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Alcohol Testing and Alcohol Involvement among Violent Deaths by State, 2014–2016

Naomi Greene, MPH[1], **Laura E. Tomedi, PhD, MPH**[2,*], **Mary E. Cox, MPH**[3], **Elizabeth Mello, MS**[4,5], **Marissa B. Esser, PhD, MPH**[6]

[1]Department of Health, Behavior, and Society, Bloomberg School of Public Health, Johns Hopkins University, Baltimore, Maryland

[2]The ECHO Institute, University of New Mexico, Albuquerque, New Mexico

[3]Division of Public Health, North Carolina Department of Health and Human Services, Raleigh, North Carolina

[4]Bureau of Alcohol and Drug Use Prevention, Care, and Treatment, New York City Department of Health and Mental Hygiene, Long Island City, New York

[5]Office of Integrated Surveillance and Informatics Services, Bureau of Infectious Disease and Laboratory Sciences, Massachusetts Department of Public Health, Boston, Massachusetts

[6]Division of Population Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia

Abstract

Blood alcohol concentration (BAC) testing rates vary across states, potentially biasing estimates of alcohol involvement in violent deaths. The National Violent Death Reporting System (NVDRS) collects information on violent deaths, including decedents' BACs. This study assessed characteristics of violent deaths by BAC testing status, and the proportion of decedents with a positive BAC or BAC ≥ 0.08 g/dL. NVDRS data from 2014–2016 (2014: 18 states; 2015: 27 states; 2016: 32 states) were analyzed to assess BAC testing (tested, not tested, unknown/missing) by state, decedent characteristics, and death investigation system (e.g., state medical examiner, coroners), in 2019. The proportion of violent deaths with a BAC > 0.0 or ≥ 0.08 g/dL was also assessed. Among 95,390 violent death decedents, 57.1% had a BAC test (range: 9.5% in Georgia to 95.8% in Utah), 2.3% were not tested, and 40.6% had an unknown/missing BAC testing status

*Corresponding Author at: 1650 University Blvd, SE, Albuquerque, NM 87131., ltomedi@salud.unm.edu.

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Credit Author Statement

LE Tomedi, ME Cox, and N Greene conceptualized the study. N Greene, ME Cox, and E Mello analyzed the data. All authors contributed to planning the analyses; interpreting the findings; and drafting, reviewing, and editing article. All authors approved of the final version.

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(range: 1.3% in Alaska to 78.0% in Georgia). Decedents who were 21–44 years, American Indian/Alaska Native or Hispanic, died by poisoning, died by undetermined intent, or were investigated by a state medical examiner were most likely to receive BAC testing. Among the violent deaths with a reported BAC, 41.1% had a positive BAC and 27.7% had a BAC ≥ 0.08 g/dL. About 2 in 5 violent deaths were missing data on alcohol testing. Increased testing and reporting of alcohol among violent deaths could inform the development and use of evidence-based prevention strategies (e.g., increasing alcohol taxes, regulating alcohol outlet density) for reducing violent deaths.

Keywords

alcohol consumption; alcohol testing; blood alcohol concentration (BAC); National Violent Death Reporting System (NVDRS); violent death

Introduction

There were more than 67,000 violent deaths (e.g., homicide, suicide) in the United States in 2017 (Centers for Disease Control and Prevention, 2020b). Deaths by homicide and suicide resulted in more than 1.5 million years of potential life lost before the age of 65 years (Centers for Disease Control and Prevention, 2020c). In 2010, violence-related deaths cost society more than $70 billion in medical costs and lost productivity (Centers for Disease Control and Prevention National Center for Injury Prevention and Control, 2014). Of all violent deaths, it is estimated that more than 17,000 are attributable to alcohol each year (Centers for Disease Control and Prevention, 2020a).

Excessive alcohol use, particularly binge drinking (consuming ≥ 4 drinks for women, or ≥ 5 drinks for men, per occasion, which generally equates to the point of acute intoxication and raises a person's blood alcohol concentration (BAC) to ≥ 0.08 g/dL) (National Institute on Alcohol Abuse and Alcoholism, n.d.), is an important risk factor for violent deaths (Kaplan et al., 2014; Naimi et al., 2016). For example, a meta-analysis found that among decedents who died by a firearm injury, more than one-quarter had a BAC ≥ 0.08 g/dL (Branas, Han, & Wiebe, 2016). Another review of the literature found that alcohol was the most common psychoactive substance present in toxicology reports among both homicide perpetrators and victims (Darke, 2010).

Several recent studies have also used the National Violent Death Reporting System (NVDRS), a state-based surveillance system, to examine alcohol involvement among violent deaths (Blair, Fowler, Jack, & Crosby, 2016). One study documented that the likelihood of having a BAC ≥ 0.08 g/dL varies by decedents' characteristics, and is associated with being male, American Indian/Alaska Native, and Hispanic (Naimi et al., 2016). In addition, in an analysis of suicide decedents using 2003–2011 NVDRS data, among those tested for alcohol, 24% of males and 18% of females had a BAC ≥ 0.08 g/dL (Kaplan et al., 2014). Despite these studies, there is a paucity of research on potential variations in BAC testing rates among people who die violently by decedents' characteristics.

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Studies using NVDRS data have also assessed alcohol involvement by the manner of death; however, BAC testing rates and completeness of the data on specific BAC levels among the decedents has not been assessed. A study of alcohol involvement among homicide decedents using 2010–2012 NVDRS data (17 participating states) found that, among those tested for alcohol, 26% of the decedents had a BAC ≥ 0.08 g/dL (Naimi et al., 2016). Further, a study using 2016 NVDRS data (32 participating states) found that almost 40% of suicide decedents who were tested for alcohol had a positive BAC (> 0.00 g/dL) (Ertl et al., 2019). Among decedents with a positive BAC, nearly two-thirds had a BAC ≥ 0.08 g/dL. However, almost half of suicide decedents were not tested for alcohol (Ertl et al., 2019), and the BAC testing rates among suicide decedents varies widely across states (Kaplan et al., 2014).

