Exploring the Relationship between Firearm Suicides, Gender, and Occupation in Riverside County, California

by

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Abstract

Suicide is a leading cause of death in the United States, affecting nearly 47,173 individuals in 2017. Research has shown gender has influenced the method of suicide used by decedents. The purpose of this study is to identify if gender, income, or occupation are predictors of suicide. Additionally, this research will explore the potential influence of occupational firearm access in firearm-related suicide mortality and access to lethal means. Research on firearm and suicide mortality will allow for a better understanding of the epidemiological profile of firearm-related deaths and injury. Such research can inform discussions regarding the potential occupational exposure risks as well as identify policy implications.

Key words: Firearm suicide, gender, occupation, access to lethal means, mortality

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Review of Literature

Introduction

Suicide is the leading cause of premature death in the United States (National Vital Statistics, 2018). Between 1996 and 2016, suicide rates increased by 25.4% for reported demographics within the United States (National Vital Statistics, 2018). O'Carroll (1996) defined suicide as a fatal self-inflicted destructive act with explicit or inferred intent to die. In 2017, 47,173 Americans died by suicide and an additional 1.4 million Americans attempting suicide (Centers for Disease Control [CDC], 2017). The United States annually spends $69 billion on suicide and self-injury (CDC, 2017).

Much research has focused on suicide ideation (wanting to take your own life) and its risk factors such as prior mental health conditions and previous suicide attempts (National Institute of Mental Health, 2018). While suicide is commonly associated with poor mental health, there is no single factor attributed to the cause of suicide. Recent studies have shown 54% percent of individuals who died by suicide had no previously diagnosed mental health condition (CDC, 2018).

Suicide Mortality

Suicide data within the United States fluctuate depending on variables such as age, gender, occupation, and access to lethal means (National Institute of Mental Health, 2019). Suicide rates have increased among elderly adults ages 64-80 with a notable increase among adults age 45-64 from 13.2 per 100,000 persons in 1999 to 19.2 per 100,000 (National Institute of Mental Health, 2019). In 2016, the greatest number of suicides were among adults between the ages of 45-80 (CDC, 2018).

Although suicide within the United States has increased for both males and females, trends differ based on the means of suicide. In 2015, the Morbidity and Mortality Weekly Report (MMWR) published a study that reviewed 22,000 deaths among individuals between the ages of 16-64, which indicated males in construction and extraction and females in the arts, design, entertainment, sports, and media had higher rates of suicide. Lower rates of suicide for both males and females were observed in education, training, and library occupations (CDC, 2018). Higher suicide rates among males in California are congruent with the US average, and they are greater among older individuals; more specifically, males over 70 are eight times more likely to commit suicide than women (Rand Corporation, 2019). The overall California suicide rate is 9.4 per 100,000 which increases with age. Suicide rates increase by age starting at age 10, plateau at age 55, and rise again at age 70 (Rand Corporation, 2019). In California, white males have the highest suicide rates averaging between 9 and 12 suicides per 100,000.

The face of suicide has changed drastically over the past decade with firearms becoming the most common method of suicide among individuals with no prior diagnosed mental health condition (CDC, 2019). Firearm suicide has become an epidemic in the United States where firearm suicide rates are eight times higher than other comparable countries (Grinshteyn & Hemenway, 2016). Firearm suicide in California is consistent with trends in the US with 37% of all suicide deaths being completed by firearms (National Center for Injury Prevention and Control, 2014). The use of firearms in suicides within Riverside County mirrors state and national trends. Although Riverside County meets the national goal of no more than 9.3

firearm deaths per 100,000, firearms were used in 43% of suicide deaths within Riverside County. Risk factors for firearm suicide include gender and occupation, particularly within occupations that provide access to firearms (Franklin et al., in press).

