



COLORADO

Department of Public
Health & Environment

Vital Records
& Statistics Branch

- Vital Records
- Vital Statistics
- Colorado Violent
Death Reporting
System

health watch

September 2015 No. 96

Suicide in Colorado, 2009-2013: A Summary from the Colorado Violent Death Reporting System

*Alison Grace Bui, MPH; Kirk Bol, MSPH; Ethan Jamison; Karl Herndon.
Colorado Violent Death Reporting System, Vital Statistics Program,
Center for Health and Environmental Data, Colorado Department of
Public Health and Environment.*

Introduction

Suicide is a critical public health concern that adversely affects a diverse population of Americans. The number of suicides has increased over the past decade for the United States and also in Colorado. Colorado had the seventh highest suicide rate (19.1 deaths per 100,000 population) among all states.¹ In 2013, suicide was the seventh leading cause of death in Colorado.² From 2009 to 2013, there were 4,654 suicide deaths in Colorado, outnumbering deaths by motor vehicle accident, unintentional poisoning, falls or homicide. In addition to the impact on the lives of victims' families and friends, suicide also causes tremendous burden to the state and its financial and administrative resources. Each suicide death in Colorado costs \$3,572 on average in direct costs (health care, autopsy and law enforcement investigation expense) and \$1,310,568 in indirect costs³ (work-loss cost).

In an effort to help reduce the burden of suicide, the Colorado Violent Death Reporting System (CoVDRS) was implemented at the Colorado Department of Public Health and Environment (CDPHE) in 2004. The CoVDRS is a public health surveillance system designed to obtain a complete census of all violent deaths occurring in Colorado, to collect demographic information and associated risk factor data, and to track the circumstantial information surrounding each death. A violent death includes any death by suicide, homicide, unintentional firearm discharge, legal intervention, or acts of terrorism, as well as selected deaths of undetermined intent when the death may have been the result of violence. Colorado is one of 32 states currently participating in the broader National Violent Death Reporting System (NVDRS), which is maintained and funded by the Centers for Disease Control and

4300 Cherry Creek Drive South
Denver, Colorado 80246-1530
(303)692-2160
(800)886-7689

cdphe.healthstatistics@state.co.us
www.colorado.gov/cdphe

Prevention (CDC). The NVDRS is the centralized database consisting of de-identified violent death data submitted by all participating states. The CoVDRS collects and inputs data from multiple sources including death certificates, coroner/medical examiner reports, and law enforcement investigations. Data collected are maintained in a single electronic database for analysis and reporting.

This report provides descriptive information using CoVDRS surveillance data from 2009 to 2013 and includes summaries of demographic characteristics of suicide victims and suicide trends in Colorado. Life and situational circumstances most frequently associated with suicide death will also be presented. The purpose of this report is to increase suicide awareness, to explore suicide trends in recent years, and to gain a better understanding of the populations that may be at greater risk for suicide in Colorado. This information may be used to inform prevention and intervention efforts by agencies interested in decreasing the impact of suicide in their communities.

Methods

Data for this report were obtained from the NVDRS database and include all deaths resulting from suicide death in Colorado among residents from 2009 to 2013. For the purposes of this report, suicide deaths that occurred in Colorado among non-Colorado residents were excluded. Colorado residents who died by suicide in other states were also excluded. Deaths were selected for inclusion in the CoVDRS based on either the indication of suicide as manner of death on the death certificate or the presence of International Classification of Diseases, 10th Revision (ICD-10) coding for suicide as underlying cause of death (X60-X84 and Y87.0).⁴ A full description of the data collection processes of the NVDRS is provided elsewhere.⁵ Circumstances associated with most suicide deaths were obtained through information contained in the death

certificates, coroner/medical examiner investigation and autopsy reports, and the law enforcement investigation reports.

Suicide deaths were analyzed by year, geographic region of residence, age, gender, race/ethnicity, marital status, poverty, lethal means of suicide, and associated precipitating circumstances. For this report, lethal means are reported as one of four possible categories: firearm, hanging/asphyxiation/suffocation, poisoning (including illicit and prescription drugs as well as carbon monoxide), and other (including jumping from a high place and sharp objects). Suicide deaths are presented as number of cases for a given category, percent of the total number of deaths for a given category, or as a mortality rate (frequency of death per 100,000 population) with the ninety-five percent (95%) confidence interval.

Population estimates used in computing suicide mortality rates (with the exception of marital status-specific and poverty-specific rates) are based on 2013 estimates from the State Demography Office, Colorado Department of Local Affairs. Age-adjusted suicide rates were calculated using the direct method and standardized according to the 2000 United States standard population. Population estimates for suicide rates by marital status were obtained from the 2009-2013 five-year American Community Survey for the population 18 years of age and older in the state of Colorado.

Poverty is estimated using area-based poverty status. Area-based poverty status is measured by calculating the percent of the population in each decedent's census tract of residence that is living at or below the federal poverty level.⁶ These population data come from the 2009-2013 five-year American Community Survey estimates made available by the U.S. Census Bureau. The poverty level categories used in this report include 0-9.9% of the population in a decedent's community living at or below the federal poverty level, 10-19.9%, 20-29.9% and 30% or greater.