Previous research has also not addressed differences in BAC testing rates by factors surrounding the death (e.g., manner of death, type of death investigation system). Data from three required sources are used by states for reporting to the NVDRS, including death certificates, coroner or medical examiner reports, and law enforcement reports (Blair et al., 2016). State-level differences may exist in the processes for collecting and reporting information on violent deaths. In addition, states do not have uniform types of death investigation systems (such as centralized state medical examiners, county-based coroners, or both and varying by county) (Centers for Disease Control and Prevention, 2015). The various types of death investigation systems could be associated with differences in processes and resources for conducting death investigations, including deciding which decedents to test for alcohol (Fierro, 2003).

Therefore, the objectives of this study were to examine individual characteristics and death-related circumstances of violent death decedents (referred to hereinafter as decedents) in the NVDRS by BAC testing status, to assess variations in BAC testing status and decedents' BAC levels by state, and to estimate the proportion of decedents that had any positive BAC (> 0.0 g/dL) or a BAC ≥ 0.08 g/dL by these characteristics. Understanding factors affecting BAC testing among all types of violent deaths could improve public health surveillance for violent deaths involving alcohol, as well as inform the development and implementation of prevention strategies.

Methods

Study Sample

The NVDRS is a state-based surveillance system that is a census of deaths by homicide, suicide, unintentional firearm injuries, legal intervention (including homicides by law enforcement while on duty), and undetermined intent (Blair et al., 2016). The NVDRS aggregates information from the following three sources to provide comprehensive information on each death: death certificates; medical examiner or coroner reports (including toxicology reports); and law enforcement reports (Blair et al., 2016). A detailed description of the NVDRS has been published elsewhere (Ertl et al., 2019). Data for this study were from the 2014–2016 NVDRS Restricted Access Dataset, a deidentified, case-level dataset with data from all participating states, managed by the Centers for Disease Control and Prevention (CDC). All deaths that met the NVDRS case definition were included. The combined three-year dataset included 22,603 decedents from 18 states

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in 2014; 31,417 decedents from 27 states in 2015; and 41,569 decedents from 32 states in 2016. Analyses were conducted at the case level; therefore, the state-specific sample sizes in this analysis were influenced by whether the state participated in the NVDRS for one, two, or three of the study-period years.

Measures

Two BAC-related measures were used, one on the status of BAC testing and one on the specific BAC level of decedents. Decedents' BAC testing status was coded into the following three categories: tested, not tested, or unknown or missing. Among decedents who were tested and had a positive BAC level reported, BAC levels were coded into two non-mutually exclusive categories of any positive BAC (> 0.0 g/dL) and BAC ≥ 0.08 g/dL.

Individual-level characteristics of decedents examined were sex, age at death, and race or ethnicity. Circumstances of the violent deaths were also assessed. The manner of death was categorized as death by suicide, homicide, undetermined intent (some evidence of the possibility that the intent was purposeful, including use of a weapon or other evidence that force was used to inflict the injury, but coroners or medical examiners were unsure whether the death was a suicide or unintentional), or 'other' (primarily unintentional firearm deaths but also deaths by legal intervention). The month of death was generally determined based on the date that the death was pronounced, categorized as January–March, April–June, July–September, and October–December. The type of death investigation system (centralized state medical examiners, county/district-based medical examiners, county-based coroners, county-based mixture of medical examiners and coroners) was determined using the CDC's list of death investigation systems (Centers for Disease Control and Prevention, 2015). The mechanism of injury was determined using the first weapon listed and then categorized as death by firearm, hanging, strangulation, suffocation, poisoning (only poisonings with some evidence of the possibility that the intent was purposeful or undetermined), sharp instrument (e.g., knife), blunt instrument (e.g., tire iron), body part used as a weapon (e.g., fists), or other (drowning, fall, motor vehicle, fire or burns, other transport vehicle, violent shaking, intentional neglect, and other or unknown). Violent deaths were categorized as other for any mechanism of death in which there were fewer than 10 decedents.

Statistical Analysis

Descriptive statistics were calculated to assess BAC testing status among decedents overall, by individual-level characteristics, death-related circumstances, and by state. In addition, descriptive statistics were used to assess decedents' BAC levels overall, by individual-level characteristics, death-related circumstances, and by state, for any positive BAC (> 0.0 g/dL) and for BAC ≥ 0.08 g/dL. Because this study focuses on data provided by death certificates, decedents were not included in this study if the year of death fell outside of the 2014–2016 period, even if the year of injury occurred during this time (n=17). Decedents were also excluded if data were missing for both death pronounced date and death date (n=52); if the death occurred in a state that did not officially participate in the 2014, 2015, or 2016 NVDRS, respectively (n=110); or if a decedent's state of death was unknown or missing (n=18). Decedents' BAC levels were estimated by state and two states (Maryland and New Jersey) were excluded due to being outliers with the level of incomplete BAC data, as these

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two states had > 25% of the violent deaths with missing data on specific BAC levels among decedents who had reportedly been tested for alcohol. Because there may be biases in the selection of decedents who receive BAC testing, particularly in states with relatively low BAC testing rates, the 30 remaining states were stratified by how routinely they conducted BAC testing. Therefore, to assess potential biases in BAC testing and state-level differences in the decedents' BAC levels, the states were stratified into two groups: those that conducted BAC tests on ≥ 75% of decedents (referred to as routine BAC testing) versus < 75% (referred to as not routine BAC testing).

