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UNDERSTANDING THE SILENT CRISIS: AN ANALYSIS OF SUICIDE METHODS AMONG KENTUCKY FEMALES

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**UNDERSTANDING THE SILENT CRISIS:
AN ANALYSIS OF SUICIDE METHODS AMONG KENTUCKY FEMALES**

CAPSTONE PROJECT PAPER

A paper submitted in partial fulfillment of the requirements for the degree of
Master of Public Health

University of Kentucky College of Public Health

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Lexington, Kentucky

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Abstract

Background: Suicide has been called the ‘silent crisis’. As rates have increased in recent years, it is now the 10th leading cause of death in the United States. Within the state of Kentucky, females die by suicide most often through the use of firearms, differing from the national trend where poisoning is most common. With a drastic increase in firearm suicides has been observed beginning in 2010. The aim of this study is to investigate why Kentucky females who have died by suicide are using firearms most often, as opposed to other methods, and compare those results to other states in order to further understand this trend.

Methods: All suicides reported to the National Violent Death Reporting System were eligible for this study. Multivariate logistic regression was performed to determine which variables, including demographic, personal circumstance, mental health, and suicide-related, were related to firearm suicide.

Results: Kentucky females who died by suicide were not receiving mental health treatment, only 36% were diagnosed and 24% in current treatment. Within comparison states, increased mental health diagnosis and treatment was associated with decreased odds of firearm suicides. It was found that females living in rural counties, and those who were depressed or had intimate partner problems/violence in Kentucky were more likely to die by firearm suicide.

Conclusion: These results contribute to understanding firearm suicide among females in Kentucky and guides efforts for interventions for at-risk populations and future research. This study specifically highlights mental health care with recommendations to emphasize means reduction counseling as a strategy to eliminate barriers to this care. Advocating for more comprehensive state gun laws and policies is also recommended.

Introduction

Overview

Suicide is arguably one of the most complicated forms of violent death investigated today.

Suicide is defined as injury-related behavior that is deliberate and self-directed, resulting in death. [1] These types of death devastate communities across the United States (U.S) and as suicide rates have increased over the last several years, it has become one of the leading causes of mortality today. In 1999, suicide was the 11th leading cause of death with 29,199 deaths, or 10.7 per 100,000 people. [2] By 2015, suicide was the 10th leading cause of death in the U.S. observing 44,193 deaths, or 13.4 per 100,000 people. [3] In just over 15 years, suicide went from the 11th to the 10th leading cause of mortality in the U.S., increasing by 13,994 deaths or 2.7 per 100,000 people. This trend is illustrated in Figure 1.

When stratifying U.S. data by gender, a similar increase can be observed within males and females. In 1999, the gender-specific age-adjusted suicide rates were 17.15 per 100,000 males and 4.01 per 100,000 females. [4] By 2015, the gender-specific age-adjusted suicide rates increased to 21.5 per 100,000 males and 6.3 per 100,000 females. [3] An increase of 4.35 deaths per 100,000 males and 2.29 deaths per 100,000 females. These trends are illustrated in Figure 1.

While suicide was the 10th leading cause of mortality in the U.S. in 2015, when stratifying the leading causes of death between age groups, the full burden of suicide becomes clear. Data from 2015 show that suicide was the 2nd leading cause of death among individuals 15-34 years of age, the 3rd among individuals 10-14 years of age, and 4th among individuals 35-44 years of age. [5] These data illustrate the burden of suicide more completely and details what a large proportion of the younger population it impacts.

Despite the high rates of suicide, it is often referred to as the silent crisis due to the lack of media attention and community conversation on the topic. While it is thought that suicide is completely preventable, awareness of the problem is the first step toward comprehensive suicide prevention.

[6] Unfortunately, suicide is complex and efforts to understand and prevent deaths is not a simple task. The complexity of suicide is characterized by a long list of contributing risk factors, the most significant of which includes personal circumstance, clinical factors with mental health being the most notable, and suicide-related stigma.

Studies conducted previously have identified a plethora of personal circumstance factors associated with an individual who has died by suicide. Examples of these can include, social disadvantages which encompass: lack of educational opportunities, few employment options, low income, and poverty. [7] Another is childhood and family adversity, including: exposure to a family member's mental illness or suicide, parental separation and divorce, and history of physical and sexual abuse. [7, 8] Finally, there are various intrapersonal stressors, which can include: alcohol abuse, substance use disorder, romantic disappointment, and intimate partner problems such as sexual, physical, or mental abuse, among others. [9, 10]

Many clinical factors have been found to contribute to suicide as well. It is thought that individuals with psychiatric illnesses and mental disorders are at an increased risk of suicide. [7, 9] This theory is supported by the estimation that more than 90% of people who die by suicide have a diagnosable psychiatric illness, most often being bipolar disorder, depression, or schizophrenia. [11] For some perspective on the size of this at-risk population, in 2016 it was estimated that 44.7 million (18.3%) of adults in the U.S. had some form of mental illness. [12] Outside of mental health, there are other clinical factors which are highly associated with an individual's risk of suicide. These are often illness which result in chronic, life-long

consequences such as: traumatic brain injury, epilepsy, psychogenic pain, migraine, stroke, sleep disorders, and HIV/AIDS. [13]

These risk factors are compounded by a unique aspect of suicide, stigmatization. Stigma is defined as a form of disgrace which can reduce an individual's social status making it more acceptable for them to be shamed by society. [14] Suicide-related stigma often stems from historical religious, legal, and social sanctions established against suicide; and this taboo nature of discussing suicide continues to persist. Suicide often leads to social unease contributing to a sense of disapproval, blame, and shame directed toward suicide victims, their family, and friends. [15] This is problematic because this stigma can create a sense of isolation among individuals who have suicidal ideation or a history of suicide attempts. This can limit their desire to seek help from medical providers and increase their likelihood of death by suicide. [16] Individuals who die by suicide are often found to have one or more of these factors, but it is not possible to develop a comprehensive list of all suicide risk factors because each individual case can present their own unique characteristics adding new circumstance factors not previously known.

The impact of suicide is just as devastating as the statistics themselves. Data available on the subject suggests that with each suicide that occurs, an estimated 147 people are exposed with 6 people experiencing major life disruption. [3] Another significant impact is the economic consequence of suicides and suicide attempts in the U.S. It is estimated that between 1981-2013, suicide costs the U.S. approximately \$44 billion annually. [17] Specifically, in 2013 the estimated total cost of suicide was nearly \$58.4 billion based on numbers alone, but is likely closer to \$93.5 billion after adjusting for underreporting. This is nearly \$298 per capita with a majority of this cost being a loss of productivity at 97.1%. [18]

Gender Differences

As discussed previously, males and females are both effected by suicide in the U.S., however there are differences between the two genders, most notably with regard to suicide methods. Males tend to use more lethal methods such as firearms, whereas females use less lethal methods such as poisoning. These differences are significant because utilizing a more lethal method increases the likelihood of completing a suicide. [6] It has been found that the fatality rate of suicide varies depending on the method used, with 85% of firearm attempts resulting in death, 69% of attempts using suffocation, 2% of attempts by poisoning, and 2% involving other methods. [13] Table 1 shows the ranking of U.S. suicide methods stratified by gender.

Female Suicide in Kentucky

The commonwealth of Kentucky ranked 35th in size according to state populations in 2015 [19], yet ranked 16th in suicide deaths out of the 50 United States and the District of Columbia that same year. [3] In recent years, there has been an increase in suicide rates. In 1999 the suicide rate in Kentucky was 11.70 per 100,000 and increased nearly 1.5 times by 2015 where the rate was 17.54 per 100,000. [4] In fact, according to the Kentucky Violent Reporting System's 10-Year Report, the 2000-2015 suicide rate in Kentucky was significantly higher than the U.S. rate within each of those years. [20]

When stratifying by gender, there is a striking increase in suicide rates in Kentucky females. In 2005 the death rate was 5.12 per 100,000 and by 2015 the rate had increased to 6.59 per 100,000. [4] Suicide rates among Kentucky females have increased by 1.60 times during this time period, a larger increase than the overall state rate. Figure 2 illustrates Kentucky suicide trends.

However, the most unusual feature of female suicide in Kentucky is the method by which they have died. As described previously, females in the U.S. die by suicide most often by poisoning

however, in Kentucky females die by suicide most often using a firearm. An estimated 50.31% of all female suicides that have been reported from Kentucky have used a firearm, compared to 31.51% of female suicides reported nationally. Table 2 displays a ranking of Kentucky female suicide methods compared to U.S. female suicide methods. Additionally, the rate of firearm suicide among Kentucky females has been increasing steadily. In 2011 the rate of firearm suicide was 2.67 per 100,000 and since then, the rate has increased until 2015 when it was 3.02 per 100,000. The increasing trend of firearm suicide compared to the poisoning suicide among females in Kentucky is detailed in Figure 3.

The high rates and continued increase of firearm suicide among Kentucky females is not only an unusual phenomenon, but a grave public health concern. As discussed previously, the more lethal the method utilizing in a suicide attempt, the more likely a suicide attempt will be successful. Therefore, as firearm suicide rates among Kentucky females continue to increase so too will the rate of completed suicides. It is the aim of this study to investigate why females in Kentucky who die by suicide chose to use firearms most often. This can be done by exploring what factors are associated with this group of females. It is our goal to understand who is most at-risk, and what personal and environmental risk factors might contribute to making that decision. With this understanding, recommendations can be made for preventative strategies through more targeted, poignant public health interventions, and additional research to begin to address and combat the increasing rate of firearm suicide among Kentucky females.

Methods

Data Source

The National Violent Death Reporting System (NVDRS) was developed by the Centers for Disease Control and Prevention (CDC) as an incident-based, active violent death surveillance system and collects data on all types of violent death, including suicide. [21] These data come from four main sources about the same incident: death certificates, coroner/medical examiner reports, law enforcement reports, and toxicology reports. A more detailed explanation of the development and implementation of the NVDRS has been previously described. [21, 22] All suicides reported to the NVDRS are eligible for this study. This study was approved by the University of Kentucky Institutional Review Board.

