a high school education or less. Acute intoxication was also more common among decedents who were not married and among non-veterans, independent of ethnic group. Regarding urban-rural characteristics, decedents who were acutely intoxicated were mostly from metropolitan areas. An exception to this was AI/AN decedents, who were almost equally distributed between metropolitan and non-metropolitan areas. This is a probable representation of the AI residential distribution in the states with AI populations that contribute to the NVDRS system (New Mexico, Oklahoma and Alaska). Finally, decedents who were acutely intoxicated most commonly completed suicide with a firearm. The greatest exception was the Asian/PI group where about half the acutely intoxicated decedents died by hanging or suffocation.

Sociodemographic Correlates of Acute Legal Intoxication among Suicide Decedents

The first logistic model in this analysis was run with all ethnic groups combined, controlling for the effects of gender, age, education, marital status, veteran status, metropolitan area, and suicide method. Results (not shown) indicated that when compared to Whites, Blacks (OR = 0.50, 0.45–0.56; $p < 0.01$) and Asians/PIs (OR = 0.54, 0.43–0.68; $p < 0.01$) were at a significantly lower risk of alcohol intoxication prior to suicide; in contrast, AIs/ANs (OR = 1.70, 1.43–2.00, $p < 0.01$) and Hispanics (OR = 1.17, 1.04–1.30; $p < 0.01$) were at significantly higher risk than Whites. Interactions with statistically significant effects were also detected: Blacks with BACs ≥ 0.08 were older than Blacks with lower BAC, while among Whites no such difference existed. Blacks who died by hanging/suffocation were less likely to have a BAC ≥ 0.08 than Whites who used firearms to complete suicide, and AIs/ANs who died by “other methods” were more likely to be intoxicated than Whites who used firearms. As a second step, ethnic-specific logistic models were then tested. These models indicated that the factors associated with acute intoxication varied across ethnic groups (Table 4). Among Whites, acute alcohol intoxication was associated with being a male and having a high school diploma or lower level of education. The only significant protective factor was being older. Whites who did not use a firearm to complete a suicide were less likely to be acutely intoxicated. Among Blacks, being a male was also a risk factor for acute intoxication prior to suicide. Blacks who completed suicide by “Hanging/suffocation” or “other” means, relative to using a firearm, were less likely to have a BAC at or above the legal limit. Among AIs/ANs, being older was a protective factor against acute intoxication prior to committing suicide. Acutely intoxicated AIs/ANs were also more likely to complete suicide using “other” means, rather than a firearm, and less likely to die from poisoning (versus a firearm). Among Asians/PIs, none of the sociodemographic characteristics investigated were identified as significant risk factors. This group, however, was less likely to be intoxicated when using “other” means of suicide compared to a firearm. Finally, among Hispanics, having less than a high school education or completing high school, compared to having more than a high school education, was associated with acute intoxication. Hispanics were also less likely to be intoxicated when using poison (versus firearms) and “other” means (versus firearms) to complete suicide.

DISCUSSION

The findings described above provide a comprehensive and comparative view of the association between alcohol intoxication and suicide among Whites and all major ethnic groups in the United States. Suicide decedents share a few sociodemographic characteristics, independent of their ethnicity. The majority of decedents were male, not married, and non-veterans. There were also considerable differences in decedents' characteristics across ethnic groups. Whites were older than other groups, while about 50% of decedents among AIs/ANs were younger than 30 years of age. Asians/Pis had higher levels of education and AIs/ANs were mostly from non-metropolitan areas. Some of these differences reflect sociodemographic differences found in the general population of each of these groups. So, according to the 2010 U.S. Census, the median age for the White population (40.3) is higher than that for other ethnic groups. Similarly, Asians have a higher level of education than other groups (U.S. Census Bureau, 2010). For instance, according to the 2010 U.S. Current Population Survey, 50% of Asians over 25 years of age had a bachelor's degree or higher level of education, compared with 28% of all Americans over 25 (U.S. Census Bureau, 2010, 2011). Regarding veteran status, the majority of suicide decedents are non-veterans, but veterans are overrepresented among these decedents in regard to their proportion in the U.S. population. Thus, according to 2010 U.S. American Community Survey, 9.3% of the civilian population 18 years of age and older has veteran status (U.S. Census Bureau, 2010). The proportion across ethnic groups is 10.3% for Whites, 8.6% for Blacks, 8.7% for AIs/ANs, 2.3% for Asians and 3.5% for Hispanics. Therefore, Table 1 shows that veterans are overrepresented among suicide decedents by a factor of 2 among Whites and Blacks and by a factor of 3 among Hispanics.