Cells with fewer than 10 decedents were suppressed to protect any potentially confidential information. Confidence intervals were not computed and tests for significant differences were not conducted because the dataset includes a census of every violent death that occurred in nearly all of the participating states. Three participating states (Illinois, Pennsylvania, Washington) did not report a census of violent deaths in their states but collected data on ≥80% of the violent deaths in 2016; therefore, the results for these three states represent only the populations of the counties from which the data were collected. Analyses were conducted using SAS Version 9.4 (Cary, NC), in 2019. This study involved secondary analyses of a deidentified dataset, therefore, Institutional Review Board oversight was not required.

Results

Among the 95,390 violent death decedents, 22,496 (23.6%) were female and 72,888 (76.4%) were male (Table 1). The largest proportion of violent deaths were among decedents aged 21–44 years (42,346, 44.4%). Overall, 54,492 (57.1%) had a BAC test conducted, 2,188 (2.3%) were not tested, and 38,710 (40.6%) had an unknown or missing BAC testing status. The BAC testing rates for males (56.4%) and females (59.4%) was similar. BAC testing varied by age group, ranging from 44.8% among decedents aged ≥ 65 years to 61.2% among decedents aged 21–44 years. BAC testing also varied by race or ethnicity, ranging from 54.5% among non-Hispanic White decedents to 68.2% among non-Hispanic American Indian/Alaska Native decedents and 69.4% among Hispanic decedents.

In addition, BAC testing varied by death-related circumstances (Table 1). BAC testing rates were highest among decedents whose manner of death was undetermined (73.2%), in states with a centralized state medical examiner system (77.0%), and among deaths by poisoning (72.5%). In contrast, BAC testing rates were lowest among decedents who died by suicide (52.6%); in states with a county-based mixture of medical examiners and coroners (39.5%); and among deaths by firearms (53.2%) or hanging, strangulation, or suffocation (53.1%). BAC testing rates did not substantially vary by month of death.

Among states that participated in the 2014–2016 NVDRS, the percentage of violent death decedents tested for alcohol varied from 9.5% in Georgia to 95.8% in Utah (Table 2). The percentage of decedents who were reported as not tested for alcohol ranged from <1% in 19 states to 19.8% in Alaska. The percentage of decedents with an unknown or missing BAC test status ranged from 1.3% in Alaska to 78.0% in Georgia. Among decedents tested for alcohol, the percentage missing a reported BAC level was highest in Maryland (48.5%) and New Jersey (37.1%); the two states were excluded for exceeding a level of 25% missing.

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In the 30 NVDRS states that reported a BAC level for at least 75% of the decedents who had been tested, there were 43,912 decedents with a specified BAC level. Among them, 41.1% had a positive BAC (> 0.00 g/dL) and 27.7% had a BAC ≥ 0.08 g/dL (Table 3). The percentage of decedents with a positive BAC or a BAC ≥ 0.08 g/dL was highest among decedents who were male, aged 21–44, non-Hispanic American Indian/Alaska Native, whose deaths were investigated in a state with a county-based mixture of medical examiners and coroners, or whose mechanism of death was a sharp instrument. Decedents who died by homicide had a similar percentage of having a positive BAC (42.1%) than those who died by other manners of death. Deaths in the category of other manners of death (primarily unintentional firearm deaths) had the largest percentage of decedents with a BAC ≥ 0.08 g/dL (29.8%). BAC levels did not vary substantially by month of death.

Of the 14,298 decedents in the 9 states with routine BAC testing, 32.5% had a positive BAC (> 0.00 g/dL) and 23.1% had a BAC ≥ 0.08 g/dL (Table 4). In those 9 states, the percentage of decedents who had a positive BAC ranged from 24.0% in Connecticut to 41.4% in New Mexico, and the percentage of decedents who had a BAC ≥ 0.08 g/dL ranged from 15.6% in Connecticut to 31.3% in Alaska. In the 21 states (29,614 decedents) that did not have routine BAC testing, 45.2% had a positive BAC and 30.0% had a BAC ≥ 0.08 g/dL. In those states, the percentage of decedents who had a positive BAC ranged from 27.5% in Maine to 100.0% in New Hampshire, and the percentage of decedents who had a BAC ≥ 0.08 g/dL ranged from 16.5% in Maine to 73.8% in New Hampshire.

Discussion

This study examined more than 95,000 violent death decedents during a three-year period and found that information on alcohol testing was unknown or missing for 2 in 5 of the decedents. It is possible that the high proportion of decedents with unknown or missing alcohol testing information may, to some extent, be due to alcohol not being perceived as a factor that contributed to the deaths, or to the costs of toxicology testing. Nevertheless, consistent with other studies, this study found that among the violent death decedents with reported BAC levels, more than 40% had a positive BAC and nearly 28% had a BAC of ≥ 0.08 g/dL (Caetano et al., 2013; Huguet, Kaplan, & McFarland, 2012; Kaplan et al., 2015, 2012; Kuhns, Wilson, Clodfelter, Maguire, & Ainsworth, 2011).

Overall, the BAC testing rate was similar by decedents' sex. However, there were three times more male decedents than females, and a higher proportion of males had positive BAC or a BAC ≥ 0.08 g/dL. Given the high proportion of missing data on alcohol testing, these data cannot be used to determine whether men are disproportionately represented among violent deaths with alcohol detected or if they are over-represented among violent deaths in general. In addition, BAC testing rates were lowest among decedents aged ≥ 65 years, which may lead to underestimates of alcohol involvement in violent deaths among this age group. While binge drinking is most prevalent among younger adults, adults aged ≥ 65 years who binge drink do so the most frequently (Kanny, Naimi, Liu, Lu, & Brewer, 2018). By race and ethnicity, BAC testing rates were lowest among non-Hispanic White decedents and highest among non-Hispanic American Indian/Alaska Natives and Hispanic decedents. These disparities in BAC testing rates by racial or ethnic group mirror racial and

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ethnic disparities in binge drinking and alcohol-related harms (Kanny et al., 2015, 2018; Landen, Roeber, Naimi, Nielsen, & Sewell, 2014). The differences may be partially due to targeted testing of certain groups or potential prejudice and disenfranchisement faced by the American Indian population (Frank, Moore, & Ames, 2000). The BAC testing rates by racial or ethnic group may also differ across regions due to varying levels of racial misclassification of American Indian/Alaska Native individuals (Jim et al., 2014).