Circumstance Variables

The NVDRS features unique circumstance variables which details various life events and stressors thought to be precipitating circumstances leading to the suicide. This information is obtained through death scene investigators who typically interview friends and family members of the deceased. In Kentucky, this information is obtained through coroners' reports. [23] The personal circumstance variables utilized in this study include: depressed mood, disclosure of intent, family relationship problem, financial problem, intimate partner problem, job problem, criminal legal problem, other legal problem, physical health problem, substance abuse, current mental health treatment, history of mental health treatment, mental health diagnosis, suicide attempt history, suicide note left, and suicidal thought history. Variable selection is discussed later. These variables were categorized dichotomously as: yes or no (reference). A more detailed explanation of these variables can be found in the NVDRS coding manual. [24]

Variable Selection

Prior to conducting statistical analysis, evaluation of the variables was done to determine: which contained a sufficient response rate, which were appropriate to use for this study, and which might act as confounders. Those with an unusually low response rate, high levels of missing data, or other abnormal features were not used in the analysis. The variables that were ultimately selected for this study fall into one of three categories, the first begin demographic variables which include: age group, race, ethnicity, location of residence, education level, and marital status. The second are personal circumstance variables, which are: alcohol use suspected, depressed mood, disclosure of intent, family relationship problem, financial problem, intimate partner problem, job problem, criminal legal problem, other legal problem, physical health problem, and substance abuse. Third are mental health or suicide-related variables which include: current mental illness treatment, history of mental illness treatment, mental health diagnosis, suicide attempt history, suicide note left, and suicidal ideation.

In order to assess the interactions of the variables used in this study, and determine which might be potential confounders, a Directed Acyclic Graph (DAG) was constructed utilizing the aforementioned variables. Based on this DAG, the set of variables that were found to be sufficient to control for confounding were: age group, alcohol use suspected, depressed mood, intimate partner problem, physical health problem, current mental illness treatment, history of mental illness treatment, mental health diagnosis, and suicide attempt history (Figure 5). [25]

Variable of Interest: Location of Residence

Kentucky is split nearly evenly between urban and rural counties therefore, an additional variable was created to identify county of residence as urban, sub-urban, or rural in order to evaluate these environments and their impact on female firearm suicide. Rural-Urban Continuum Codes,

developed by the National Cancer Institute's Surveillance, Epidemiology and End Results Program were used for categorization. Counties in metropolitan areas with a population of 1 million people or more were categorized 'urban', counties in a metropolitan area with a population of less than 1 million people were categorized 'sub-urban', and counties in non-metropolitan area are categorized as 'rural'. More information on the Rural-Urban Continuum Codes have been described elsewhere. [26]

Outcome Variable: Firearm Suicide

Firearm Suicide, for this study, is defined as a female who has died by suicide using a firearm. This variable was developed and categorized dichotomously as: yes or no. Observations categorized as 'yes' are females who have died by suicide using a firearm, while observations categorized as 'no' died by suicide using any other method.

Comparison States

To understand why suicide methods differs among Kentucky females compared to the national ranking and other states, data from two additional states were analyzed for comparison. In this study, Ohio and Virginia were selected. These states were selected because they are part of the NVDRS and their data is included in the CDC's RAD. Virginia began contributing data in 2003 and Ohio in 2011. Second, female suicides in Ohio and Virginia mirror the national trend of poisoning being the most common method, followed by firearms. This is detailed in Table 3. Third is the relative stability of the rate of suicide within Ohio and Virginia as compared to Kentucky. These trends are illustrated in Figure 4. Additional reasons why these states were selected focus on the generalizability of the three state populations, which can be noted as similar with regard to their geographic location in relation to one another and similar state level emergency medical priorities, such as the current opioid epidemic. [27]

Statistical Analysis

Descriptive statistics were calculated using frequencies and percentages to understand our study populations further. Univariate logistic regression was conducted on demographic variables and other multi-categorical variables to evaluate their relationship with firearm suicide. Chi-square tests of independence were used to conduct bivariate analysis and compare females who have died by firearm suicide and females who die by suicide using any other method in terms of personal circumstances and mental health related variables. Those variables whose relationship was found to be statistically significantly associated with the outcome variable along with the variables found to be sufficient to control for confounding were included in a state-specific multivariate logistic regression models. Backward elimination was conducted to determine the final model for each state's study population.

Results

Descriptive Statistics Analysis

Table 4 details national-level demographic information among all observations in the RAD dataset, stratified by gender. This information creates a profile of males and females who have died by suicide. The majority of suicides were white, non-Hispanic males. Of 143,993 victims, 112,086 (77.8%) were male, and among male observations, 98,220 (87.99%) were white and 105,268 (94.24%) non-Hispanic. Among the 31,847 female observations, 28,105 (88.66%) were white and 30,203 (95.16%) were non-Hispanic. There is a similar distribution between males and females in the other variables with the only exception being marital-status; a majority of males were reported as being single (39,991, 35.66%), followed by married (39,369, 35.18%), then divorced (25,181, 22.50%), whereas a majority of females reported being married (10,978, 34.54%), followed by divorced (9,154, 28.80%), then single (8,677, 27.30%). Age groups were evenly distributed between the 18-34, 35-49, or 50-64 age ranges. The majority of both males and females were educated at a high school-level, followed by college-level with a small percentage of observations having an education level of 8th grade or less, or having an advanced degree.

Table 5 details demographic information of females who have died by suicide in Kentucky, Ohio, and Virginia, stratified by suicide method. This information mirrors Table 4, with one exception: Virginia had more non-White minorities die by suicide, in comparison to the other states; these minority groups more often died by suicide using non-firearm method. The location of residence variable is included in this table and was found to differ across the three states. In Kentucky, of 1,303 observations there is slightly greater proportion of observations who lived in rural counties (583, 44.7%), compared to urban (557, 42.7%), with sub-urban following (163,

12.5%). Among those who used a firearm, the greatest proportion lived in rural areas (336, 51.85%), followed by urban (233, 35.96%), then sub-urban (79, 12.19%); for those that did not use a firearm the greatest proportion of individuals lived in urban counties (324, 49.47%), followed by rural (247, 37.71%), then sub-urban (84, 12.82%). Of 1,650 suicides in Ohio, a greater proportion lived in urban counties (819, 49.6%), followed by sub-urban (529, 32.1%), then rural (302, 18.3%) and a greater proportion of both firearm (221, 43.25%) and non-firearm (598, 52.50%) suicides were found in urban areas, sub-urban second, then rural. In Virginia, of 2,843 suicides, most lived in rural counties (1,290, 45.4%), followed by urban (1,193, 41.9%), and sub-urban (360, 12.7%); and similar to Kentucky, the highest proportion of firearm suicide was in rural counties (479, 48.73%) followed by urban, then sub-urban, and the highest proportion of non-firearm suicide was in urban counties (847, 45.54%), followed by rural, then sub-urban.

Table 6 displays the frequencies of personal circumstance variables among females within Kentucky, Ohio, and Virginia, stratified by suicide method. A much smaller proportion of Kentucky females reported disclosing their intent of suicide, having family relationship problems, or financial problems as compared to those in Ohio and Virginia. Across all three states, of females who were reported to have had intimate partner problems, a greater proportion died by firearm suicide, compared to other methods (KY Firearm = 18.06%, Other = 13.59%; OH Firearm = 23.68% and Other = 20.9%; VA Firearm = 36.11% and Other = 28.98%). All three states reported a relatively high and equal proportion of females with substance abuse problems (KY = 18.04%; OH = 18.7%; VA = 19.1%), and these individuals died by suicide more often using other methods [KY Firearm = 11.11% and Other = 24.89%; OH Firearm = 12.92% and Other = 21.25%; VA Firearm = 12% and Other = 22.85%). A significantly smaller

proportion of Kentucky females had a diagnosed mental illness (KY = 36.3%), compared to the other states (OH = 63.5%; VA = 71.4%). Similarly, a small proportion of Kentucky females were receiving current treatment for their mental illness (KY = 24.6%), compared to the other states (OH = 45%; VA = 60.9%). Additionally, a low proportion of Kentucky females were reported to have had a history of suicidal ideation (KY = 0.05%) and previously suicide attempts (KY = 15.8%), as compared to other states (OH = 33.5%; VA = 29.6%) and (OH = 29.9%; VA = 34.4%), respectively.

Univariate Logistic Regression

Univariate logistic regression was used to model the data (Table 7). Variables found to be statistically significant and increase to odds of firearm suicide include: all Ohio age groups (18-34 years $P = 0.006$; 35-49 years $P = 0.01$; 50-64 years $P = 0.003$; ≥ 65 years $P = 0.0005$), and individuals in Virginia who were ≥ 65 years of age ($P = 0.02$). Black females in Kentucky ($P = 0.009$), along with Black females ($P = 0.003$) and Pacific Islanders ($P < .0001$) in Virginia. Location of Residence among those living in rural counties within all three states ($P < .0001$) and Virginia females living in sub-urban counties ($P < .0001$). Further, when looking at location of residence, that results suggest that the odds of dying by firearm suicide was lowest among those living in urban counties. Finally, those who were married within all three states (KY: $P = 0.005$; OH: $P < .0001$; VA: $P < .0001$), and single (KY: $P = 0.006$; OH: $P < .0001$; VA: $P < .0001$).