However, comparisons with the general population are not the only parameter that should be used to understand the sociodemographic characteristics of suicide decedents. For instance, among AIs/ANs, about 50% of suicide decedents were younger than 29 years of age. This is the proportion of AIs/ANs in the U.S. population in this age group. Yet, the fact that such a large proportion of those who complete suicide in the AI/AN population are in such a young age group should be in itself of considerable concern. Data from the Indian Health Service (Gone and Trimble, 2012) show high rates of suicide among AI/AN young adults. For the age group 15–24 years of age, these 2 authors report a rate of 34.2/100,000 suicides, which is 3.7 times higher than the U.S. rate of 9.2/100,000. In the age group 25–34, the suicide rate among AIs/ANs is 37.5/100,000, and this is 2.9 times the U.S. rate of 12.7/100,000 in the same age group.

In regard to alcohol, the results described herein provide important new information about alcohol and suicide in the 4 major ethnic/racial groups in the United States. First, the percentage of suicide decedents tested for BAC is relatively high across all ethnic groups. Yet, Blacks, Asian/Pis and Hispanics were more likely to be tested than Whites. A possible explanation for this difference is that White suicide decedents are older than decedents in these ethnic minority groups, and because of that are less tested. Regarding the indication that AIs/ANs are tested less than Whites, this may be due to differences in medical legal death investigation practice in different states. For instance, the state of Alaska, where ANs are located, has a lower rate of BAC testing than other states (47%). Second, the identification of ethnic-specific correlates of suicide (Table 4) advances research to understand effect-modifiers, which is crucial to elucidate why membership in a particular ethnic group increases or lowers the risk of suicide (Keyes et al., 2012). The AI/AN group show the highest average BAC in almost all age categories and the Asian/PI group the lowest. Among suicide decedents tested for BAC, the same pattern is repeated: AI/AN shows the highest percentage of decedents legally intoxicated in almost all sociodemographic categories in Table 3, and the Asian/PI group the lowest.

The data in Tables 1 and 3 are not independent and therefore differences in proportions between the tables could not be tested for statistical significance. However, visual inspection shows that Whites and AI/AN who were intoxicated (Table 3) were younger than all White and AI/AN decedents (Table 1). Asians who were intoxicated were older than all Asian decedents, and Hispanics who were intoxicated tended to be between 21 and 49 years of age. General population data on alcohol use and intoxication (binge drinking) indicates that younger age groups (18 to 29 years of age) drink more and have a higher frequency of binge drinking (Caetano et al., 2010). This is in accordance with the results for intoxication seen in Table 3, but does not explain the age distribution for Asians. For Hispanics, general population data indicate that heavier drinking happens not only among younger groups but tends to extend beyond the twenties into the thirties and forties, especially among men (Ramisetty-Mikler et al., 2010), which is in accordance with the results for intoxication in Table 3. Finally, comparison of data in Tables 1 and 3 also shows that intoxication among Asians and Hispanics seems to be associated with increased use of firearms to commit suicide. However, this is not confirmed for Asians in the multivariate analysis in Table 4.

The multivariate analysis confirmed the association between acute intoxication and male gender, younger age, education and suicide method (firearm) for some groups (Whites, Blacks, Hispanics) but not all, indicating the diversity that exists across these ethnic groups with regard to suicide and acute intoxication. This diversity is well exemplified in the interaction effects between ethnicity and method of suicide described in the results and also in the variation in ORs associated with different methods of suicide across ethnic groups in Table 4. Some of these associations also confirm previous NVDRS analyses (e.g., CDC, 2009; Kaplan et al., 2012) as well as other research in the literature specific to AI/AN groups (e.g., May et al., 2002), and mirror levels of alcohol consumption and drinking patterns in the U.S. population. For instance, national data show that the rates of heavier drinkers, drinkers who exceed safe daily limits, binge drinkers, and alcohol abuse and dependence among AIs/ANs are higher than among other groups and usually lowest among Asians (Grant et al., 2004; Chen et al., 2006; Hasin et al., 2007; SAMHSA, 2012).

Attempts to understand the high rate of suicide in the AI/AN ethnic group and their use of alcohol share common themes. These two problems not only are correlated but excessive use of alcohol is frequently seen as a major reason for the high rate of suicide in the AI/AN group. For instance, May et al. (2002) explain the higher rate of suicide among younger adults in the AI/AN group, which is also reported herein, as associated with the higher rate of alcohol use in this group. Results in Table 1 show that 50% of those who complete suicide in the AIs/ANs group were younger than 30 years of age. In Table 3, this same age group also comprises 50% of all acutely intoxicated AIs/ANs. The high rate of suicide by firearms, which is evident in the AI/AN group in Table 3, has also been linked to alcohol use prior to the suicide (Sher et al., 2009). The issue is complex, but several common risk factors to suicide and alcohol among AI/AN have been recognized. Among them are loss of culture and historical trauma, ethnic discrimination, poverty and unemployment, family history of substance abuse and mental illness, and family breakdown (Shaughnessy et al., 2004; Olson and Wahab, 2006; SAMHSA, 2012). At the same time it is also important to recognize that there is considerable diversity across the various tribes who are grouped together under the AI/AN label (Beals et al., 2005). Some of these tribes have high rates of alcohol use and high rates of suicide and others have rates that are similar or even lower than those of the U.S. general population (May and Van Winkle, 1994; Olson and Wahab, 2006).