To calculate suicide rates and frequencies by geographic location with the state, counties in Colorado were categorized in two different ways. First, Colorado counties were categorized by Health Statistics Region (HSR), a method often used to examine regional differences for various health indicators within Colorado. Second, counties of residence were categorized as urban, rural or frontier, according to the Colorado Office of Rural Health.⁷

Results are generally presented with 95 percent confidence intervals. Differences between rates are described as *significant* if the confidence intervals of two rates being compared do not overlap, or the p-value of a formal comparison test is less than 0.05.

Results

Suicide Deaths

Suicide Rates - State of Colorado

From 2009 to 2013, the number and age-adjusted rate of suicide deaths remained relatively stable. An increase in the number of suicide deaths and the suicide rate was seen in 2012; however, no statistically significant changes were observed during this time period (Table 1).

Table 1. Suicide deaths and age-adjusted rates, Colorado residents (2009-2013).

Year	n	Age-adjusted rate (95% CI)
2009	914	18.2 (17.0-19.4)
2010	847	16.4 (15.3-17.5)
2011	882	16.9 (15.8-18.1)
2012	1021	19.1 (17.9-20.3)
2013	990	18.3 (17.1-19.4)

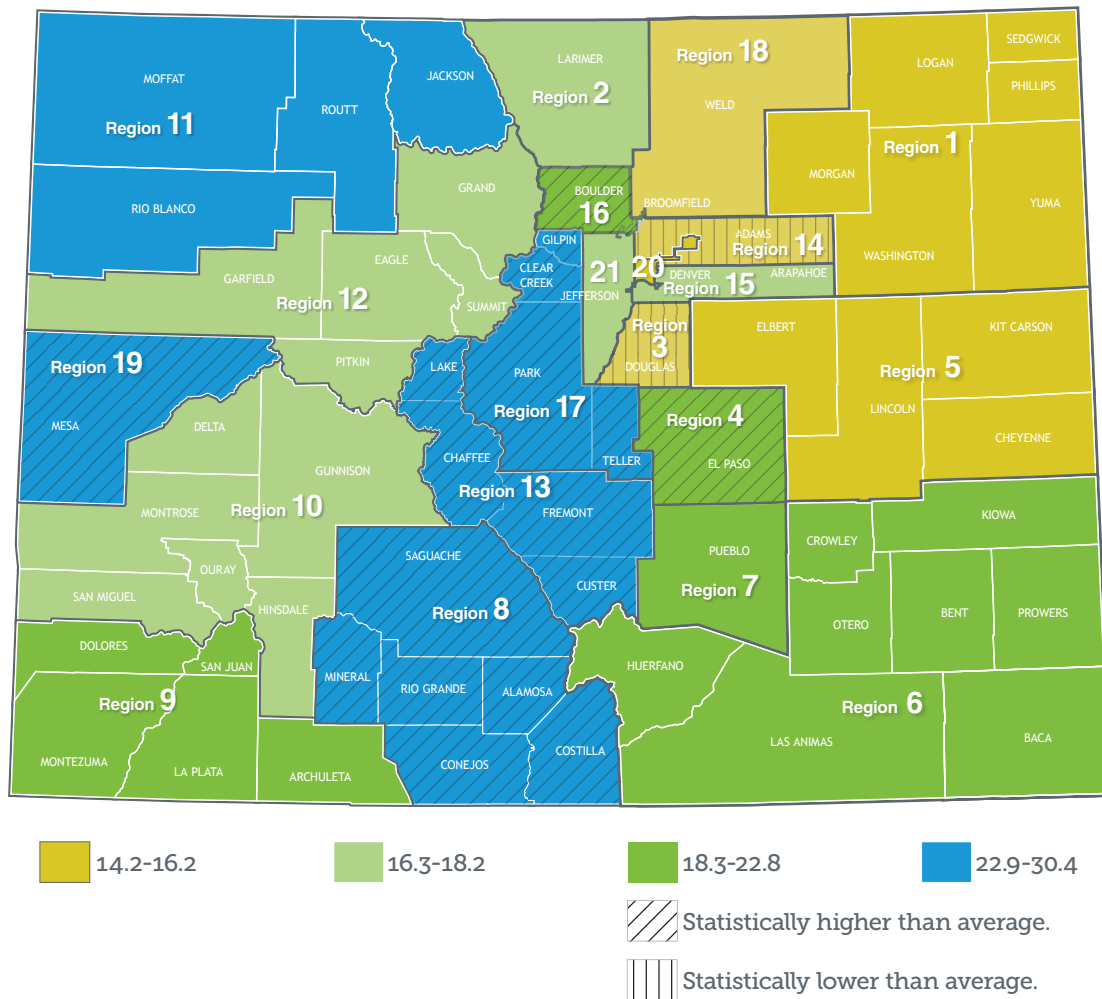
Rates are per 100,000 population.

Source: Colorado Violent Death Reporting System, Colorado Department of Public Health and Environment.

Suicide Rates - Region of Residence

Figure 1 shows a map of the age-adjusted suicide rates across the state of Colorado by Health Statistics Region (HSR) for 2009 to 2013 (combined). Suicide rates by region are grouped by quartile and further identified by whether they are significantly higher or lower than the statewide suicide rate (17.8 deaths per 100,000 population). Regions 3 and 14 were the only regions with age-adjusted suicide rates lower than the state. Areas that have age-adjusted suicide rates that are higher than the state include regions 4, 8, 13, 16, 17 and 19. Figure 2 presents the same results in chart form.