Chi-Square Test of Independence

Chi-square test of independence was performed on the personal circumstance, mental health, and suicide-related variables within the dataset against our outcome of interest (Table 8). In Kentucky, those with an intimate partner problem (OR = 1.40; $P = 0.03$) were found to be significantly and associated with an increase odds firearm suicide, while criminal legal problem

(OR = 0.40, P = 0.01), substance abuse (OR = 0.37, P <.0001), a history of suicide attempts (OR = 0.47, P < .0001), or who left a suicide note (OR = 0.70; P = 0.01) were found to be significantly associated with a decrease in odds of firearm suicide. In Ohio, those with a job problem (OR = 1.63, P = 0.02) or a physical health problem (OR = 1.74, P = 0.0004) were found to be significantly associated with firearm suicide, while those with substance abuse (OR = 0.55, P <.0001), currently being treatment for a mental illness (OR = 0.51, P <.0001), a history of mental illness treatment (0.51, <.0001), those with a mental health diagnosis (OR = 0.55, P <.0001), and with suicide attempt history (OR = 0.56, P <.0001) were found to be significantly associated with a decrease in odds of firearm suicide. In Virginia, those with an intimate partner problems (OR = 1.40, P <.0001), a non-criminal legal problem (1.61, P = 0.04), or who left a suicide note (OR = 1.27; P = 0.003) were found to be significantly associated with increase in odds of firearm suicide, while family relationship problem (OR = 0.76, P = 0.03), substance abuse (OR = 0.46, P <.0001), current treatment for mental illness (OR = 0.43, P <.0001), history of mental illness treatment (OR = 0.39, P <.0001), mental health diagnosis (OR = 0.42, P <.0001), and a history of suicide attempts (OR = 0.44, P <.0001) were significantly associated with a decrease in odds of firearm suicide.

Multivariate Logistic Regression

In Kentucky (Table 9) the following variables were found to be statistically significantly associated with an increase in odds of firearm suicide when controlling for all other variables: living in a rural county (OR = 2.05, P <.0001), depressed mood (OR = 1.45, P = 0.01), and intimate partner problem (OR = 1.48, P = 0.02), whereas these variables were found to be statistically significantly and associated with a decrease in odds of firearm suicide when controlling for all other variables: criminal legal problem (OR = 0.41, P = 0.03), physical health

problem (OR = 0.67, P = 0.02), substance abuse (OR = 0.38, P < .0001), or suicide attempt history (OR = 0.50, P = 0.0004). In Ohio (Table 10) the following variables were found to be statistically significantly associated with an increase in odds of firearm suicide when controlling for all other variables: living in a rural county (OR = 1.77, P = 0.001), job problem (OR = 1.71, P = 0.02), and physical health problem (OR = 1.70, P = 0.001), whereas these variables were found to be statistically significantly and associated with a decrease in odds of firearm suicide when controlling for all other variables: substance abuse (OR = 0.59, P = 0.0008), suicide attempt history (OR = 0.69, P = 0.005). In Virginia (Table 11), the following variables were found to be statistically significantly associated with an increase in odds of firearm suicide when controlling for all other variables: age group of 50-64 years of age (OR = 1.87, P = 0.02) or ≥ 65 years of age (OR = 1.79, 95% CI 1.02, 3.15), living in a sub-urban county (OR = 1.68, P = 0.001), depressed mood (OR = 1.25, P = 0.001), intimate partner problems (OR = 1.45, P < .0001), and non-criminal legal problem (OR = 1.65, P = 0.04), whereas these variables were found to be statistically significantly and associated with a decrease in odds of firearm suicide when controlling for all other variables: Pacific Islander (OR = 0.18, P = 0.02), substance abuse (OR = 0.52, P < .0001), current treatment for mental illness (OR = 0.60, P = 0.002), and history of suicide attempts (OR = 0.59, P < .0001).

Discussion

Demographic and Personal Circumstance: Public Health Interventions

Out of 1,303 Kentucky females who died by suicide an overwhelmingly high proportion were white (1,233, 94.6%), non-Hispanic (1,260, 96.7%), between 18-64 years of age (1,105, 84.8%), and had a high school level of education (811, 62.2%). While suicide awareness and community prevention efforts should be enacted across all communities and demographics, specific suicide prevention should continue to be targeted in these groups.

Other findings provided more details about Kentucky females who died by firearm suicide. Significant variables included: those living in rural county (OR = 2.05), depressed mood (OR = 1.45), and intimate partner problems (OR = 1.48). These factors provide insight into who, where, and why females in Kentucky are choosing to die by firearm suicide as opposed to other methods. With this information, focused content intervention programs can be targeted to those who need it most. By continuing to promote suicide prevention in Kentucky to females who reside in rural counties with content specific to those who have depressed mood or intimate partner problems/violence could be a first step in beginning to reduce firearm suicides.

The Lack of Mental Health Care

Our results suggest that mental health care is associated with female firearm suicide in Kentucky. As noted previously, a low proportion of Kentucky females who died by suicide had a mental health diagnosis when compared to the other states. There is also a disproportionate number of Kentucky females who had a mental health diagnosis and who were currently being treated for a mental illness or who had a history of being treated for a mental illness. While this incongruity also exists in Ohio and Virginia, it is much larger in Kentucky. Of Kentucky females found to have had a mental health diagnosis they also had increased odds (OR = 1.02) of firearm suicide

death. It could be theorized that even when females receive a mental health diagnosis, they are not receiving the proper treatment. On the other hand, Kentucky females who were currently being treated for mental illness had lower odds (OR = 0.59) of dying by firearm suicide, although they were found to be statistically insignificant. However, this might suggest that treatment does help those at risk. Results from Virginia's final model indicate that receiving a mental health diagnosis or seeking proper treatment can reduce the rate of firearm suicides. In their model, females who had a mental health diagnosis or who were receiving current treatment had a statistically significant decrease in odds of dying by firearm suicide (OR = 0.86 and OR = 0.60, respectively). Promoting mental healthcare in communities is a key first step in mobilizing individuals to seek appropriate medical treatment in an effort to reduce firearm suicide incidence.

Barriers and Recommendations for Mental Health Care

As noted previously, there is a disproportionate number of people with a mental health diagnosis and the number of those who were currently on or had a history of mental illness treatment, particularly in Kentucky. This could be due to a myriad of reasons, including complicated referral processing, barriers to working with the homeless or those who are incarcerated, and the widespread unmet need for mental health services across the U.S. [28] However, despite the clear need for suicide-screening and treatment for at-risk patients, there is a shortage in mental health care providers. It is thought that over three-quarters, nearly 77% of U.S. counties have a shortage of mental health providers. [28] In addition to a lack of providers, many do not administer the recommended counselling services in order to prevent suicide deaths within at-risk patients. [13] For example, it has been recommended that providers administer a form of counseling known as means reduction. Means reduction counseling includes both the at-risk patient and their family/friends and focuses on the voluntary elimination of items that an

individual can use in a suicide attempt. Eradication of suicide means can be an effective tool because it is estimated that 82% of attempts are impulsive with time from initial thoughts of suicide to the attempt itself lasting between 5 minutes to 1 hour. [13] Unfortunately, it is estimated that only 4-14% of emergency departments delivery means reduction counseling and 22% of psychologists after a patient has attempted a suicide. [13]

Despite the low use of means reduction in the U.S., other countries have implemented this type of counseling to address their high incidence of suicide. Studies evaluating the effectiveness of its implementation have shown that means reduction was effective in lowering the number of suicide deaths by 30%-50%. [29] This evidence suggests that an emphasis on means reduction in the U.S. could yield similar results. To that end, another strength in utilizing means reduction is that it does not necessarily require a mental health specialist such as a psychiatrist or psychologist. This type of counseling can be delivered through other medical providers such as emergency department or primary care clinicians, public health educators, or even through online resources. It is thought that utilization of alternative media to disseminate this type of information can effectively communicate means reduction's protective guidance. [30, 31] By delivering means reduction counseling through these alternative channels, we can address the barriers which may currently exist and provide mental health care to more people.

State Firearm Law and Policy

It is important to provide a basic understanding of the gun laws and policies established within each state of interest. It is estimated that one-third, or 29.1% of U.S. residents are gun owners with 42.4% of Kentucky residents, 19.6% of Ohio residents, and 29.3% of Virginia residents being gun owners. [32] Comparing gun laws and policy, there are major differences state-to-state. Kentucky statues allows for concealed carrying of certain firearms subject to restrictions

and regulations, which include: requiring licensed firearm dealers to conduct background checks, prohibiting providing a firearm to a minor intentionally or recklessly, forfeiture of a firearm if an individual has been convicted of a felony, and the ability to suspend an individual's ability to conceal carry if they have been convicted of domestic violence. [33] Kentucky statutes do not regulate the sale of ammunition, require private sellers of firearms to conduct background checks, require firearm dealers to obtain a state license or conduct background checks on their purchasers, have an established waiting period before purchase, or impose design safety standards on handguns. [33] Ohio's gun laws and policies are nearly identical to Kentucky's with the main difference being that they have more regulation on their concealed carry policy with regard to firearm safety, handling, and training. [34] However, significant differences exist within Virginia's gun laws and regulations. Major differences include regulation of assault weapons, extensive regulations of concealed carry licensing, a more in-depth system to conduct background checks, preventing children from accessing firearms with regulations to place responsibility on adults, and establishment of design safety standards for handguns. [35] These differences might suggest that Kentucky females have easier access to firearms as compared to females in the other states. It is possible that the availability of these weapons could be a contributing factor to the high rates of firearm suicide observed in Kentucky females. To combat these suicide rates, advocating for more comprehensive gun laws and policies can be an important step. More specifically, Kentucky might want to amend or add new laws to reflect those of Virginia. By adding more regulations and developing policy which promotes safer weapon design and keeping guns out of the hands of individuals who should not have them might help reduce the number of weapons available, therefore reducing the rate of firearm suicides.