Suicide Manner

The leading methods of suicide in the US are firearms, suffocation, and poisoning (CDC, 2004). In the US, guns are the most common method of suicide at 55.3% of suicide deaths (CDC, 2018). Other lethal methods of suicide include hanging, strangulation, and suffocation, which altogether accounts for 26.9% of suicides, while poisoning accounts for 10.4% of suicide deaths (Stone, Simon & Filler, 2019).

According to the Centers for Disease Control ([CDC] 2016), self-inflicted gunshot wounds, which comprise more than 50% of deaths by suicide, highlight self-inflicted firearm deaths as a critical public health issue for both the victim and society. Research has begun shifting from solely looking at predictors of suicide attempts to predictors of suicide deaths. The research transitions from attempts to death by suicide aids in the identification of new risk variables, which include firearm familiarity and access (Klonsky & May, 2015). In 2013, the CDC attributed $50.8 billion (24%) of fatal injury cost to suicide (The National Institute of Mental Health [NIMH], 2019). Suicide by firearm may differ by the state due to variability in firearm restrictions and access (Lewicki & Miller, 2013)

Firearm suicide trends within California are essential to the changing epidemiology of suicide as California has some of the strictest firearm regulations

within the US (Matthay, Galin & Ahern, 2017). Rising suicide rates, along with intensified attention to the role of firearms in society, have increased the focus on suicide as a crucial health issue (Case & Deaton, 2015). Annually, 55% of suicides within the US are attributed to the use of firearms (CDC, 2018). The annual number of firearm suicides within the United States is double the number of firearm homicides (Siegel & Rothman, 2016). Between 2005-2014 in Riverside County, an average of 259 people per year were killed by firearms; 65 of these deaths were due to homicides and 91 deaths were attributed to suicides each year (Gardner, 2017). Data shows white males, middle-aged and older, were four times more likely to die from a suicide involving a firearm when compared to any other group (Drexler, 2019). Studying occupations with access to firearms would be beneficial to research on suicide risk factors.

Suicide by Gender

Gender is an important epidemiological factor in suicide research as males and females have different patterns and risk factors for this behavior (Milner, Spittal, Pirkis, & LaMontagne, 2015). In most countries, the number of male suicides greatly exceeds female suicides. Research has revealed a 3-7% in suicide among males compared to females (Nock, Borges, & Bromet, 2013). Between 2000 and 2016 the US national suicide rate for males increased to 21% from 17.7%. For males, the rate increased 21%, from 17.7 in 2000 to 21.4 in 2016 (Hedegaard, Curtin, & Warner, 2018). Alternately, for females the national suicide rate increased 50% from 4.0 in 2000 to 6.0 in 2016. Annually, 84% of males and 16% of females who complete suicide in the United States have no known mental health issue (CDC, 2018).

A suicide attempt is a strong predictor for future completed suicide (Mayo Clinic, 2016). According to a World Health Organization report ([WHO] 2010), women frequently have higher rates of suicide attempts, while men have fewer attempts but more completed suicides. Suicide is the eighth leading cause of death for women over the age of 45 (CDC, 2015). Historically, females have used poison and suffocation as primary methods of suicide. Between 2009 and 2014, the most common method of suicide for women was poison (Patel, 2016).

Suicide is the seventh leading cause of death for males with 84% of males having no prior diagnosed mental health condition (CDC, 2016). Within the last ten years, male suicide has become a marker for male mortality. It is important to note that males may have a higher rate of firearm-related suicides because the method of choice has a low survival rate, which reduces stigma (Siegel & Rothman, 2016). The stigma of mental illness among males decreases their willingness to seek help. Additionally, cultural ideologies that suggest males are required to be breadwinners for their families contribute to their suicidal behavior if are unable to meet these cultural standards (Bilsker & White, 2011). Further, males typically use a more violent and lethal means to end their lives (Windfur & Kapur, 2011). Previous literature suggested that preferences for methods of suicide differ based on gender: males often desire a quick and painless death while females often want a quick and painless death with no risk of disfigurement (Milner, Witt, Maheen, & La Montagne, 2017).