This study also observed differences in the BAC levels of decedents, varying by whether states routinely conducted BAC tests on violent death decedents. The percentage of decedents with a positive BAC was almost 13 percentage points higher in the 21 states that did not have routine BAC testing compared to the 9 states with routine BAC testing (45.2% versus 32.5%). In addition, the percentage of decedents with a BAC ≥ 0.08 g/dL was almost 7 percentage points higher in the states that did not have routine BAC testing compared with the states with routine BAC testing (30.0% versus 23.1%), suggesting potential biases towards conducting BAC tests on decedents suspected of consuming alcohol. This bias in BAC testing in some states may lead to overestimates of alcohol involvement among violent death decedents with certain characteristics. Therefore, future analyses looking at alcohol involvement in violent deaths might consider using data from states with more routine reporting to reduce the impact of this bias.

This study found that the type of death investigation system (e.g., medical examiner, coroner system) in which violent deaths were investigated was associated with the likelihood of a decedent being tested for alcohol and the completeness of the BAC level information in the NVDRS. Medical examiner systems have forensic pathologists and medical doctors who conduct death investigations (Fierro, 2003). In contrast, coroner systems often rely on individuals who may not have medical training for completing death investigations, individuals who are elected into the coroner role, or both (Fierro, 2003). These inherent differences by the type of death investigation system, as well as if the system is centralized, are particularly important to consider within the context of death investigators being constrained by inadequate resources and a lack of national support across the country (National Research Council 2009, 2009). These differences could contribute to decisions about when BAC tests are performed. Future research could assess differences in decedents' BAC levels by type of death investigation system while controlling for other factors that could affect this relationship, such as decedents' characteristics and circumstances surrounding the deaths.

Limitations

This study has several limitations. First, during 2014–2016, the NVDRS was not nationally representative; therefore, the findings cannot be generalized to the U.S. population. Second, the findings are limited to alcohol involvement among violent death decedents, not violent death perpetrators, because most of the NVDRS data pertains to the violent event and the victim. Third, this study assessed state-level differences in BAC testing rates; however, it is possible that sub-state differences exist.

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Implications

The BAC testing status was not available for 2 in 5 violent death decedents, but among those with a reported BAC, more than one-quarter had a BAC ≥ 0.08 g/dL. These findings can inform the development and implementation of evidenced-based strategies to reduce excessive drinking, including those that are designed to increase the price of alcohol (e.g., increasing alcohol taxes (Elder et al., 2010)) and to reduce the accessibility to and availability of alcohol (e.g., maintaining limits on days (Middleton et al., 2010) and hours of sale (Hahn et al., 2010), and regulating the number and concentration of places that sell alcohol) (Campbell et al., 2009) as recommended by the Community Preventive Services Task Force. Scientific evidence has shown that effective population-level alcohol policies are not only associated with reductions in excessive alcohol use, but also decreases in alcohol-related harms, such as violence (Campbell et al., 2009; Elder et al., 2010). For example, studies have documented that both homicide perpetrators and victims commonly have positive BAC levels (Darke, 2010). Alcohol outlet density regulations in communities may reduce social aggregation of people drinking excessively and engaging in aggressive or violent acts (Campbell et al., 2009). Another literature review found that stronger alcohol control policies were associated with reductions in suicide and lower levels of alcohol involvement among people who died by suicide (Xuan et al., 2016). These evidence-based alcohol prevention strategies can be used as part of a comprehensive, multifaceted approach with programs and policies designed to reduce particular types of violent deaths (David-Ferdon et al., 2016).

Since the NVDRS provides unique data on BAC levels of decedents, it can also be useful for evaluating the effectiveness of evidence-based strategies for preventing violent deaths (Naimi et al., 2017). In light of the high proportion of violent death decedents in this study who were missing information on BAC testing status, BAC level, or both, and differences by decedents' characteristics and circumstances surrounding the deaths, a data validation procedure that requires abstractors in all states to indicate whether BAC was tested – and fill in the BAC level when they indicate that alcohol was tested and positive – might reduce the extent of missing alcohol information in the NVDRS, thereby improving its usefulness for public health practice.

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References

Blair JM, Fowler KA, Jack SPD, & Crosby AE (2016). The National Violent Death Reporting System: overview and future directions. Injury Prevention, 22, 6–11. doi:10.1136/injuryprev-2015-041819

Branas CC, Han S, & Wiebe DJ (2016). Alcohol use and firearm violence. Epidemiologic Reviews, 38(1), 32–45. doi:10.1093/epirev/mxv010 [PubMed: 26811427]

Caetano R, Kaplan MS, Huguet N, Mcfarland BH, Conner K, Giesbrecht N, & Nolte KB (2013). Acute alcohol intoxication and suicide among United States ethnic/racial groups: findings from the National Violent Death Reporting System. Alcoholism: Clinical and Experimental Research, 37(5), 839–846. doi:10.1111/acer.12038 [PubMed: 23384174]

Campbell CA, Hahn RA, Elder R, Brewer R, Chattopadhyay S, Fielding J, … Middleton JC (2009). The effectiveness of limiting alcohol outlet density as a means of reducing excessive alcohol consumption and alcohol-related harms. American Journal of Preventive Medicine, 37(6), 556–569. doi:10.1016/j.amepre.2009.09.028 [PubMed: 19944925]