Recommendations for Future Research

We recommend further research be conducted into Kentucky females dealing with substance abuse, physical health problems, or criminal legal problems. These three variables were found to be statistically significantly associated with a decreased odds of firearm suicide, although these relationships are unclear. As noted previously, suicide trends in Kentucky were decreasing between 2006-2010 before a large spike occurring between 2010-2011. Research into what might have caused the decrease or the spike might provide insight into suicide in Kentucky and the spike in female firearm suicide. Additional research is also recommended into gun ownership, law and policy as it contributes to firearm suicide. While the problem of firearm suicide is of particular concern among females in Kentucky aged 18-34, non-firearm suicide is also a continuing problem. Therefore, continued efforts to better understand suicide of all methods can lead to increased suicide awareness and better, more effective intervention and prevention strategies to ultimately reduce the rate of all suicides.

Limitations

There are some limitations in regard to the NVDRS circumstance variables. Death investigators typically collect circumstantial information from family, friends, or other individuals close to the victim. This makes the information subject to recall bias; the people being interviewed might give inaccurate answers, not know the correct answers, or misunderstand the questions.

Additionally, there are differences in death scene investigations and data collection within each state. In studies like ours, which include multiple states, it is important to understand that these differences exist. With regard to Kentucky, coroners are the chief investigators. As elected county officials, Kentucky's 120 coroners are not required to have a background in health care or public health, which can impact the completeness and quality of the data, impacting the

circumstance variables most notably. While the inclusion of these circumstance variables is a novel element to the NVDRS, an understanding of how each state collects this information and by whom is important to know when analyzing results.

There is a limited amount of data available on firearms within the dataset used for this study.

Therefore, the addition of more comprehensive firearm-specific variables or improving the collection on firearm variables which already exist would be beneficial for studying the correlation between firearm ownership characteristics and subsequent firearm suicide.

Conclusions

As a leading cause of mortality, suicide continues to be a burden on the U.S. health care system and presents a challenge for prevention. Historically, over 50% of females who have died by suicide in Kentucky used a firearm. Additionally, a significant increase in the rate of firearm suicide was observed in beginning in 2011. Based on the results of this study, we have a better understanding about why this is happening. Findings from this study show that the most significant contributing factor to female firearm suicide is the lack of appropriate mental health care characterized by low rates of mental health diagnoses among those who have died by suicide and a large discrepancy between those with a diagnosis and those who received any type of treatment. The results of this study show that Kentucky has a large degree of unmet need within the population of interest. Continuing to promote and increasing availability of mental health resources, it may be possible to connect more people with the type of care they need. Further, the appropriate type of therapy is also important to understand. Strategies like means reduction counseling can be an effective tool that various medical providers, public health educators, or even web-based programs can be used to help those in need. Finally, it is important to look at the prevalence of firearm ownership within individual states along with gun laws and policies. Ohio and Virginia have more extensive and comprehensive gun laws and regulations. It is reasonable to assume that the minimal regulations in Kentucky could contribute to the high rate of female firearm suicides. Continuing to advocate for comprehensive gun laws and policies can be another factor in minimizing the number of firearm suicides observed among Kentucky females.

Disclosures

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Biographical Sketch

I, Charles Rhea, was born September 30th, 1992 in Louisville, Kentucky. I completed my undergraduate studies at Western Kentucky University in May of 2015 where I earned an Honors College degree and a Bachelor's of Science in Public Health concentrating in Environmental Health Science. I began my graduate studies at the University of Kentucky in August of 2016 pursuing a Master's of Public Health concentrating in Epidemiology and will be graduating in May of 2018.

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Figures and Tables

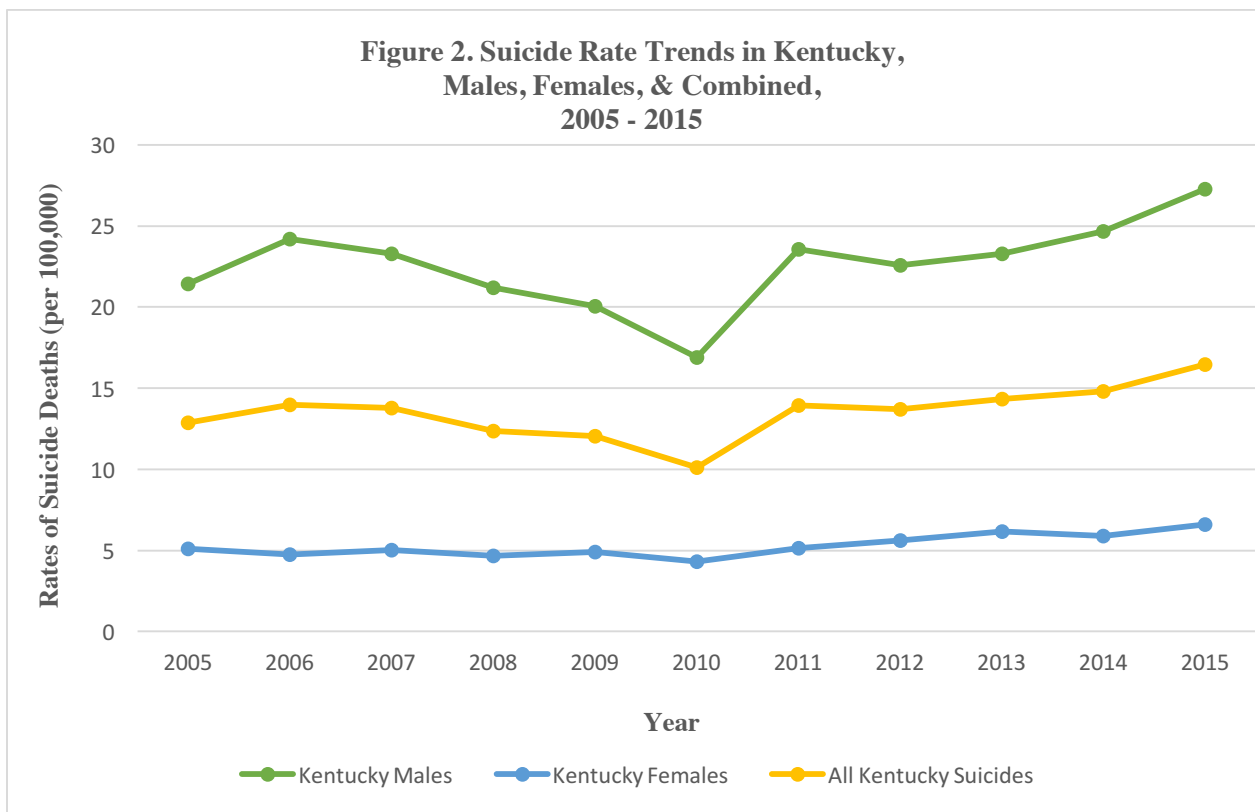
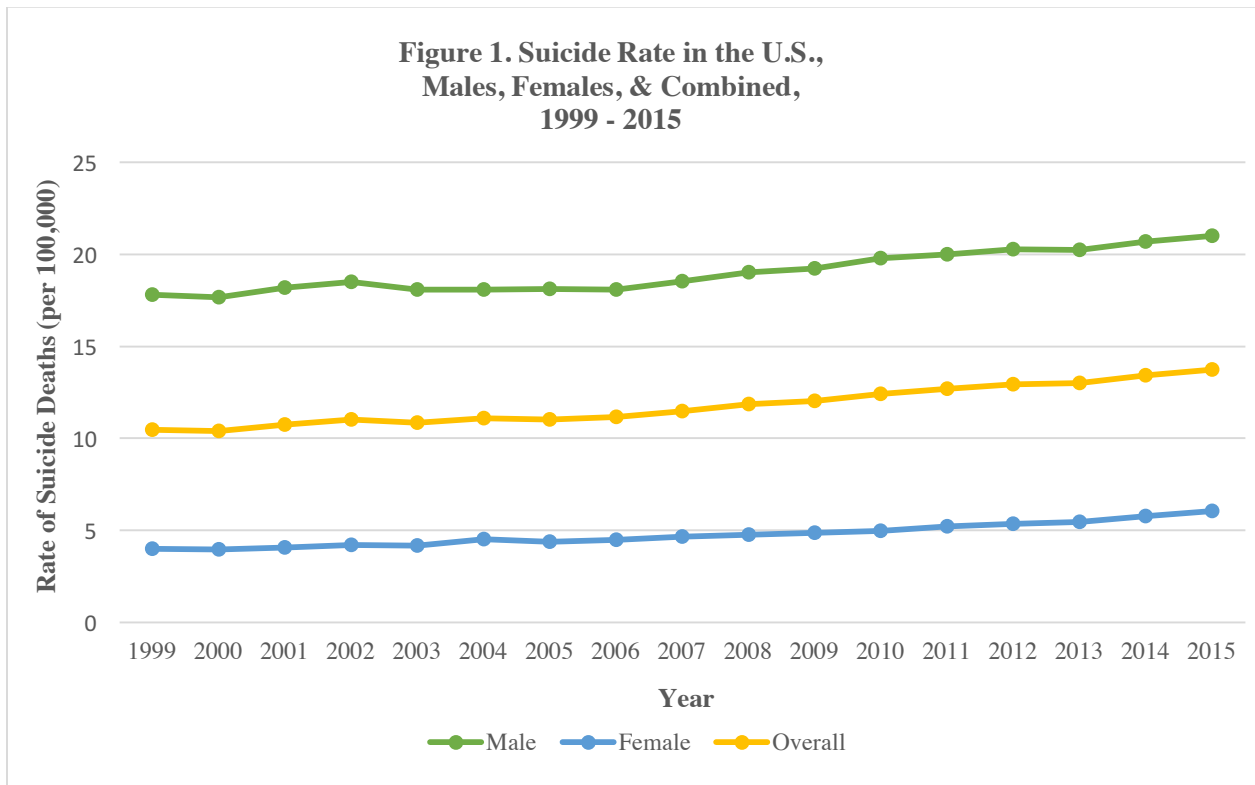


Figure 3. Comparison of Female Firearm and Poisoning Suicide Rates, Kentucky, 2005 - 2015