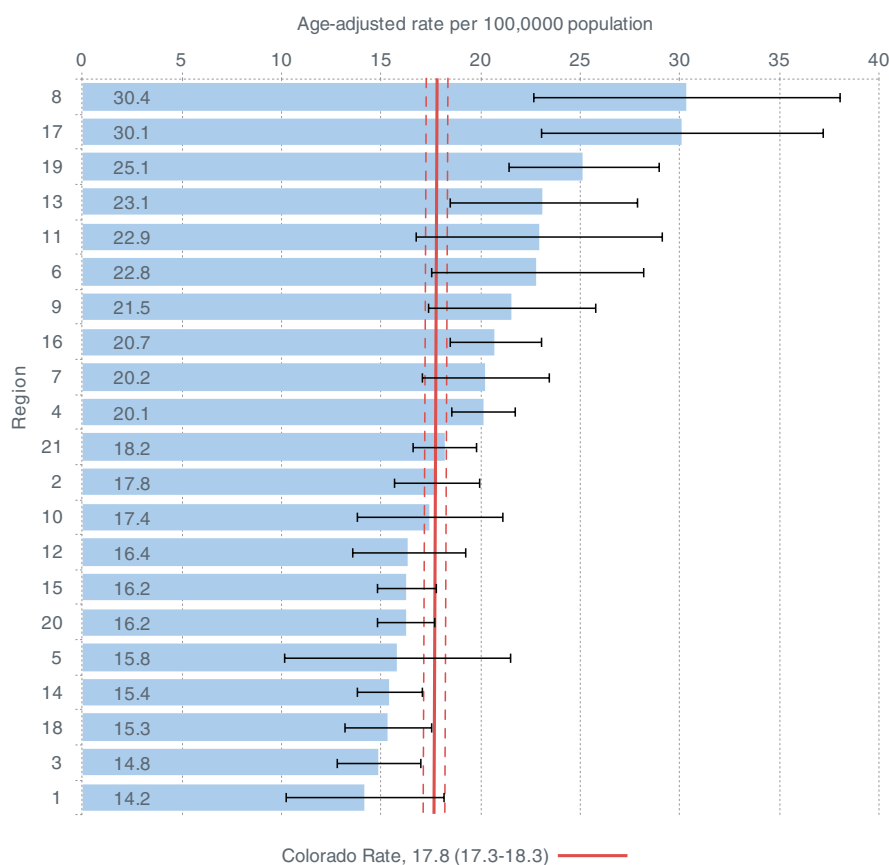
Figure 1. Map of age-adjusted suicide rate by Health Statistics Region, Colorado residents (2009-2013).



Rates are per 100,000 population.

Source: Colorado Violent Death Reporting System, Colorado Department of Public Health and Environment.

Figure 2. Age-adjusted suicide rate rank by Health Statistics Region, Colorado residents (2009-2013).



Error bars represent the 95% confidence interval.

Rates are per 100,000 population.

Source: Colorado Violent Death Reporting System, Colorado Department of Public Health and Environment.

Table 2 presents the age-adjusted suicide rates by urban, rural or frontier residence status. Urban counties are found along the Front Range Urban Corridor beginning with Larimer County and ending with Pueblo County in southern Colorado. Also included in the urban counties is Mesa County. The counties designated as rural and frontier lie scattered in the regions directly surrounding Colorado’s urban corridor. Though residents of urban counties accounted for the greatest number of suicide deaths, urban-county residents had the lowest age-adjusted suicide rates among all three county types. The age-adjusted rate for rural counties was significantly higher than that for urban counties.

Table 2. Age-adjusted suicide rates by county of residence classification, Colorado residents (2009-2013).

County classification	n	Age-adjusted rate(95% CI)
Urban	3,943	17.5 (16.9-18.0)
Rural	581	19.8 (18.1-21.4)
Frontier	129	19.0 (15.6-22.4)

Rates are per 100,000 population.

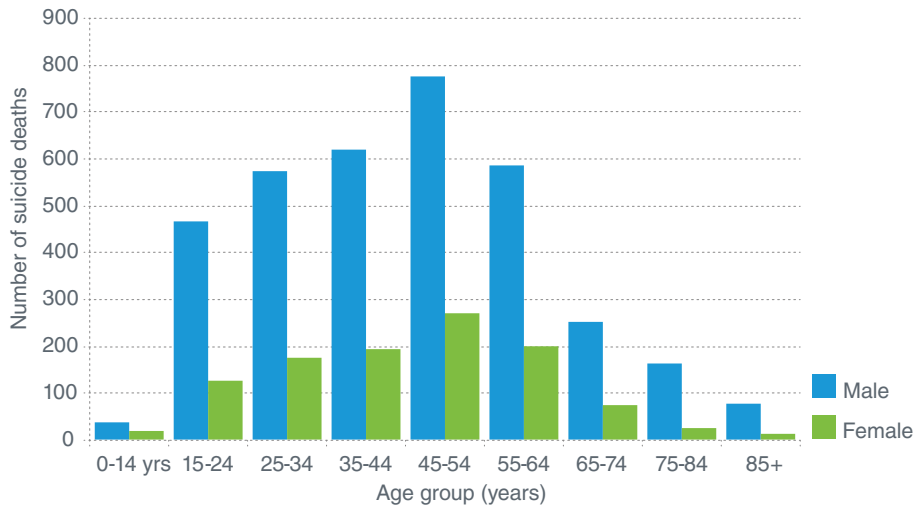
Source: Colorado Violent Death Reporting System, Colorado Department of Public Health and Environment.