Centers for Disease Control and Prevention. (2015). Death Investigation Systems. Retrieved June 25, 2020, from https://www.cdc.gov/phlp/publications/coroner/death.html

Centers for Disease Control and Prevention. (2020a). Alcohol Related Disease Impact (ARDI) application. Retrieved September 14, 2020, from www.cdc.gov/ardi

Centers for Disease Control and Prevention. (2020b). Fatal injury reports, national, regional and state, 1981–2017. Retrieved September 14, 2020, from https://webappa.cdc.gov/sasweb/ncipc/mortrate.html

Centers for Disease Control and Prevention. (2020c). WISQARS years of potential life lost (YPLL) Report, 1981–2017. Retrieved September 14, 2020, from https://webappa.cdc.gov/sasweb/ncipc/ypll.html

Centers for Disease Control and Prevention National Center for Injury Prevention and Control. (2014). Data & Statistics (WISQARS): Cost of Injury Reports. Retrieved September 14, 2020, from https://wisqars.cdc.gov:8443/costT/

Darke S (2010). The toxicology of homicide offenders and victims: a review. Drug and Alcohol Review, 29(2), 202–215. doi:10.1111/j.1465-3362.2009.00099.x [PubMed: 20447230]

David-Ferdon C, Vivolo-Kantor AM, Dahlberg LL, Marshall K, Rainford N, & Hall JE (2016). A comprehensive technical package for the prevention of youth violence and associated risk behaviors. Atlanta, GA.

Elder RW, Lawrence B, Ferguson A, Naimi TS, Brewer RD, Chattopadhyay SK, … Fielding JE (2010). The effectiveness of tax policy interventions for reducing excessive alcohol consumption and related harms. American Journal of Preventive Medicine, 38(2), 217–229. doi:10.1016/j.amepre.2009.11.005 [PubMed: 20117579]

Ertl A, Sheats KJ, Petrosky E, Betz CJ, Yuan K, & Fowler KA (2019). Surveillance for violent deaths - National Violent Death Reporting System, 32 states, 2016. Morbidity and Mortality Weekly Report. Surveillance Summaries (Washington, D.C. : 2002), 68(9), 1–36. doi:10.15585/mmwr.ss.6809a1

Fierro M (2003). Comparing medical examiner and coroner systems. In Medicolegal Death Investigation System: Workshop Summary (pp. 23–28). Washington,DC: The National Academies Press. Retrieved from https://www.nap.edu/read/10792/chapter/7

Frank JW, Moore RS, & Ames GM (2000). Historical and cultural roots of drinking problems among American Indians. American Journal of Public Health, 90(3), 344–351. doi:10.2105/AJPH.90.3.344 [PubMed: 10705850]

Hahn RA, Kuzara JL, Elder R, Brewer R, Chattopadhyay S, Fielding J, … Lawrence B (2010). Effectiveness of policies restricting hours of alcohol sales in preventing excessive alcohol consumption and related harms. American Journal of Preventive Medicine, 39(6), 590–604. doi:10.1016/j.amepre.2010.09.016 [PubMed: 21084080]

Huguet N, Kaplan MS, & McFarland BH (2012). Rates and correlates of undetermined deaths among African Americans: results from the National Violent Death Reporting System. Suicide & Life-Threatening Behavior, 42(2), 185–196. doi:10.1111/j.1943-278X.2012.00081.x [PubMed: 22486604]

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Jim MA, Arias E, Seneca DS, Hoopes MJ, Jim CC, Johnson NJ, & Wiggins CL (2014). Racial misclassification of American Indians and Alaska Natives by Indian Health Service Contract Health Service Delivery Area. American Journal of Public Health, 104(SUPPL. 3). doi:10.2105/AJPH.2014.301933

Kanny D, Brewer RD, Mesnick JB, Paulozzi LJ, Naimi TS, & Lu H (2015). Vital signs: alcohol poisoning deaths - United States, 2010–2012. MMWR Morb Mortal Wkly Rep, 63(53), 1238–1242. [PubMed: 25577989]

Kanny D, Naimi TS, Liu Y, Lu H, & Brewer RD (2018). Annual total binge drinks consumed by U.S. adults, 2015. American Journal of Preventive Medicine, 54(4), 486–496. doi:10.1016/j.amepre.2017.12.021 [PubMed: 29555021]

Kaplan MS, Huguet N, Caetano R, Giesbrecht N, Kerr WC, & McFarland BH (2015). Economic contraction, alcohol intoxication and suicide: analysis of the National Violent Death Reporting System. Injury Prevention, 21(1), 35–41. doi:10.1136/injuryprev-2014-041215 [PubMed: 25024394]

Kaplan MS, Huguet N, McFarland BH, Caetano R, Conner KR, Giesbrecht N, & Nolte KB (2014). Use of alcohol before suicide in the United States. Annals of Epidemiology, 24(8), 588–592.e2. doi:10.1016/j.annepidem.2014.05.008 [PubMed: 24953567]

Kaplan MS, McFarland BH, Huguet N, Conner K, Caetano R, Giesbrecht N, & Nolte KB (2012). Acute alcohol intoxication and suicide: a gender-stratified analysis of the National Violent Death Reporting System. Injury Prevention, 19(1), 38–43. doi:10.1136/injuryprev-2012-040317 [PubMed: 22627777]

Kuhns JB, Wilson DB, Clodfelter TA, Maguire ER, & Ainsworth SA (2011). A meta-analysis of alcohol toxicology study findings among homicide victims. Addiction, 106(1), 62–72. doi:10.1111/j.1360-0443.2010.03153.x [PubMed: 20955489]