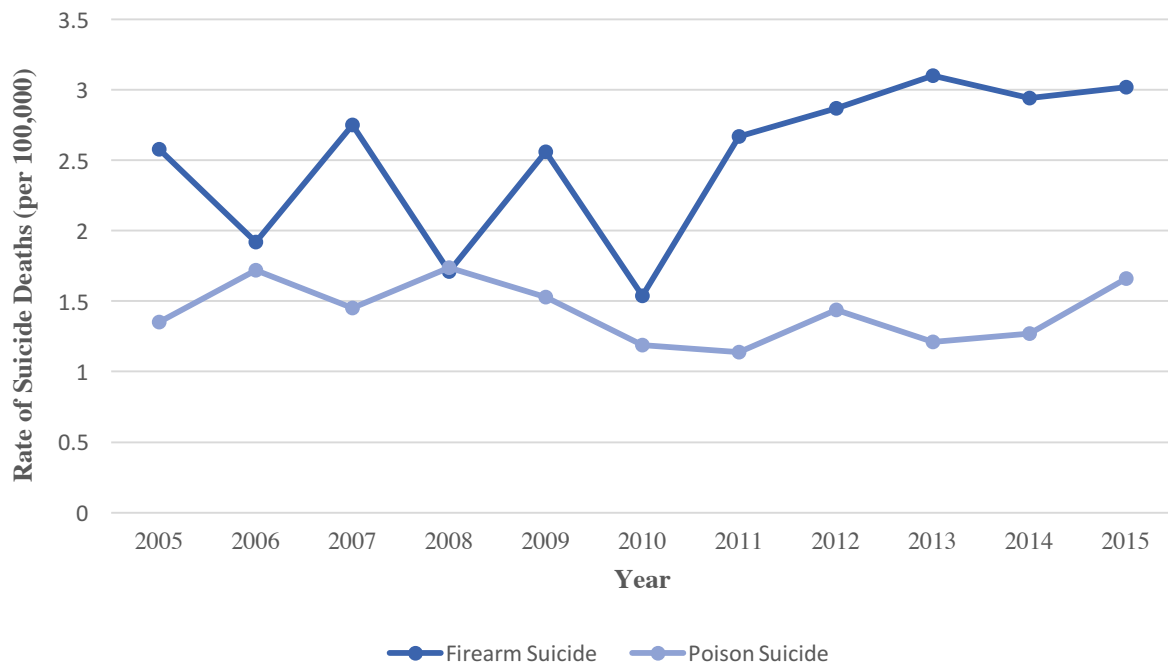


Figure 4. Comparison of Female Firearm and Poisoning Suicides, Kentucky (2005-2015), Virginia (2003-2015), and Ohio (2011-2015)

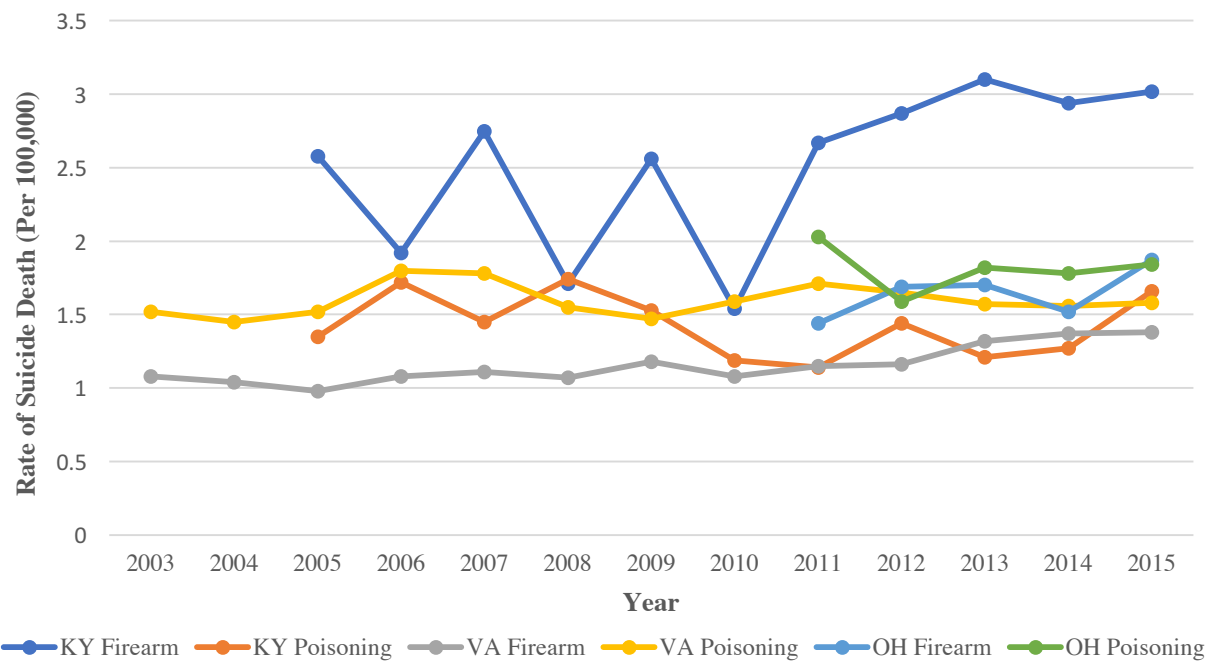


Figure 5. Directed Acyclic Graph used to analyze the variable interaction and assess for confounding used in this study.

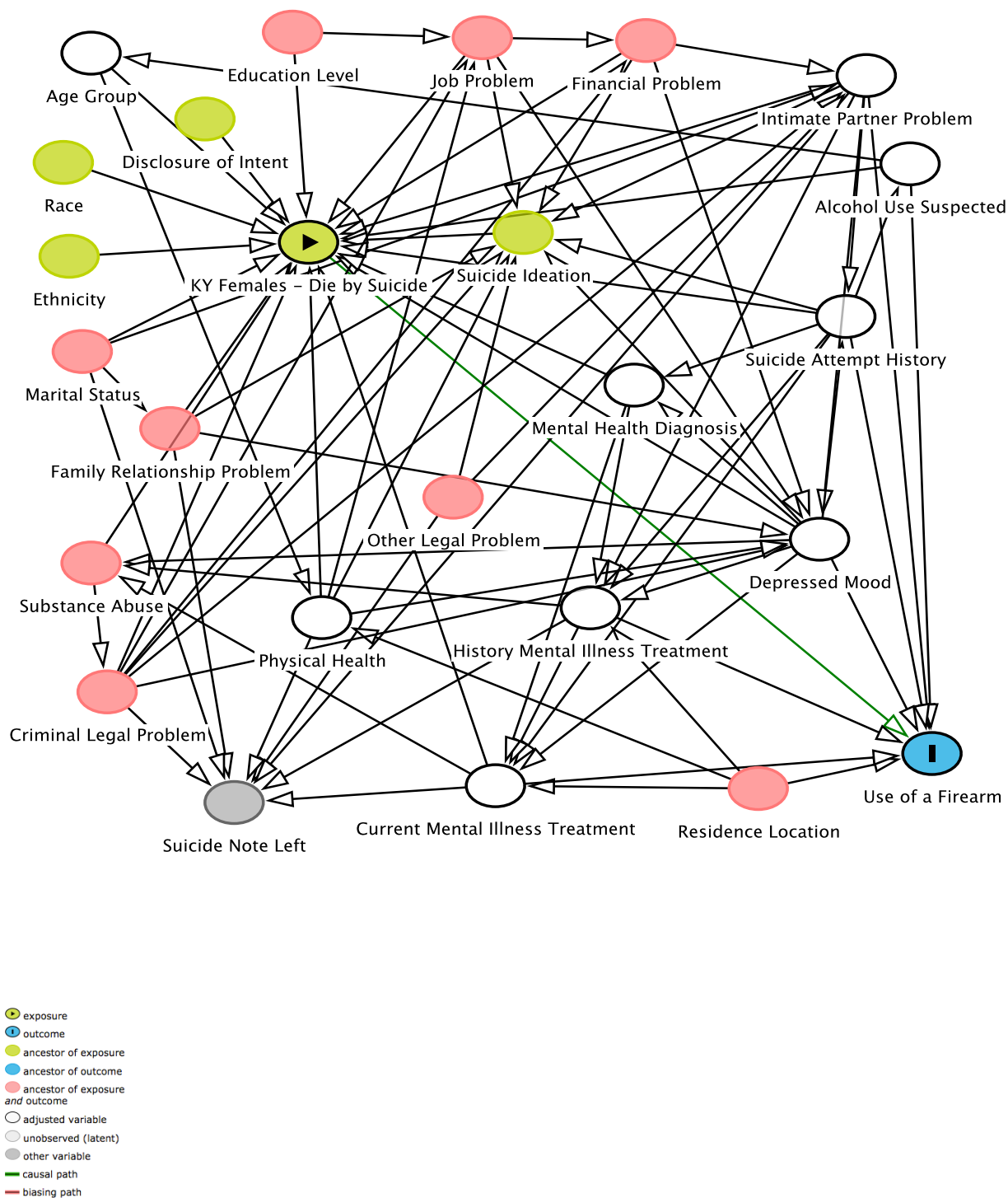


Table 1. Comparing suicide methods among males and females in the U.S., National Violent Death Reporting System – Restricted Access Dataset.

Male		Females	
	n (%)		n (%)
Firearm	63,243 (56.79)	Poisoning	11,671 (36.86)
Hanging	28,585 (25.67)	Firearm	9,977 (31.51)
Poisoning	12,153 (10.91)	Hanging	7,416 (23.43)
Other	7,379 (6.63)	Other	2,603 (8.22)
Total	111,307 (100)	Total	31,667 (100)

Table 2. Comparing suicide methods among females in Kentucky and U.S., National Violent Death Reporting System – Restricted Access Dataset.