Suicide Demographics

Age and Gender

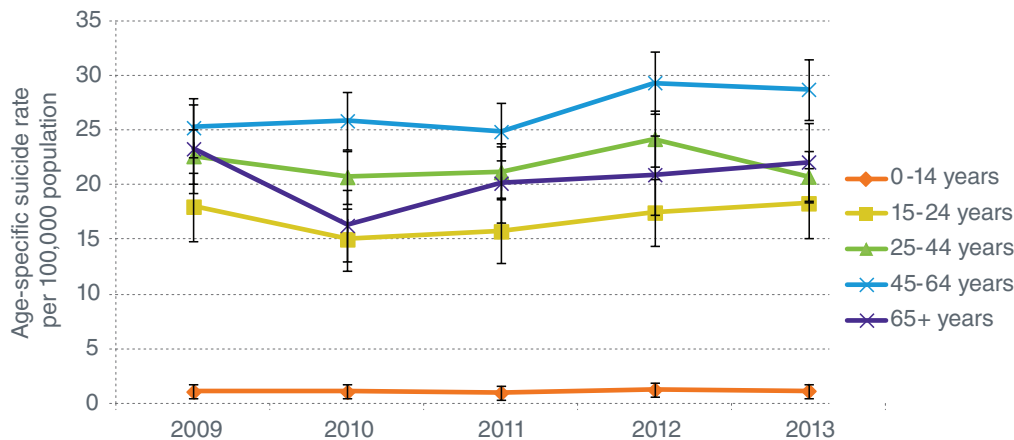
Figure 3 shows the total number of suicide deaths in Colorado among residents by age and gender. During that time period, the number of male suicides was more than three times the total number of female suicides (3,553 and 1,101 deaths, respectively). The average age for all suicide victims was 45 years. Among male suicides, the number of deaths was highest in the 45-54-year age group (776 deaths). A similar trend was seen among female suicides: The highest number of deaths occurred in the 45-54-year age group (271 deaths).

Figure 3. Suicide deaths by age and gender, Colorado residents (2009-2013).



Source: Colorado Violent Death Reporting System, Colorado Department of Public Health and Environment.

Figure 4. Age-specific suicide rate, Colorado residents (2009-2013).



Error bars represent the 95% confidence interval.

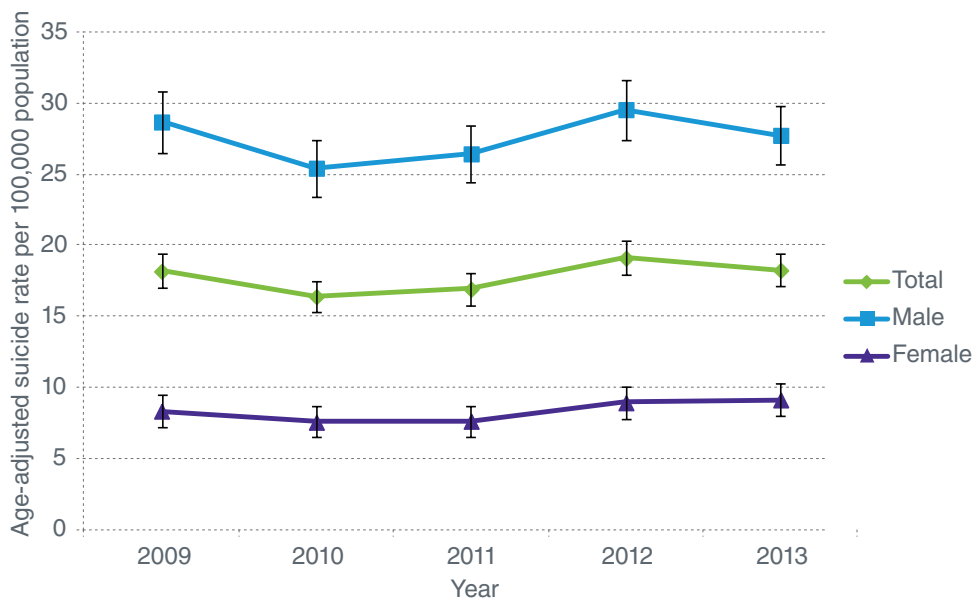
Rates are per 100,000 population.

Source: Colorado Violent Death Reporting System, Colorado Department of Public Health and Environment.

Figure 4 shows age-specific suicide rates among the age groups. The suicide rate among 45-64-year olds was consistently the highest compared to all other age groups, with a significant difference in 2013. The rates for 15-24-year olds steadily increased since 2010 although the difference was not statistically significant.

Consistently from 2009 to 2013, males had significantly higher age-adjusted suicide rates compared to females; on average, the age-adjusted suicide rate in men was over three times higher than in women (27.6 vs. 8.3, respectively) (Figure 5).

Figure 5. Age-adjusted suicide rate by gender, Colorado residents (2009-2013).



Error bars represent the 95% confidence interval.