Suicide, Occupation, and Access to Firearms

Research has shown the relationship between access to means to commit suicide and suicide within the occupations of the military, police, military veterans, and medical field is limited and affected by geographic location (Logan, Fowler, Patel, & Holland, 2016). Research has shown a rise in suicide by firearm within states with less restrictive firearm regulations and in rural communities (Rand, 2018). Firearm ownership and firearm suicide rates are higher in rural areas (Harvard, 2019).

Key factors in firearm access include occupation and gun ownership. Heinz (2017) suggested prior gun ownership as a contributing factor to firearm suicide. However, studies have shown difficulty in identifying those with access to and/or those who own a firearm (Klieve, Sveticic, & De Leo, 2009). For example, the USA Injury Control and Risk Survey reported 6.2% of respondents may have owned a firearm but did not have immediate access while 8.3% of respondents did not personally own a firearm but did have direct access (Smith, 2001).

It is important to assess access, income, and stress levels as they relate to occupational risk factors for suicide. Past research has concluded access to lethal suicide methods has played a role in influencing an individual's choice of suicide methods. Occupations that have greater access and familiarity with lethal suicide methods have shown an increased rate of suicide than occupations without access (Milner, Witt, Maheen, & La Montage, 2017). It is important to note that not all occupations have higher suicide risk due to the access to lethal suicide means, but some may be influenced by other factors that operate separately from occupation. These factors include income, stressful working environments, and the lack of help-

seeking services provided by employers as well as mental health stigma within the profession (Milner et al., 2013).

Occupation and firearm exposure. The literature on suicide has consistently identified relationships between occupation and suicide (Roberts, Jaremin, & Lloyd, 2012). Occupation is a hidden suicide risk because it is not defined as an occupation-related death unless the worker chose to end his life at the place of employment (Chen & Stallones, 2011). Suicide risk factors among occupations become vital to understanding the relationship between access and firearm exposure. Individuals with access to lethal means of suicide are at higher risk than individuals with little to no access to firearms.

Milner and colleagues (2017) described the availability of potentially lethal suicide methods as an explanation for higher rates of suicide in specific occupational groups. While this reasoning is accurate for individuals within occupations with ready access to firearms, such as police officers, and employed individuals within the military, it does not explain the inconsistency of increased suicide rates in other occupations with no access to lethal means including firearm access (Mahon, Tobin, Cusack, Kelleher, & Mallone, 2005; Milner et al., 2017). In 2015, the CDC (2018) identified the highest suicide rates were for males who worked in Construction and Extraction, while occupations with the highest female suicide rates included Arts Design, Entertainment, Sports, and Media (CDC, 2018). High-risk occupations include blue-collar workers, physicians, and individuals who served in the armed services. Also, research has shown gender may modify the association between

occupation and suicide, which has led to differing effects of occupation for both males and females (Hawton et al., 2001; Lindeman et al.,1996).

Armed forces and firearm access. Research has indicated suicide as the second most common cause of death among those in the Armed Services (Ritchie, Keppler, & Rothberg, 2003). Historically, suicide rates for the US military were below civilian rates; however, in 2008 suicide rates for members of the Armed Forces matched the civilian rate (Kuehn, 2009). Individuals within the Armed Services have experienced occupational exposure due to prolonged stints in military service and firearm training. Hilton (2009) emphasized the importance of firearm training received by Armed Service members and determined that 69% of military personnel who received training used a firearm to commit suicide compared to 49% of individuals who had no prior military training. Current research suggested multiple factors may add to the risk of firearm suicide among military personnel, including firearm ownership, accessibility, firearm storage, and off duty usage (Dempsey et al., 2019).

Conclusion

According to the CDC, in 2017 there were twice as many suicides as homicides (National Institute of Health, 2017). Literature has demonstrated the relationship between gender and occupation is consistent with the rise of firearm suicide. The association between firearm access and increased suicide rates has not been conclusive (Klieve et al., 2009). Occupation may influence firearm suicide rates due to firearm access. Considering the demographic factors and increased suicide

rates within Riverside County, this study focused on understanding the roles of gender, occupation, and firearms in suicides.