Kentucky Females		U.S. Females	
	n (%)		n (%)
Firearm	648 (50.31)	Poisoning	11,671 (36.86)
Poisoning	372 (28.88)	Firearm	9,977 (31.51)
Hanging	194 (15.06)	Hanging	7,416 (23.43)
Other	74 (5.68)	Other	2,603 (8.22)
Total	1,303 (100)	Total	31,667 (100)

Table 3. Comparing suicide methods among females in Kentucky, Ohio, and Virginia, National Violent Death Reporting System – Restricted Access Dataset.

Kentucky		Ohio		Virginia	
	n (%)		n (%)		n (%)
Firearm	648 (50.31)	Poisoning	562 (34.06)	Poisoning	1,063 (37.39)
Poisoning	372 (28.88)	Firearm	511 (30.97)	Firearm	983 (34.58)
Hanging	194 (15.06)	Hanging	459 (27.82)	Hanging	560 (19.70)
Other	74 (5.68)	Other	188 (7.15)	Other	237 (8.34)
Total	1,303 (100)	Total	1,650 (100)	Total	2,843 (100)

Table 4. National-level demographic information of those who died by suicide, stratified by gender, National Violent Death Reporting System – Restricted Access Dataset.

	Males n (%)	Females n (%)	Unknown n (%)	Total n (%)
Age Group				
≤ 17 years of age	3,157 (2.82)	1,173 (3.68)	--	4,330 (3.01)
18 – 34 years of age	30,529 (27.24)	7,007 (22.00)	1 (2.08)	37,537 (26.07)
35 – 49 years of age	31,085 (27.73)	10,335 (32.45)	1 (2.08)	41,421 (28.77)
50 – 64 years of age	28,702 (25.61)	9,613 (30.18)	1 (2.08)	38,316 (26.61)
≥ 65 years of age	18,613 (16.61)	3,719 (11.68)	45 (93.75)	22,377 (15.54)
<i>Missing = 12</i>				
Race				
White	98,220 (87.99)	28,105 (88.66)	--	126,326 (88.14)
Black	7,607 (6.81)	1,642 (5.18)	--	9,249 (6.45)
Asian	1,442 (1.29)	429 (1.35)	--	1,871 (1.31)
Pacific Islander	1,383 (1.24)	689 (2.17)	--	2,072 (1.45)
Native American	816 (0.73)	172 (0.54)	--	988 (0.69)
Unspecified	2,154 (1.93)	664 (2.09)	--	2,818 (1.97)
<i>Missing = 669</i>				
Ethnicity				
Non-Hispanic/Latino	105,268 (94.24)	30,203 (95.16)	2 (33.33)	135,473 (94.44)
Hispanic/Latino	5,455 (4.88)	1,265 (3.99)	1 (16.67)	6,721 (4.69)
Unknown	978 (0.88)	271 (0.85)	3 (50.00)	1,252 (0.87)
<i>Missing = 547</i>				
Education Level				
8 th Grade/Less	3,603 (5.25)	713 (3.66)	42 (100)	4,358 (4.94)
High School*	39,745 (57.86)	9,541 (49.01)	--	49,286 (55.88)
College**	21,771 (24.68)	7,937 (40.77)	--	29,708 (33.68)
Advanced College	3,573 (5.20)	1,275 (6.55)	--	4,848 (5.50)
<i>Missing = 55,793</i>				
Marital Status				
Married****	39,363 (35.18)	10,978 (34.54)	1 (2.13)	50,342 (35.02)
Divorced	25,181 (22.50)	9,154 (28.80)	1 (2.13)	34,336 (23.89)
Widowed	6,061 (5.42)	2,636 (8.29)	1 (2.13)	8,698 (6.05)
Single	39,991 (35.66)	8,677 (27.30)	--	48,668 (33.80)
Unknown	1,399 (1.25)	343 (1.08)	44 (93.62)	1,786 (1.24)
<i>Missing = 253</i>				
Total	112,086 (100)	31,847 (100)	48 (100)	143,993 (100)

* = Includes those with some high school education, high school graduates, and those with a GED

** = Includes those with some college education, and those with an Associate's and Bachelor's degree

*** = Includes those with a Master's or Doctorate degree

**** = Includes individuals married, in a civil union, and in a domestic partnership.

Table 5. Demographic information for females who have died by suicide, stratified by state and suicide method, National Violent Death Reporting System – Restricted Access Dataset.

	Kentucky n (%)		Ohio n (%)		Virginia n (%)	
	Firearm	Other	Firearm	Other	Firearm	Other
Age Group						
≤ 17 years of age	20 (3.09)	18 (2.75)	13 (2.54)	69 (6.06)	23 (2.34)	63 (3.39)
18 – 34 years of age	128 (19.75)	159 (24.27)	111 (21.72)	241 (21.16)	191 (19.43)	413 (22.20)
35 – 49 years of age	207 (31.94)	222 (33.89)	152 (29.75)	375 (32.92)	322 (32.76)	656 (35.27)
50 – 64 years of age	192 (29.63)	197 (30.08)	160 (31.31)	331 (29.06)	311 (31.64)	530 (28.49)
≥ 65 years of age	101 (15.59)	59 (9.01)	75 (14.68)	123 (10.80)	136 (13.84)	198 (10.65)
Race						
White	628 (97.06)	605 (92.65)	476 (93.33)	1,043 (91.57)	904 (91.96)	1,583 (85.11)
Black	13 (2.01)	30 (4.59)	28 (5.49)	67 (5.88)	59 (6.00)	164 (8.82)
Asian	--	--	--	--	1 (0.10)	3 (0.16)
Pacific Islander	1 (0.15)	5 (0.77)	2 (0.39)	17 (1.49)	14 (1.42)	97 (5.22)
Native American	3 (0.46)	7 (1.07)	1 (0.20)	3 (0.26)	1 (0.10)	4 (0.22)
Unspecified	2 (0.31)	6 (0.92)	3 (0.59)	9 (0.79)	4 (0.41)	9 (0.48)
Missing	3		1		--	
Ethnicity						
Non-Hispanic/Latino	627 (97.06)	633 (97.09)	501 (99.01)	1,115 (98.41)	969 (98.68)	1,816 (97.69)
Hispanic/Latino	8 (1.24)	11 (1.69)	24 (0.79)	16 (1.41)	12 (1.22)	41 (2.21)
Unknown	11 (1.70)	8 (1.23)	1 (0.20)	2 (0.18)	1 (0.10)	2 (0.11)
Missing	5		11		2	
Location of Residence						
Urban	233 (35.96)	324 (49.47)	221 (43.25)	598 (52.50)	346 (35.20)	847 (45.54)
Sub-Urban	79 (12.19)	84 (12.82)	167 (32.68)	362 (31.78)	158 (16.07)	202 (10.86)
Rural	336 (51.85)	247 (37.71)	123 (24.07)	179 (15.72)	479 (48.73)	811 (43.60)
Unknown	--		42		--	
Education Level						
8 th Grade/Less	43 (6.79)	39 (6.10)	10 (1.98)	36 (3.19)	3 (2.80)	12 (4.69)
High School*	418 (66.03)	393 (61.50)	287 (56.83)	590 (52.26)	55 (51.40)	115 (44.92)
College**	148 (23.38)	177 (27.70)	186 (36.83)	434 (38.44)	40 (11.02)	96 (37.50)
Advanced College***	24 (3.79)	30 (4.69)	22 (4.36)	69 (6.11)	9 (8.41)	33 (12.89)
Missing	31		16		2,480	
Marital Status						
Married ****	259 (40.03)	209 (31.91)	217 (42.47)	334 (29.35)	408 (41.51)	533 (28.66)
Single	131 (20.25)	160 (24.43)	133 (26.03)	362 (31.81)	186 (18.92)	512 (57.53)
Divorced	190 (29.37)	225 (34.35)	120 (23.48)	337 (29.61)	302 (30.72)	643 (34.57)
Widowed	62 (9.58)	56 (8.55)	38 (7.44)	100 (8.79)	85 (8.65)	165 (8.87)
Unknown	5 (0.77)	5 (0.76)	3 (0.59)	5 (0.44)	2 (0.20)	7 (0.38)
Missing	1		1		--	
Total	648 (100)	655 (100)	511 (100)	1,139 (100)	983 (100)	1,860 (100)

* = Includes those with some high school education, high school graduates, and those with a GED

** = Includes those with some college education, and those with an Associate's and Bachelor's degree

*** = Includes those with a Master's or Doctorate degree

**** = Includes individuals married, in a civil union, and in a domestic partnership.

Missing and Unknown variables apply to the entire state, and are not differentiated between males and females.

Table 6. Personal circumstance, mental health, suicide-related variables among females who died by suicide, stratified by state and suicide method, National Violent Death Reporting System - Restricted Access Dataset.