Strengths and Limitations

Data from the NVDRS have numerous strengths. The NVDRS is the only surveillance system for violent deaths in the United States. Second, the NVDRS collects information from multiple sources to characterize violent deaths as opposed to using only death

certificates (which contain limited data). Third, the NVDRS is the first data set to provide BAC for suicide decedents. Fourth, while the NVDRS states are not necessarily representative of the United States, the populations of these 16 states are similar in terms of gender, age, ethnic/racial composition, urban/rural characteristics, and overall suicide rates to the nation as a whole. Finally, collection of post-mortem data is particularly challenging when states have independent county coroner systems rather than a centralized C/ME system. It is worth noting that 69% of the states participating in the NVDRS have centralized C/ME compared to only 15% in non-NVDRS states (Edwards et al., 2009).

The study also has limitations. Not all suicide decedents were tested for blood alcohol content across states. Two states, Alaska and Oregon, had low BAC testing rates (45% and 24%, respectively). Second, the assessment of decedents' ethnicity varies. Ethnicity was determined from information provided by family members, by direct observation by the coroner or medical examiner's office, by police officers, and by directors of funerary agencies. There is evidence that ethnicity is misidentified in death certificates, being more substantially so for AIs/ANs and Hispanics than other ethnic groups (Arias et al., 2008). Third, diverse ethnic groups were lumped together, especially among Asians, Pacific Islanders and Hispanics. The association between suicide and alcohol intoxication may vary considerably across these groups. Fourth, coroners and medical examiners may be less likely to test decedents whom they considered unlikely to have an alcohol problem. In addition, blood alcohol and other toxicological testing depend on state or local funding. Unfortunately, federal resources provided to the NVDRS states did not cover toxicological testing. Finally, as noted above, the NVDRS only covered 16 states for the time frame analyzed in this study, but in all likelihood, it presents a relatively accurate picture of the country as a whole.

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Table 1

Sociodemographic characteristics of all suicide decedents by ethnicity: National Violent Death Reporting System 2003–2009

	White (50564)	Black (4174)	AI/AN (1043)	Asian/PI (1029)	Hispanic (2574)
Gender					
Male (46549)	78.0	83.6	77.7	65.6	83.3***
Female (12832)	22.0	16.4	22.3	34.4	16.7
Age					
< 21 (4028)	5.7	11.7	22.0	8.4	14.0***
21–29 (8386)	12.1	25.5	27.9	21.6	27.2
30–39 (10112)	16.2	22.4	20.5	20.5	21.6
40–49 (13427)	23.3	19.2	16.3	18.6	19.0
50 (23412)	42.7	21.1	13.3	31.0	18.2
Education					
High school (34914)	66.6	74.7	84.8	48.0	81.4***
> High school (16577)	33.4	25.3	15.2	52.0	18.6
Marital status					
Not married (36531)	61.0	69.9	77.7	55.4	68.9***
Married (22205)	39.0	30.1	22.3	44.6	31.1
Veteran status					
Non-veteran (42265)	76.8	81.4	89.4	95.8	89.2***
Veteran (11772)	23.2	18.6	10.6	4.2	10.8
Urban-rural continuum					
Metropolitan (45561)	76.8	85.7	38.2	95.7	82.7***
Non-metropolitan (13362)	23.2	14.3	61.8	4.3	17.3
Method of suicide					
Firearm (29801)	51.5	51.9	42.6	21.4	36.5***
Hanging/suffocation (13468)	20.9	24.9	35.0	47.8	40.1
Poison (10582)	18.8	10.3	12.9	12.5	14.3
Other (5497)	8.8	12.8	9.5	18.3	9.1

Note: Ns appear in parentheses.

p<.001 for chi-square test of significance across all ethnic groups

Table 2Average BAC by age and ethnicity: National Violent Death Reporting System 2003 to 2009^{*}

Age Group	White (n=11451)	Black (n=823)	AI/AN (n=328)	Asian/PI (n=180)	Hispanic (n=767)
<21	0.11 ^c	0.10 ^c	0.17 ^{a,b,d,e}	0.08 ^c	0.11 ^c
21–29	0.14 ^{b,d}	0.11 ^{a,c,e}	0.16 ^{b,d}	0.09 ^{a,c,e}	0.15 ^{b,d}
30–39	0.14 ^{b,c,d}	0.11 ^{a,c,e}	0.21 ^{a,b,d,e}	0.09 ^{a,c,e}	0.14 ^{b,c,d}
40–49	0.14 ^b	0.11 ^{a,c,e}	0.18 ^b	0.15	0.14 ^b
50	0.14	0.12	0.14	0.10	0.15

^{*} Means restricted to those with a BAC positive. Mean differences for each race/ethnic groups (^aWhite, ^bBlack, ^cAI/AN, ^dAsian/PI, ^eHispanic) were tested using Tukey's Post-hoc test within analysis of variance.