Landen M, Roeber J, Naimi T, Nielsen L, & Sewell M (2014). Alcohol-attributable mortality among American Indians and Alaska Natives in the United States, 1999–2009. American Journal of Public Health, 104(SUPPL. 3), 343–349. doi:10.2105/AJPH.2013.301648

Middleton JC, Hahn RA, Kuzara JL, Elder R, Brewer R, Chattopadhyay S, … Lawrence B (2010). Effectiveness of policies maintaining or restricting days of alcohol sales on excessive alcohol consumption and related harms. American Journal of Preventive Medicine, 39(6), 575–589. doi:10.1016/j.amepre.2010.09.015 [PubMed: 21084079]

Naimi TS, Xuan Z, Coleman SM, Lira MC, Hadland SE, Cooper SE, … Swahn MH (2017). Alcohol policies and alcohol-involved homicide victimization in the United States. Journal of Studies on Alcohol and Drugs, 78(5), 781–788. doi:10.15288/jsad.2017.78.781 [PubMed: 28930066]

Naimi TS, Xuan Z, Cooper SE, Coleman SM, Hadland SE, Swahn MH, & Heeren TC (2016). Alcohol involvement in homicide victimization in the United States. Alcoholism: Clinical and Experimental Research, 40(12), 2614–2621. doi:10.1111/acer.13230 [PubMed: 27676334]

National Institute on Alcohol Abuse and Alcoholism. (n.d.). Drinking levels defined. Retrieved September 14, 2020, from https://www.niaaa.nih.gov/alcohol-health/overview-alcohol-consumption/moderate-binge-drinking

National Research Council 2009. (2009). Strengthening forensic science in the United States: A path forward. In Strengthening Forensic Science in the United States: A Path Forward. Washington, DC: The National Academies Press. doi:10.17226/12589

Xuan Z, Naimi TS, Kaplan MS, Bagge CL, Few LR, Maisto S, Saitz R, & Freeman R (2016). Alcohol policies and suicide: a review of the literature. Alcohol Clin Exp Res, 40(10), 2043–2055. doi:10.1111/acer.13203 [PubMed: 27618526]

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Highlights

- Information on alcohol testing was unknown or missing for 2 in 5 of the decedents.
- Among those with a reported blood alcohol concentration, 1 in 4 were ≥ 0.08 g/dL.
- Alcohol testing was more common in states with centralized medical examiners.

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Table 1.

Characteristics of violent deaths by blood alcohol concentration testing status, NVDRS, 2014–2016

Characteristics	Total	BAC Tested		BAC Not Tested		BAC Testing Status Unknown/Missing	
	N[a]	n	%	n	%	n	%
Overall	95,390	54,492	57.1	2,188	2.3	38,710	40.6
Sex							
Female	22,496	13,360	59.4	561	2.5	8,575	38.1
Male	72,888	41,132	56.4	1,627	2.2	30,129	41.4
Age Group (Years)							
10–20	7,792	4,348	55.8	182	2.3	3,262	41.9
21–44	42,346	25,921	61.2	978	2.3	15,447	36.5
45–64	31,281	17,928	57.3	711	2.3	12,642	40.4
≥65	12,520	5,611	44.8	268	2.1	6,641	53.0
Race or Ethnicity							
American Indian/Alaska Native, non-Hispanic	1,461	997	68.2	64	4.4	400	27.4
Asian/Pacific Islander, non-Hispanic	1,835	1,141	62.2	32	1.7	662	36.1
Black, non-Hispanic	18,406	11,144	60.5	472	2.6	6,790	36.9
Hispanic	6,604	4,583	69.4	135	2.0	1,886	28.6
White, non-Hispanic	65,642	35,789	54.5	1,456	2.2	28,397	43.3
Manner of Death							
Suicide	61,070	32,152	52.6	1,396	2.3	27,522	45.1
Homicide	22,768	14,038	61.7	580	2.5	8,150	35.8
Undetermined[b]	9,696	7,096	73.2	144	1.5	2,456	25.3
Other[c]	1,856	1,206	65.0	68	3.7	582	31.4
Month of Death [d]							
January – March	20,863	12,104	58.0	492	2.4	8,267	39.6
April – June	22,400	13,087	58.4	509	2.3	8,804	39.3
July – September	23,634	13,503	57.1	574	2.4	9,557	40.4
October – December	21,809	12,322	56.5	534	2.5	8,953	41.0
Death investigation system							
Centralized State Medical Examiner	34,321	26,440	77.0	585	1.7	7,296	21.3
County/District-based Medical Examiner	14,754	8,444	57.2	361	2.5	5,949	40.3
County-based Mixed Medical Examiners and Coroners	31,867	12,574	39.5	1,072	3.4	18,221	57.2
County-based Coroners	14,448	7,034	48.7	170	1.2	7,244	50.1
Mechanism							
Firearm	48,625	25,862	53.2	1,035	2.1	21,728	44.7
Hanging, strangulation, suffocation	17,944	9,534	53.1	385	2.2	8,025	44.7
Poisoning	16,009	11,611	72.5	459	2.9	3,939	24.6
Sharp instrument	3,894	2,495	64.1	97	2.5	1,302	33.4
Blunt instrument	1,278	766	59.9	46	3.6	466	36.5

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Characteristics	Total	BAC Tested		BAC Not Tested		BAC Testing Status Unknown/Missing	
	N[a]	n	%	n	%	n	%
Body parts as personal weapons	1,066	609	57.1	37	3.5	420	39.4
Other[e]	5,255	3,160	60.1	116	2.2	1,979	37.7

BAC: Blood alcohol concentration, NVDRS: National Violent Death Reporting System

[a]Sample sizes by characteristics may not sum to the total due to missing information for some decedents.