	Kentucky n (%)		Ohio n (%)		Virginia n (%)	
	Firearm	Other	Firearm	Other	Firearm	Other
Alcohol use Suspected						
Yes	87 (14.72)	105 (18.17)	89 (18.50)	198 (18.22)	188 (19.14)	407 (21.89)
No	321 (54.31)	307 (53.11)	367 (76.30)	819 (75.34)	785 (79.94)	1,439 (77.41)
Not Applicable	5 (0.85)	9 (1.56)	--	--	--	1 (0.05)
Unknown	178 (30.12)	157 (27.16)	25 (5.20)	70 (6.44)	9 (0.92)	12 (0.65)
Missing	134		82		2	
Depressed Mood						
Yes	249 (38.43)	235 (35.88)	136 (26.61)	272 (23.88)	420 (42.73)	729 (39.19)
No	399 (61.57)	420 (64.12)	375 (73.39)	867 (76.12)	563 (57.27)	1,131 (60.81)
Disclosed Intent						
Yes	72 (11.11)	80 (12.21)	122 (23.87)	256 (22.48)	228 (23.19)	407 (21.88)
No	576 (88.89)	575 (87.79)	389 (76.13)	883 (77.52)	755 (76.81)	1,453 (78.12)
Family Relationship Problem						
Yes	17 (2.62)	23 (3.51)	46 (9.00)	101 (8.87)	102 (10.38)	246 (13.23)
No	631 (97.38)	632 (96.49)	465 (91.00)	1,038 (91.13)	881 (89.62)	1,614 (86.77)
Financial Problem						
Yes	34 (5.25)	35 (5.34)	40 (7.83)	68 (5.97)	117 (11.90)	219 (11.77)
No	614 (94.75)	620 (94.66)	471 (92.17)	1,071 (94.03)	866 (88.10)	1,641 (88.23)
Intimate Partner Problem						
Yes	117 (18.06)	89 (13.59)	121 (23.68)	238 (20.90)	355 (36.11)	539 (28.98)
No	531 (81.94)	566 (86.41)	390 (76.32)	901 (79.10)	628 (63.89)	1,321 (71.02)
Job Problem						
Yes	31 (4.78)	21 (3.05)	41 (8.02)	58 (5.09)	82 (8.34)	174 (9.35)
No	617 (95.22)	635 (96.95)	470 (91.98)	1,081 (94.91)	901 (91.66)	1,686 (90.65)
Legal Problem, Criminal						
Yes	10 (1.54)	25 (3.82)	11 (2.15)	35 (3.07)	58 (5.90)	95 (5.11)
No	638 (98.46)	630 (96.18)	500 (97.85)	1,104 (96.93)	925 (94.10)	1,765 (94.89)
Legal Problem, Other						
Yes	8 (1.23)	7 (1.07)	16 (3.13)	26 (2.28)	36 (3.66)	43 (2.31)
No	640 (98.77)	648 (98.93)	495 (96.87)	1,113 (97.72)	947 (96.34)	1,817 (97.69)
Physical Health Problem						
Yes	97 (14.97)	117 (17.86)	82 (16.05)	113 (9.92)	180 (18.31)	347 (18.66)
No	551 (85.03)	538 (82.14)	429 (83.95)	1,026 (90.08)	803 (81.69)	1,513 (81.34)
Substance Abuse						
Yes	72 (11.11)	163 (24.89)	66 (12.92)	242 (21.25)	118 (12.00)	425 (22.85)
No	576 (88.89)	492 (75.11)	445 (87.08)	897 (78.75)	865 (88.00)	1,435 (77.15)
Current Mental Illness Treatment						
Yes	144 (22.22)	176 (26.87)	173 (33.86)	569 (49.96)	467 (47.51)	1,265 (68.01)
No	504 (77.78)	479 (73.13)	338 (66.14)	570 (50.04)	516 (52.49)	595 (31.99)
History of Mental Illness Treatment						
Yes	157 (24.23)	179 (27.33)	201 (39.33)	636 (55.84)	540 (54.93)	1,405 (75.54)
No	491 (75.77)	476 (72.67)	310 (60.67)	503 (44.16)	443 (45.07)	455 (24.46)
Mental Health Diagnosis						
Yes	222 (34.26)	251 (38.32)	275 (53.82)	772 (67.78)	617 (62.77)	1,489 (80.05)
No	426 (65.74)	404 (61.68)	236 (46.18)	367 (32.22)	366 (37.23)	371 (19.95)
Suicide Attempt History						
Yes	71 (10.96)	135 (20.61)	112 (21.92)	381 (33.45)	233 (23.70)	774 (41.61)
No	577 (89.04)	520 (79.39)	399 (78.08)	758 (66.55)	750 (76.30)	1,086 (58.39)
Suicide Note Left						
Yes	105 (16.20)	141 (21.53)	188 (36.79)	463 (40.65)	428 (43.54)	704 (37.85)
No	543 (83.80)	514 (78.47)	323 (63.21)	676 (59.35)	555 (56.46)	1,156 (62.15)
Suicide Ideation						
Yes	30 (4.58)	30 (4.58)	169 (33.07)	383 (33.63)	274 (27.87)	568 (30.54)
No	618 (95.37)	625 (95.42)	342 (66.93)	756 (66.37)	709 (72.13)	1,292 (69.46)
Total	648 (100)	655 (100)	511 (100)	1,139 (100)	983 (100)	1,860 (100)

Table 7. Univariate logistic regression results of demographic variables of females who died by suicide, stratified by state.
National Violent Death Reporting System - Restricted Access Dataset.

	Kentucky			Ohio			Virginia		
	OR _{Adj}	95% CI	P	OR _{Adj}	95% CI	P	OR _{Adj}	95% CI	P
Age Group									
≤ 17 years of age	<i>Reference</i>			<i>Reference</i>			<i>Reference</i>		
18 – 34 years of age	0.73	(0.37, 1.43)	0.35	2.45	(1.30, 4.61)	0.006	1.27	(0.76, 2.10)	0.36
35 – 49 years of age	0.84	(0.43, 1.63)	0.61	2.15	(1.16, 4.01)	0.01	1.34	(0.82, 2.21)	0.24
50 – 64 years of age	0.88	(0.45, 1.71)	0.70	2.58	(1.38, 4.78)	0.003	1.61	(0.98, 2.64)	0.06
≥ 65 years of age	1.54	(0.76, 3.14)	0.23	3.24	(1.68, 6.25)	0.0005	1.88	(1.11, 3.18)	0.02
Race									
White	<i>Reference</i>			<i>Reference</i>			<i>Reference</i>		
Black/African Amer.	0.42	(0.22, 0.81)	0.009	0.92	(0.58, 1.44)	0.79	0.63	(0.46, 0.86)	0.003
Asian	--	--	--	--	--	--	0.58	(0.06, 5.62)	0.64
Pacific Islander	0.19	(0.02, 1.65)	0.13	0.26	(0.06, 1.12)	0.07	0.25	(0.14, 0.45)	<.0001
Native American	0.41	(0.12, 1.60)	0.20	0.73	(0.08, 7.04)	0.79	0.44	(0.05, 3.92)	0.46
Unspecified	0.32	(0.07, 1.60)	0.17	0.73	(0.20, 2.71)	0.64	0.78	(0.24, 2.53)	0.67
Ethnicity									
Non-Hispanic/Latino	<i>Reference</i>			<i>Reference</i>			<i>Reference</i>		
Hispanic/Latino	0.73	(0.29, 1.84)	0.51	0.56	(0.19, 1.67)	0.30	0.55	(0.29, 1.05)	0.07
Unknown	1.39	(0.55, 3.47)	0.48	1.11	(0.10, 12.3)	0.93	0.94	(0.09, 10.3)	0.96
Location of Residence									
Urban	<i>Reference</i>			<i>Reference</i>			<i>Reference</i>		
Sub-Urban	1.31	(0.92, 1.86)	0.133	1.25	(0.98, 1.59)	0.07	1.92	(1.50, 2.44)	<.0001
Rural	1.89	(1.40, 2.18)	<.0001	1.45	(1.18, 1.79)	<.0001	1.45	(1.22, 1.71)	<.0001
Education Level									
8 th Grade/Less	<i>Reference</i>			<i>Reference</i>			<i>Reference</i>		
High School	0.97	(0.61, 1.52)	0.88	0.56	(0.86, 3.58)	0.12	1.91	(0.52, 7.06)	0.33
College	0.76	(0.47, 1.23)	0.26	0.43	(0.75, 3.17)	0.24	1.67	(0.45, 6.23)	0.44
Advanced College	0.72	(0.36, 1.45)	0.36	0.14	(0.49, 2.68)	0.75	1.09	(0.25, 4.72)	0.91
Marital Status									
Married/Civil Union	<i>Reference</i>			<i>Reference</i>			<i>Reference</i>		
Divorced	0.68	(0.52, 0.89)	0.005	0.55	(0.42, 0.72)	<.0001	0.61	(0.51, 0.74)	<.0001
Widowed	0.89	(0.60, 1.34)	0.59	0.59	(0.39, 0.88)	0.01	0.67	(0.50, 0.90)	0.008
Single	0.66	(0.49, 0.89)	0.006	0.57	(0.44, 0.74)	<.0001	0.48	(0.38, 0.59)	<.0001
Unknown	0.81	(0.23, 2.83)	0.74	0.92	(0.22, 3.90)	0.91	0.37	(0.08, 1.81)	0.22
Alcohol Use Suspected									
Yes	<i>Reference</i>			<i>Reference</i>			<i>Reference</i>		
No	1.26	(0.91, 1.75)	0.16	1.00	(0.75, 1.32)	0.98	1.18	(0.97, 1.43)	0.28
Not Applicable	0.67	(0.22, 2.08)	0.49	--	--	--	--	--	--

Table 8. Chi-square analysis results of personal circumstance, mental health, and suicide related variables, stratified by state, National Violent Death Reporting System - Restricted Access Dataset.