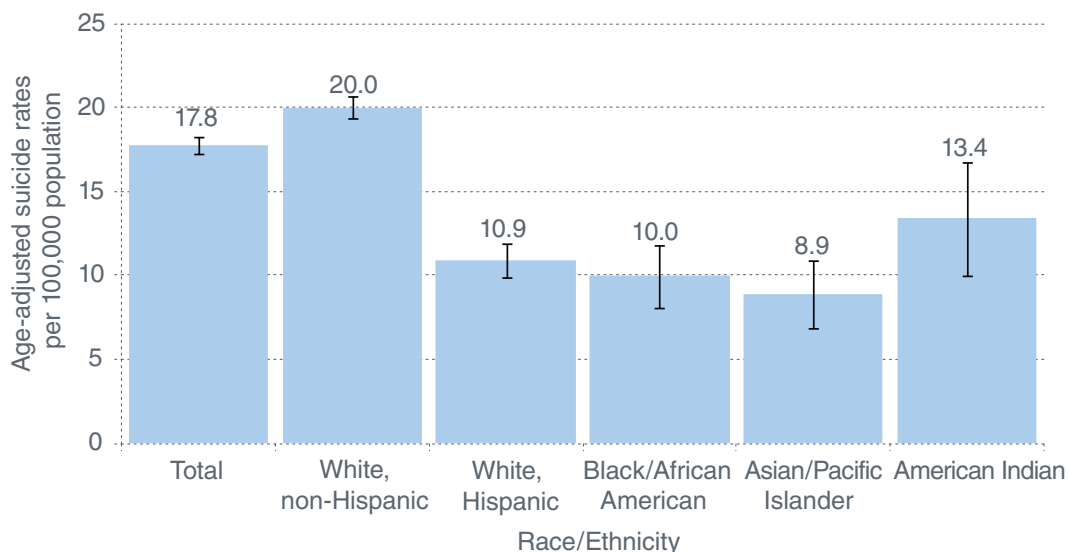
Rates are per 100,000 population.

Source: Colorado Violent Death Reporting System, Colorado Department of Public Health and Environment.

Race/Ethnicity

White non-Hispanics had the highest rate of suicide among all race and ethnic groups at 20.0 deaths per 100,000 population. White non-Hispanics were significantly higher compared to all other race and ethnic groups, with age-adjusted rates nearly twice as high compared to all other groups (Figure 6).

Figure 6. Age-adjusted suicide rates by Race/Ethnicity, Colorado residents (2009-2013).



Error bars represent the 95% confidence interval.

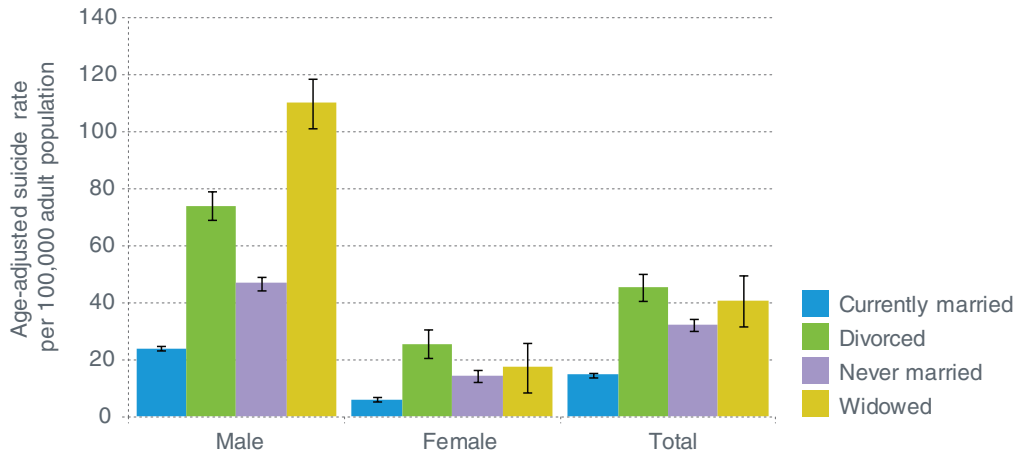
Rates are per 100,000 population.

Source: Colorado Violent Death Reporting System, Colorado Department of Public Health and Environment.

Marital Status and Poverty

Among suicides in victims 18 years of age and older (n=4,575) the greatest proportion of deaths occurred in those who were married (35.9%) although the age-adjusted rate was significantly lower compared to those with any other marital status. Comparing rates of suicide, divorced victims had the highest age-adjusted rate. Suicide rates in males were higher than females regardless of marital status. Among males, those who were widowed had the highest rate of suicide: Widowed males were over four times more likely to die by suicide than married males. Among females, those who were divorced had the highest rate of suicide: Divorced females were more than four times more likely to die by suicide than married females (Figure 7).

Figure 7. Suicide rates by gender and marital status, age > 18 years, Colorado residents (2009-2013).