[b]To be included in NVDRS, deaths of undetermined intent must have some evidence of the possibility that the intent was purposeful, including use of a weapon or other evidence that force was used to inflict the injury. Most commonly, the coroner or medical examiner is unsure whether the death was a suicide or unintentional.

[c]Includes unintentional firearm deaths or deaths by legal intervention.

[d]Death date was based on date the death was pronounced, when available, and date of death when a date of death pronounced was not available.

[e]Includes drowning, fall, motor vehicle, fire or burns, other transport vehicle, violent shaking, intentional neglect, and other/unknown.

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Table 2.

Blood alcohol concentration testing status and missing reported BAC level by state, N = 95,390

	Total	BAC Tested		BAC Not Tested		BAC Testing Status Unknown/Missing		Missing Reported BAC Level[a]	
States	**N**	**N**	**%**	**N**	**%**	**n**	**%**	**n**	**%**
Ranges	**296–7,563**	**170–6,410**	**9.5–95.8**	**<10–819**	**<1–19.8**	**11–5,740**	**1.3–78.0**	**<10–3,108**	**<1–48.5**
Alaska[b,c,d]	821	647	78.8	163	19.8	11	1.3	_[e]	_[e]
Arizona[c,d]	3,559	2,318	65.1	41	1.1	1,200	33.7	55	2.4
Colorado[b,c,d]	4,322	3,218	74.5	25	0.6	1,079	25	82	2.5
Connecticut[c,d]	1,042	970[e]	93.1	_[e]	_[e]	68	6.5	_[e]	_[e]
Georgia[b,c,d]	6,567	623	9.5	819	12.5	5,125	78	_[e]	_[e]
Hawaii[c,d]	579	490[e]	84.6	_[e]	_[e]	90	15.5	11	2.3
Illinois[d]	2,165	1,563	72.2	95	4.4	507	23.4	91	5.8
Indiana[d]	1,726	284	16.4	116	6.7	1,326	76.8	_[e]	_[e]
Iowa[d]	604	470[e]	77.8	_[e]	_[e]	132	21.8	11	2.3
Kansas[c,d]	1,347	560[e]	41.6	_[e]	_[e]	784	58.2	_[e]	_[e]
Kentucky[b,c,d]	3,395	1,690[e]	49.8	_[e]	_[e]	1,702	50.1	85	5
Maine[c,d]	533	190[e]	35.6	_[e]	_[e]	330	61.9	_[e]	_[e]
Maryland[b,c,d]	6,788	6,410[e]	94.4	_[e]	_[e]	378	5.6	3,108	48.5
Massachusetts[b,c,d]	2,559	1,900[e]	74.2	_[e]	_[e]	646	25.2	2.7	1.4
Michigan[b,c,d]	7,035	2,918	41.5	15	0.2	4,102	58.3	38	1.3
Minnesota[c,d]	1,911	1,593	83.4	38	2	280	14.6	98	6.2
New Hampshire[c,d]	529	170[e]	32.1	_[e]	_[e]	357	67.5	_[e]	_[e]
New Jersey[b,c,d]	3,556	2,739	77	302	8.5	515	14.5	1,015	37.1
New Mexico[b,c,d]	2,050	1,770[e]	86.3	_[e]	_[e]	271	13.2	12	0.7
New York[c,d]	5,180	2,497	48.2	18	0.4	2,665	51.4	453	18.1
North Carolina[b,c,d]	6,361	5,699	89.6	117	1.8	545	8.6	100	1.8
Ohio[b,c,d]	7,563	1,820[e]	24.1	_[e]	_[e]	5,740	75.9	71	3.9
Oklahoma[b,c,d]	3,540	2,573	72.7	180	5.1	787	22.2		
Oregon[b,c,d]	2,952	990	33.5	37	1.2	1,925	65.2		
Pennsylvania[d]	2,291	466	20.3	66	2.9	1,759	76.8	_[e]	_[e]
Rhode Island[b,c,d]	494	470[e]	95.1	_[e]	_[e]	25	5.1	_[e]	_[e]
South Carolina[b,c,d]	3,658	1,285	35.1	20	0.6	2,353	64.3	156	12.1
Utah[b,c,d]	2,532	2,426	95.8	12	0.5	94	3.7	_[e]	_[e]

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	Total	BAC Tested		BAC Not Tested		BAC Testing Status Unknown/Missing		Missing Reported BAC Level[a]	
States	**N**	**N**	**%**	**N**	**%**	**n**	**%**	**n**	**%**
Vermont[c,d]	296	200[e]	67.6	-[e]	-[e]	93	31.4	-[e]	-[e]
Virginia[b,c,d]	4,866	2,979	61.2	53	1	1,834	38	54	1.8
Washington[d]	1,237	320[e]	25.9	-[e]	-[e]	917	74.1	-[e]	-[e]
Wisconsin[b,c,d]	3,332	2,233	67	29	0.9	1,070	32.1	38	1.7

BAC: Blood alcohol concentration

[a]Decedents who had a BAC test but the BAC level was not reported. Percentages are based on the number of decedents who had a BAC test.

[b]Participated in the NVDRS in 2014.

[c]Participated in the NVDRS in 2015.

[d]Participated in the NVDRS in 2016.

[e]Cells with fewer than 10 decedents were suppressed to protect any potentially confidential information. Estimates of BAC testing (N and %) were rounded to the nearest 10 people so data that were suppressed cannot be derived.

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Table 3.