	Kentucky				Ohio				Virginia			
	OR	X ²	95% CI	P	OR	X ²	95% CI	P	OR	X ²	95% CI	P
Depressed Mood	1.16	0.91	(0.89, 1.40)	0.34	1.16	1.42	(0.91, 1.47)	0.23	1.15	3.33	(0.99, 1.35)	0.07
Disclosed Intent	0.90	0.38	(0.64, 1.26)	0.54	1.08	0.39	(0.85, 1.38)	0.53	1.08	0.64	(0.90, 1.30)	0.42
Family Relation. Problem	0.74	0.86	(0.39, 1.49)	0.35	1.02	0.01	(0.71, 1.47)	0.93	0.76	4.86	(0.59, 0.97)	0.03
Financial Problem	0.98	0.01	(0.60, 1.59)	0.94	1.34	2.00	(0.89, 2.00)	0.16	1.01	0.01	(0.80, 1.29)	0.92
Intimate Partner Problem	1.40	4.89	(1.04, 1.89)	0.03	1.17	1.61	(0.92, 1.51)	0.21	1.40	15.2	(1.18, 1.63)	<.0001
Job Problem	1.60	2.59	(0.90, 2.83)	0.11	1.63	5.37	(1.07, 2.46)	0.02	0.88	0.81	(0.67, 1.16)	0.37
Legal Problem, Criminal	0.40	6.44	(0.19, 0.83)	0.01	0.69	1.10	(0.34, 1.38)	0.29	1.12	0.79	(0.83, 1.63)	0.37
Legal Problem, Other	1.16	0.08	(0.42, 3.21)	0.78	1.38	1.02	(0.74, 2.60)	0.31	1.61	4.34	(1.02, 2.52)	0.04
Physical Health Problem	0.81	1.99	(0.60, 1.09)	0.16	1.74	12.7	(1.28, 2.36)	0.0004	0.98	0.05	(0.80, 1.19)	0.82
Substance Abuse	0.37	41.8	(0.28, 0.51)	<.0001	0.55	16.1	(0.41, 0.74)	<.0001	0.46	49.0	(0.36, 0.57)	<.0001
Current Mental Illness Treatment	0.78	3.80	(0.60, 1.00)	0.05	0.51	36.9	(0.41, 0.64)	<.0001	0.43	114	(0.36, 0.50)	<.0001
History of Mental Illness Treatment	0.85	1.63	(0.66, 1.09)	0.20	0.51	38.6	(0.41, 0.63)	<.0001	0.39	126	(0.34, 0.47)	<.0001
Mental Health Diagnosis	0.84	2.32	(0.67, 1.05)	0.13	0.55	29.7	(0.44, 0.68)	<.0001	0.42	100	(0.35, 0.50)	<.0001
Suicide Attempt History	0.47	22.8	(0.35, 0.65)	<.0001	0.56	22.4	(0.44, 0.71)	<.0001	0.44	90.2	(0.37, 0.52)	<.0001
Suicide Note Left	0.70	6.03	(0.53, 0.93)	0.01	0.85	2.20	(0.69, 1.05)	0.14	1.27	8.69	(1.08, 1.48)	0.003
Suicidal Thought History	1.01	0.002	(0.60, 1.70)	0.97	0.98	0.05	(0.78, 1.22)	0.83	0.88	2.19	(0.74, 1.04)	0.14

Table 9. Final multivariate logistic regression model for Kentucky, National Violent Death Reporting System - Restricted Access Dataset.

	Estimate	SE	OR	95% CI	P-Value
Age Group					
≤ 17 years of age	<i>Reference</i>				
18 – 34 years of age	-0.22	0.14	0.88	(0.42, 1.84)	0.12
35 – 49 years of age	-0.09	0.12	1.00	(0.49, 2.07)	0.48
50 – 64 years of age	-0.14	0.13	0.95	(0.46, 1.96)	0.25
≥ 65 years of age	0.55	0.18	1.89	(0.86, 4.14)	0.002
Location of Residence					
Urban	<i>Reference</i>	--	--	--	
Sub-Urban	-0.06	0.13	1.31	(0.89, 1.93)	0.63
Rural	0.39	0.09	2.05	(1.57, 2.66)	<.0001
Alcohol Use Suspected					
No	<i>Reference</i>	--	--	--	--
Yes	0.14	0.19	0.94	(0.66, 1.33)	0.44
Not Applicable	-0.60	0.43	0.44	(0.14, 1.38)	0.16
Depressed Mood					
No	<i>Reference</i>	--	--	--	
Yes	0.19	0.08	1.45	(1.08, 1.95)	0.01
Intimate Partner Problem					
No	<i>Reference</i>	--	--	--	
Yes	0.20	0.08	1.48	(1.07, 2.07)	0.02
Legal Problem, Criminal					
No	<i>Reference</i>	--	--	--	
Yes	-0.45	0.20	0.41	(0.19, 0.90)	0.03
Mental Health Diagnosis					
No	<i>Reference</i>	--	--	--	
Yes	0.01	0.10	1.02	(0.70, 1.49)	0.91
Physical Health Problem					
No	<i>Reference</i>	--	--	--	
Yes	-0.20	0.09	0.67	(0.48, 0.93)	0.02
Substance Abuse					
No	<i>Reference</i>	--	--	--	
Yes	-0.48	0.08	0.38	(0.28, 0.53)	<.0001
Current Mental Illness Treatment					
No	<i>Reference</i>	--	--	--	
Yes	-0.27	0.15	0.59	(0.32, 1.06)	0.08
History of Mental Illness Treatment					
No	<i>Reference</i>	--	--	--	
Yes	0.15	0.15	1.35	(0.75, 2.43)	0.33
Suicide Attempt History					
No	<i>Reference</i>	--	--	--	
Yes	-0.35	0.09	0.50	(0.35, 0.71)	0.0004

Table 10. Final multivariate logistic regression model for Ohio,
National Violent Death Reporting System - Restricted Access Dataset.

	Estimate	SE	OR	95% CI	P-Value
Age Group					
≤ 17 years of age	<i>Reference</i>	--	--	--	
18 – 34 years of age	0.21	0.13	2.80	(1.41, 5.50)	0.11
35 – 49 years of age	0.08	0.12	2.46	(1.26, 4.80)	0.48
50 – 64 years of age	0.23	0.12	2.86	(1.46, 5.58)	0.05
≥ 65 years of age	0.30	0.15	3.05	(1.50, 6.22)	0.05
Location of Residence					
Urban	<i>Reference</i>	--	--	--	
Sub-Urban	-0.10	0.08	1.14	(0.88, 1.47)	0.23
Rural	0.34	0.10	1.77	(1.31, 2.40)	0.001
Alcohol Use Suspected					
No	<i>Reference</i>	--	--	--	
Yes	0.10	0.12	1.00	(0.74, 1.34)	0.41
Not Applicable	--	--	--	--	--
Depressed Mood					
No	<i>Reference</i>	--	--	--	
Yes	0.06	0.07	1.12	(0.87, 1.45)	0.37
Intimate Partner Problem					
No	<i>Reference</i>	--	--	--	
Yes	0.13	0.07	1.31	(0.99, 1.72)	0.06
Job Problem					
No	<i>Reference</i>	--	--	--	
Yes	0.27	0.11	1.71	(1.10, 2.65)	0.02
Physical Health Problem					
No	<i>Reference</i>	--	--	--	
Yes	0.27	0.08	1.70	(1.22, 2.37)	0.001
Substance Abuse					
No	<i>Reference</i>	--	--	--	
Yes	-0.27	0.08	0.59	(0.42, 0.80)	0.0008
Current Mental Illness Treatment					
No	<i>Reference</i>	--	--	--	
Yes	-0.20	0.12	0.67	(0.42, 1.09)	0.10
History of Mental Illness Treatment					
No	<i>Reference</i>	--	--	--	
Yes	-0.07	0.13	0.87	(0.53, 1.43)	0.58
Mental Health Diagnosis					
No	<i>Reference</i>	--	--	--	
Yes	-0.07	0.08	0.86	(0.63, 1.18)	0.35
Suicide Attempt History					
No	<i>Reference</i>	--	--	--	
Yes	-0.19	0.07	0.69	(0.53, 0.89)	0.005

Table 11. Final multivariate logistic regression model for Virginia,
National Violent Death Reporting System - Restricted Access Dataset.

	Estimate	SE	OR	95% CI	P-Value
Age Group					
≤ 17 years of age	<i>Reference</i>	--	--	--	--
18 – 34 years of age	-0.004	0.10	1.52	(0.88, 2.62)	0.97
35 – 49 years of age	0.06	0.09	1.63	(0.96, 2.77)	0.45
50 – 64 years of age	0.20	0.09	1.87	(1.10, 3.19)	0.02
≥ 65 years of age	0.16	0.12	1.79	(1.02, 3.15)	0.18
Race					
White	<i>Reference</i>	--	--	--	
Black/African Amer.	0.18	0.33	0.52	(0.38, 0.73)	0.58
Asian	0.13	1.03	0.50	(0.05, 5.44)	0.90
Pacific Islander	-0.90	0.39	0.18	(0.10, 0.32)	0.02
Native American	-0.41	0.98	0.29	(0.03, 2.72)	0.68
Unspecified	0.16	0.59	0.51	(0.15, 1.73)	0.79
Location of Residence					
Urban	<i>Reference</i>	--	--	--	
Sub-Urban	0.26	0.08	1.68	(1.29, 2.18)	0.001
Rural	0.01	0.06	1.31	(1.09, 1.57)	0.89
Alcohol Use Suspected					
No	<i>Reference</i>	--	--	--	
Yes	2.25	72.5	0.81	(0.65, 1.00)	0.98
Not Applicable	--	--	--	--	0.97
Depressed Mood					
No	<i>Reference</i>	--	--	--	
Yes	0.11	0.04	1.25	(1.01, 1.48)	0.001
Intimate Partner Problem					
No	<i>Reference</i>	--	--	--	
Yes	0.19	0.05	1.45	(1.20, 1.75)	<.0001
Legal Problem, Other					
No	<i>Reference</i>	--	--	--	
Yes	0.25	0.12	1.65	(1.02, 2.66)	0.04
Physical Health Problem					
No	<i>Reference</i>	--	--	--	
Yes	0.002	0.06	1.00	(0.80, 1.25)	0.98
Substance Abuse					
No	<i>Reference</i>	--	--	--	
Yes	-0.33	0.06	0.52	(0.41, 0.66)	<.0001
Current Mental Illness Treatment					
No	<i>Reference</i>	--	--	--	
Yes	-0.25	0.08	0.60	(0.44, 0.83)	0.002
History of Mental Illness Treatment					
No	<i>Reference</i>	--	--	--	
Yes	-0.14	0.09	0.76	(0.51, 1.12)	0.16
Mental Health Diagnosis					
No	<i>Reference</i>	--	--	--	
Yes	-0.08	0.08	0.86	(0.63, 1.17)	0.34
Suicide Attempt History					
No	<i>Reference</i>	--	--	--	
Yes	-0.27	0.05	0.59	(0.48, 0.71)	<.0001