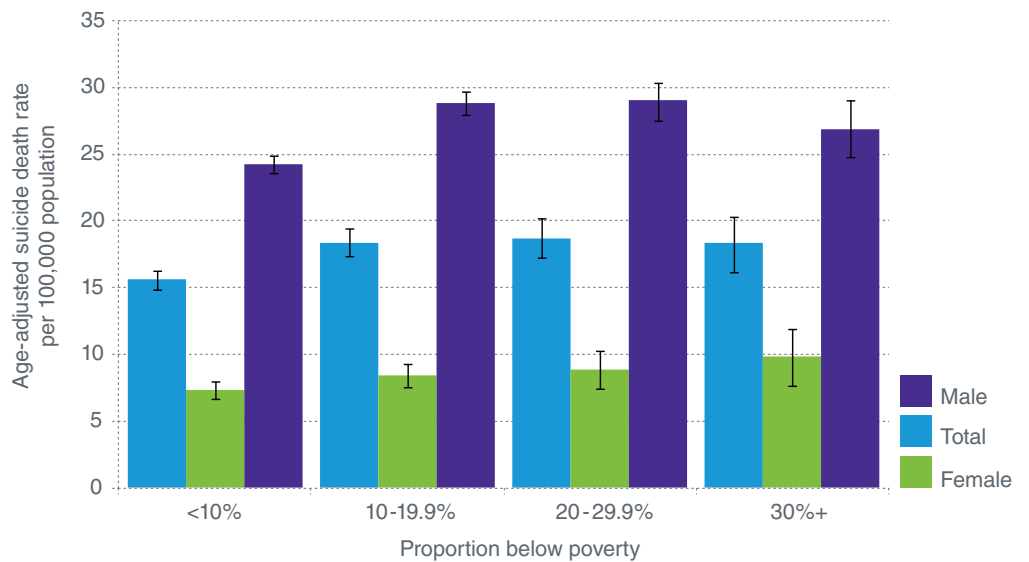
Error bars represent the 95% confidence interval.

Rates are per 100,000 population.

Source: Colorado Violent Death Reporting System, Colorado Department of Public Health and Environment.

Figure 8 shows the area-based poverty estimates for Colorado residents. Area-based poverty status represents the percentage of the population in the census tract of the decedent’s residence living at or below the federal poverty level. Among both females and males, as well as overall, these results suggest that as the proportion of one’s community that lives below the poverty level increases, the age-adjusted suicide rate also increases.

Figure 8. Area-based poverty estimates, Colorado residents (2009-2013).



Error bars represent the 95% confidence interval.

Rates are per 100,000 population.

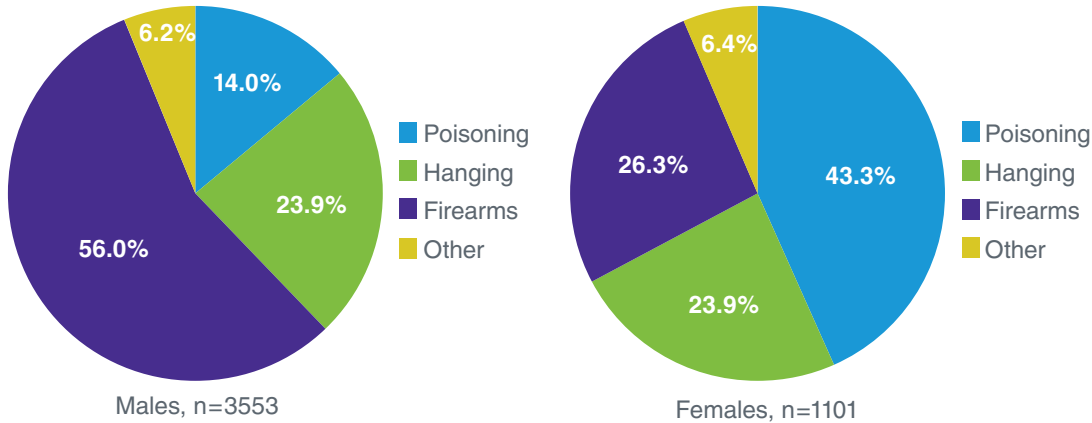
Source: Colorado Violent Death Reporting System, CDPHE.

Suicide Methods

Age and Gender

Male suicide deaths most frequently involved the use of a firearm as lethal means (56.0%), followed by hanging/asphyxiation/suffocation (23.9%) and poisoning (14.0%). In contrast, the greatest proportion of female suicide deaths involved the use of poison as lethal means (43.3%), followed by firearm (26.3%) and hanging/asphyxiation/suffocation (23.9%) (Figure 9). The method of suicide also varied according to age. As age increased, the use of a firearm as a lethal method increased; whereas the use of hanging/asphyxiation/suffocation was highest among younger victims (Figure 10).