BAC levels among violent deaths with a specific BAC level reported by characteristics

	Total[a]	BAC > 0.0 g/dL[b]		BAC ≥ 0.08 g/dL[b]	
Characteristics	**N**	**n**	**%**	**n**	**%**
Overall	43,912	18,037	41.1	12,176	27.7
Sex					
Female	10,929	3,842	35.2	2,431	22.2
Male	32,983	14,195	43.0	9,745	29.5
Age Group (Years)					
10–20	4,596	1,131	24.6	384	8.4
21–44	19,727	9,442	47.9	6,797	34.5
45–64	14,331	6,322	44.1	4,379	30.6
≥65	4,674	1,114	23.8	611	13.1
Race or Ethnicity					
American Indian/Alaska Native, non-Hispanic	968	520	53.7	440	45.5
Asian/Pacific Islander, non-Hispanic	903	252	27.9	141	15.6
Black, non-Hispanic	7,569	3,339	44.1	1,969	26.0
Hispanic	3,888	1,601	41.2	1,111	28.6
White, non-Hispanic	29,868	12,078	40.4	8,357	28.0
Manner of Death					
Suicide	28,103	11,531	41.0	8,007	28.5
Homicide	11,248	4,738	42.1	2,996	26.6
Undetermined[c]	3,477	1,333	38.3	850	24.4
Other[d]	1,084	435	40.1	323	29.8
Month of Death [e]					
January – March	9,759	3,826	39.2	2,551	26.1
April – June	10,382	4,350	41.9	2,997	28.9
July – September	10,726	4,562	42.5	3,032	28.3
October – December	9,724	3,950	40.6	2,708	27.8
Death investigation system					
Centralized State Medical Examiner	19,818	6,592	33.3	4,573	23.1
County/District-based Medical Examiner	5,601	2,505	44.7	1,625	29.0
County-based Mixed Medical Examiners and Coroners	11,797	6,183	52.4	4,008	34.0
County-based Coroners	6,696	2,757	41.2	1,970	29.4
Mechanism					
Firearm	22,248	9,354	42.0	6,508	29.3
Hanging, strangulation, suffocation	8,014	3,425	42.7	2,368	29.5
Poisoning	7,521	2,682	35.7	1,531	20.4
Sharp instrument	2,035	931	45.7	657	32.3
Blunt instrument	623	261	41.9	172	27.6
Body parts as personal Weapons	520	199	38.3	157	30.2

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	Total[a]	BAC > 0.0 g/dL[b]		BAC ≥ 0.08 g/dL[b]	
Characteristics	**N**	**n**	**%**	**n**	**%**
Other[f]	2,561	1,020	39.8	690	26.9

BAC: Blood alcohol concentration

[a] Decedents with a specific BAC level reported and in states with a BAC level reported for at least 75% of decedents who had been tested (excluding Maryland and New Jersey).

[b] BAC categories are not mutually exclusive. BAC > 0.00 g/dL indicates any positive BAC.

[c] To be included in NVDRS, deaths of undetermined intent must have some evidence of the possibility that the intent was purposeful, including use of a weapon or other evidence that force was used to inflict the injury. Most commonly, the coroner or medical examiner is unsure whether the death was a suicide or unintentional.

[d] Includes unintentional firearm deaths or deaths by legal intervention.

[e] Death date was based on date the death was pronounced, when available, and date of death when a date of death pronounced was not available.

[f] Includes drowning, fall, motor vehicle, fire or burns, other transport vehicle, violent shaking, intentional neglect, and other/unknown.

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Table 4.

BAC levels among violent deaths with a BAC level reported by testing routineness and state

	Total[a]	BAC > 0.0 g/dL[b]		BAC ≥ 0.08 g/dL[b]	
States	**N**	**n**	**%**	**n**	**%**
Routine BAC Testing [c]	**14,298**	**4,652**	**32.5**	**3,299**	**23.1**
Alaska	646	266	41.2	202	31.3
Connecticut	974	234	24.0	152	15.6
Hawaii	476	127	26.7	80	16.8
Iowa	458	151	33.0	100	21.8
Minnesota	1,495	614	41.1	434	29.0
New Mexico	1,759	729	41.4	522	29.7
North Carolina	5,599	1,719	30.7	1,217	21.7
Rhode Island	465	158	34.0	107	23.0
Utah	2,426	654	27.0	485	20.0
Not Routine BAC Testing [c]	**29,614**	**13,395**	**45.2**	**8,877**	**30.0**
Arizona	2,263	811	35.8	513	22.7
Colorado	3,136	1,169	37.3	849	27.1
Georgia	615	226	36.7	149	24.2
Illinois	1,472	486	33.0	312	21.2
Indiana	277	276	99.6	184	66.4
Kansas	553	227	41.0	161	29.1
Kentucky	1,601	462	28.9	361	22.5
Maine	200	55	27.5	33	16.5
Massachusetts	1,883	627	33.3	392	20.8
Michigan	2,880	1,543	53.6	1,012	35.1
New Hampshire	172	172	100.0	127	73.8
New York	2,044	1,376	67.3	774	37.9
Ohio	1,748	1,746	99.9	1,166	66.7
Oklahoma	2,568	786	30.6	573	22.3
Oregon	977	357	36.5	222	22.7
Pennsylvania	460	320	69.6	202	43.9
South Carolina	1,129	623	55.2	415	36.8
Vermont	198	74	37.4	49	24.7
Virginia	2,925	995	34.0	644	22.0
Washington	318	313	98.4	221	69.5
Wisconsin	2,195	741	33.8	518	23.6

BAC: Blood alcohol concentration

[a] Decedents with a specific BAC level reported and in states with a BAC level reported for at least 75% of decedents who had been tested (excluding Maryland and New Jersey).

[b] BAC categories are not mutually exclusive. BAC > 0.00 g/dL indicates any positive BAC.

[c]States with routine BAC testing refers to states that conducted BAC tests on ≥ 75% of violent death decedents. States with not routine BAC testing refers to states that conducted BAC tests on < 75% of violent death decedents.

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