Table 3

Sociodemographic characteristics of suicide decedents with BACs 0.08 g/dl by ethnicity: National Violent Death Reporting System 2003–2009

	% White (7504)	% Black (470)	% AI/AN (246)	% Asian/PI (94)	% Hispanic (535)
Gender					
Male (7306)	82.1	88.7	80.1	72.3	86.7***
Female (1543)	17.9	11.3	19.9	27.7	13.3
Age					
< 21 (367)	3.4	5.3	15.0	7.4	7.7***
21–29 (1663)	16.3	29.8	32.5	22.3	37.0
30–39 (1880)	20.8	23.0	30.1	16.0	22.2
40–49 (2487)	29.3	25.1	14.6	24.5	20.6
50 (2452)	30.1	16.8	7.7	29.8	12.5
Education					
High school (5744)	69.1	75.9	85.3	54.9	85.4***
> High school (2374)	30.9	24.1	14.7	45.1	14.6
Marital status					
Not married (5595)	62.4	66.9	79.4	62.4	69.9***
Married (3205)	37.6	33.1	20.6	37.6	30.1
Veteran status					
Non-veteran (6584)	80.2	80.0	90.2	96.4	89.5***
Veteran (1523)	19.8	20.0	9.8	3.6	10.5
Urban-rural continuum					
Metropolitan (6825)	77.7	85.8	44.5	94.7	80.7***
Non-metropolitan (1973)	22.3	14.2	55.5	5.3	19.3
Method of suicide					
Firearm (4848)	55.8	62.8	43.5	28.7	43.0***
Hanging/suffocation (2166)	23.1	20.0	34.6	48.9	39.3
Poison (1371)	16.2	10.6	11.8	16.0	11.2
Other (464)	4.9	6.6	10.2	6.4	6.5

Note: Ns appear in parentheses.

p<.001 for chi-square test of significance across all ethnic groups

Multivariate logistic regression of sociodemographic factors on acute alcohol intoxication (BAC .08 g/dl) among suicide decedents by ethnicity:
National Violent Death Reporting System 2003–2009

Table 4

	White (29919)	Black (2722)	AI/AN (573)	Asian/PI (656)	Hispanic (1688)
Male (vs female)	1.29 (1.20–1.39) ***	1.55 (1.10–2.19) *	1.25 (0.80–1.94)	1.58 (0.92–2.74)	1.15 (0.84–1.57)
Age (in 5-year intervals)	0.89 (0.88–0.90) ***	0.97 (0.93–1.00)	0.84 (0.78–0.91) ***	0.97 (0.89–1.05)	0.92 (0.88–0.96) ***
High school (vs > high school)	1.15 (1.08–1.23) **	1.10 (0.84–1.44)	1.04 (0.63–1.69)	1.36 (0.82–2.25)	1.60 (1.19–2.15) **
Missing (vs > high school)	1.08 (0.96–1.20)	1.02 (0.72–1.46)	0.44 (0.08–2.45)	1.05 (0.46–2.42)	1.35 (0.80–2.29)
Married (vs not married)	1.02 (0.96–1.08)	0.95 (0.75–1.20)	1.14 (0.74–1.77)	1.39 (0.83–2.34)	1.03 (0.82–1.30)
Veteran (vs non-veteran)	1.02 (0.95–1.10)	0.92 (0.70–1.22)	0.89 (0.49–1.61)	1.60 (0.46–5.62)	0.90 (0.63–1.28)
Metropolitan (vs non-metropolitan)	0.94 (0.88–1.01)	0.94 (0.70–1.27)	1.18 (0.82–1.71)	0.48 (0.17–1.37)	0.83 (0.63–1.10)
Hanging/suffocation (vs firearm)	0.81 (0.76–0.87) ***	0.62 (0.48–0.82) ***	0.88 (0.59–1.32)	0.83 (0.46–1.50)	0.89 (0.70–1.13)
Poison (vs firearm)	0.63 (0.58–0.68) ***	0.86 (0.60–1.23)	0.56 (0.33–0.97) *	1.14 (0.54–2.43)	0.58 (0.41–0.82) **
Other (vs firearm)	0.57 (0.50–0.65) ***	0.49 (0.32–0.75) ***	2.67 (1.28–5.55) **	0.25 (0.09–0.69) **	0.64 (0.41–0.99) *

Note: numbers represent suicide decedents tested for BAC.

* p<.05;
** p<.01;
*** p<.001