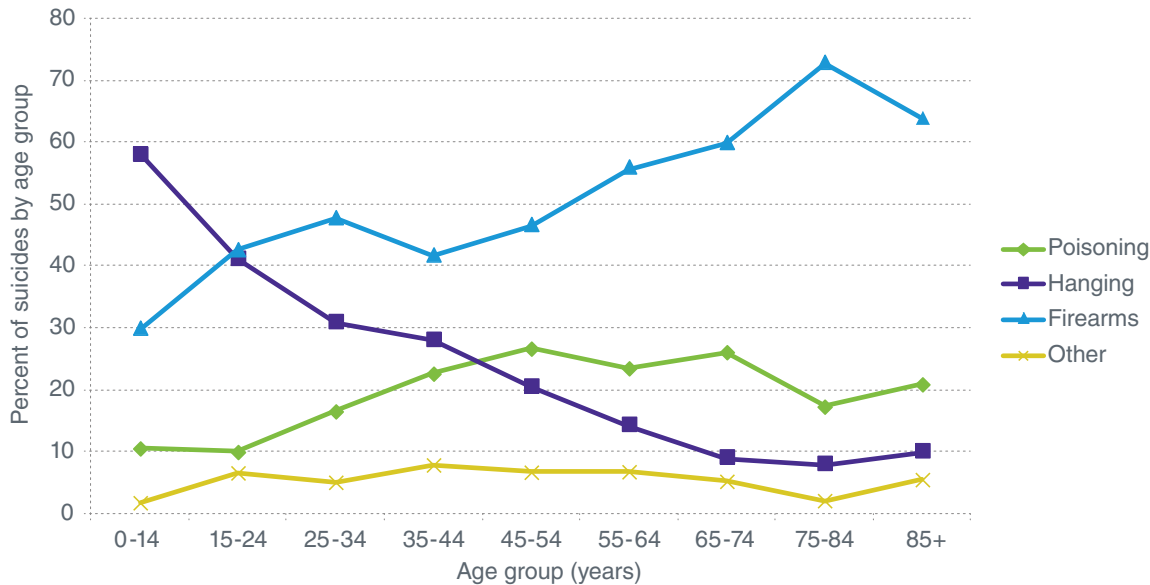
Figure 9. Suicide deaths by method and gender, Colorado residents (2009-2013).



Other method included jumping from a high place, sharp object or other/unspecified methods.

Source: Colorado Violent Death Reporting System, Colorado Department of Public Health and Environment.

Figure 10. Suicide methods by age group, 2007-2011.



Other method included jumping from a high place, sharp object or other/unspecified methods.

Source: Colorado Violent Death Reporting System, Colorado Department of Public Health and Environment.

Suicide Circumstances

Table 3 outlines the 15 circumstances most frequently associated with suicide deaths in Colorado among residents. The most frequent circumstance associated with Colorado suicide deaths was indication by family, friends, or acquaintances that the victim was exhibiting a *depressed mood* (including being noted as feeling *sad* or *despondent*) close to the date/time of death (57.7%). There are numerous circumstances related to mental health and treatment as well as other adverse life events that were documented to be related to the suicide deaths.

Table 3. Suicide deaths by circumstance, Colorado residents (2009-2013).

Circumstance	N	Percent
Suicides with at least 1 known circumstance	4,280	92.0
	N	Percent*
Current depressed mood	2,468	57.7
Current mental health problem	1,898	44.4
Ever treated for mental health problem	1,733	40.5
Left a suicide note	1,622	37.9
Intimate partner problem	1,529	35.7
Disclosed intent to commit suicide	1,509	35.3
Diagnosis of depression	1,429	33.4
Current mental health treatment	1,417	33.1
Physical health problem	1,319	30.8
History of previous suicide attempts	1,192	27.9
Problem with alcohol	1,162	27.2
Job problem	880	20.6
Financial problem	844	19.7
Problem with other substance	691	16.1
Crisis within two weeks of suicide	502	11.7

*Percent of total cases with at least one circumstance known.

Source: Colorado Violent Death Reporting System, Colorado Department of Public Health and Environment.

Additionally, Table 4 presents documented toxicological results associated with these suicide deaths, that is, what substances were present in the victim at the time of death. Among suicide deaths for which toxicology results were available, alcohol (30.1%) was the most frequently identified substance, followed by opiates (13.3%) and antidepressants (12.6%). Other substances noted were presented in fewer than 10 percent of suicide deaths.

Table 4. Suicide deaths by presence of substances, Colorado residents (2009-2013).

Circumstance	N	Percent
Suicides with available toxicology results	4,292	92.2
	N	Percent*
Alcohol present	1,290	30.1
Opiate present	570	13.3
Antidepressant present	542	12.6
Marijuana present	371	8.6
Amphetamine present	154	3.6
Cocaine present	110	2.6

*Percent of total cases with toxicology results known.

Source: Colorado Violent Death Reporting System, Colorado Department of Public Health and Environment.

Discussion

Over the past five years, the rate of mortality from suicide among Colorado residents has consistently remained at a high level. In recent years, the number of suicide deaths has surpassed the number of deaths due to motor vehicle accidents, and suicide has become the seventh leading cause of death in Colorado. Not only does the state maintain an average suicide rate nearly one and a half times the national rate (19.1 Colorado crude suicide death rate, 2013; 13.0 US rate, 2013),¹ the state's average suicide rate has ranked among the ten highest in the nation for several consecutive years. Within the state of Colorado, considerable variation in suicide frequency and suicide risk were observed among Colorado's diverse populations: Differences by geographic region, racial/ethnic group, and gender, weapon of lethal means, age category, relationship status, and poverty were apparent in Colorado suicides from 2009 to 2013. Analysis of precipitating circumstances prior to death among suicide victims also revealed important commonalities that may provide information useful for guiding suicide intervention efforts in Colorado communities.

Variations in the age-adjusted suicide rate were seen in geographic clusters of counties located in various regions of the state. Even beyond the United States, those who live in counties designated rural or frontier are generally considered to be at increased risk of death by suicide compared to those who live in urban-designated counties.⁸⁻¹⁰ Suicide rates among rural versus urban Colorado residents show similar trends and support the findings of prior studies.

Certain demographic populations within the state are disproportionately affected by suicide: The male population consistently experienced suicide rates over one and a half times greater than the Colorado state average and over three times greater than females. Male Colorado residents between the ages of 35 and 54 years not only experienced the highest suicide rates among the age groups and genders, they have consistently contributed a staggering proportion of all Colorado resident suicides over the past five years (30%). The high suicide rate and frequency seen in the middle-aged Colorado male population have important implications on statewide public health planning and prevention efforts.

Disparities in suicide rates also exist among Colorado's racial/ethnic groups. The age-adjusted suicide rate in the White non-Hispanic population is nearly two times greater than the average rate of the White Hispanic, Black/African American, Asian American/Pacific Islander, and American Indian populations.

Previous studies have demonstrated that suicide rates vary significantly by marital status,¹¹ and some studies even indicate a possible protective effect of marriage.¹² Among Colorado residents, differences by marital status similar to those seen in other studies were observed. Married victims had significantly lower rates of suicide, regardless of gender. The association between marital status and suicide rate is also modified by gender. The age-adjusted suicide rates in the widowed male and divorced female populations were the highest.

There are three major types of weapons used most frequently in suicide deaths: firearm, hanging/asphyxiation/suffocation, or poisoning. The frequency of weapon use varies significantly by gender and age group. Compared to women, men are more likely to use a firearm as lethal means and less likely to die by poisoning. The younger Colorado population shows a tendency toward use of hanging/asphyxiation as lethal means while the older Colorado population tends toward use of a firearm.

Analysis of the toxicological results show a relatively high prevalence of alcohol among victims of suicide, and significant prevalence of opiates (both prescription and illicit) and antidepressants. Substance misuse and abuse remain significant public health concerns in Colorado, with rates of both intentional (suicide) and accidental drug overdose deaths increasing in recent years.² Better understanding the relationships between substance misuse and abuse, mental health (specifically depression), and thoughts and behaviors that lead to suicide will be key to inform suicide prevention strategies.

The findings contained in this report represent the most currently available information concerning the circumstances, demographics and recent trends of suicide among Colorado residents. While the suicide rate among Colorado residents remains at a critically elevated level, the information presented here can contribute to current suicide prevention efforts. The results of these analyses will serve the interest of local and state agencies for suicide planning and intervention efforts by providing a better understanding of the populations at greatest risk for suicide death. This report will also serve the interest of Colorado citizens by contributing to decreased burden of suicide in Colorado communities attained through evidence-based prevention programs based on the findings of further CoVDRS analyses.

Acknowledgements

The authors would like to thank the Colorado Violent Death Reporting System Advisory Leadership Team and members of its Advisory Network for their past and ongoing support and guidance of CoVDRS efforts. The Leadership Team is comprised of staff from CDPHE's Violence and Suicide Prevention Section, Injury and Substance Abuse Prevention Section, and Children, Youth and Families Branch.

This publication was supported by the Cooperative Agreement Number 1 U17 CE 002593 - 01, funded by the Centers for Disease Control and Prevention. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention or the Department of Health and Human Services.

References

1. Centers for Disease Control and Prevention, National Center for Health Statistics. Underlying Cause of Death 1999-2013 on CDC WONDER Online Database, released 2015. Multiple Cause of Death Files, 1999-2013.
2. Colorado Health and Environmental Data. <http://www.chd.dphe.state.co.us>
3. WISQARS (Web-Based Injury Statistics Query and Reporting System), from the CDCP National Center for Injury Prevention and Control. Cost of injury data query report: suicide deaths, all mechanisms of injury combined, all ages and both sexes, state of CO. Access from <https://wisqars.cdc.gov:8443/costT/>
4. International Statistical Classification of Diseases and Related Health Problems 10th Revision. Access from <http://apps.who.int/classifications/icd10/browse/2010/en#/X60>
5. National Violent Death Reporting System, Division of Violence Prevention, Centers for Disease Control and Prevention. <http://www.cdc.gov/violenceprevention/nvdrs/>
6. Center for Health and Environmental Data Vital Statistics Unit. Colorado Births and Deaths Report 2013. Colorado Department of Public Health & Environment. Accessed from <http://www.chd.dphe.state.co.us/Resources/vs/2013/Colorado.pdf>
7. Colorado Rural Health Center, Colorado Office of Rural Health. Accessed from <http://coruralhealth.org/wp-content/uploads/2014/09/2014.RuralHealth.Snapshot.pdf>
8. Singh, Gopal K; Siahpush, Mohammad. Increasing Rural-Urban Gradients in US Suicide Mortality, 1970-1997. *American Journal of Public Health*: Vol. 92, No. 7, Jul 2002.
9. Gessert, Charles E. Rurality and Suicide. *American Journal of Public Health*: Vol. 93, No. 5, May 2003.
10. Alvaro-Meca, A.; Kneib, T.; Gil-Prieto, R.; Gil de Miguel, A. Epidemiology of suicide in Spain, 1981-2008: A spatiotemporal analysis. *Public Health*: 2013 Jan 30: 1-6.
11. Kposowa, AJ. Marital status and suicide in the National Longitudinal Mortality Study. *Journal of Epidemiology and Community Health*. 2000 Apr; 54:254-261.
12. Denney, Justin T.; Rogers, Richard G.; Krueger, Patrick M.; Wadsworth, Tim. Adult Suicide Mortality in the United States: Marital Status, Family Size, Socioeconomic Status, and Differences by Sex. *Social Science Quarterly*: 2009 Dec 1; 90:1167-1185.