Purpose of the Study

The purpose of this study was to determine if gender or occupation are predictors of suicide. Additionally, this research explored the potential influence of occupational firearm access in firearm-related suicide mortality. The following study addressed the gaps in the research to inform prevention programs within Riverside County.

Research Questions

This study answered the following research questions:

1. Are gender and history of service in the Armed Forces predictors of suicide mortality?
2. To what degree do gender and occupation influence firearm-related suicide mortality?
3. Is there a possible association between firearm-related suicides, gender and a history of service in the Armed Forces?

Hypothesis

It is hypothesized that gender is the strongest predictor of suicide mortality rather than history of service in the military. It is additionally hypothesized that gender is a strongest predictor of firearm-related suicide mortality than occupation. It is hypothesized that among individuals with a military background, gender will be the strongest risk factor of suicide mortality.

Method

Design

This study used a cross-sectional design to determine if gender and occupation influence suicide mortality. Mortality data for adults in a Southern California county from the years of 2005-2017 was used in this study. The Institutional Review Board (IRB) at California Baptist University (CBU) deemed this research as non-human subject research on April 22, 2019 due to the nature of the secondary data (see Appendix B).

Procedures

The data used in this study was from the Death Statistical Masterfile (DSMF) for a county in Southern California. The DMSF is maintained by the California Department of Public Health and is a dataset provided by the state to aid in accurate identifications for the deceased. Data in the DMSF is compiled from death certificates recorded by local health jurisdictions and reported to the State of California. The dataset includes all deaths that occurred among county residents between the years 2005 and 2017. The overall mortality data file also included a variable indicating the manner of death, classified as either a suicide or other cause.

A second file was created as a subset of the overall mortality file. The subset included only suicide deaths as well as enhanced occupation classifications. The subset data file contained only suicide mortality data. In the suicide mortality file, occupation classifications were detailed and manner of suicide was included. The two files were imported into the Statistical Package for the Social Sciences (SPSS) version 26 for analysis.

Participants

Study participants were adult decedents for the years 2005-2017. During the selected time frame there were 187,115 deaths and 2,938 suicide-related deaths. The study included place of residence deaths and excluded deaths among those under 18 years. Using G*Power Software, Version 3.1.9.2, a small effect size of .1, an alpha level of .05, and a power of 80% was selected to estimate the minimum required sample size to perform the analyses to answer the first and second research questions. The sample size for the first research question was estimated at 776,324, and the sample size for the second and third research questions was estimated at 1,200. Based on the sample size, the analysis for the second and third research questions were sufficiently powered; however, the analysis for the first research question may have been underpowered due to the lack of sufficient suicide mortality data as suicide only accounts for 1% of all deaths.

Independent Variable and Dependent Variable

There are two dependent variables in this study: suicide and firearm-related suicides. The first dependent variable, suicide, was identified using ICD-10 codes X59-X84 and R99. Deaths with these codes were recoded as “1= suicide death” and all other deaths were recoded as “2 = not a suicide death.” The second dependent variable, firearm-related suicide, was identified by ICD-10 codes X72 and X73. Deaths with these codes were recoded as “1 = firearm-related suicide” and “2 = non-firearm-related suicide.”

In this study there were three independent variables. The first independent variable was gender, which is a dichotomous variable measured by "1 = male" and "2 = female." The second independent variable was occupation, which was classified based on the 23 major occupational groups (see Appendix A). The variable occupation was changed from a free text field and recoded into 23 occupation categories based on the Bureau of Labor Statistics' occupational groupings. The third independent variable was military status, which is a categorical variable and measured by "1 = yes" and "2 = no."

Data Analysis

For the first research question, "*Are gender and history of service in the Armed Forces predictors of suicide mortality?*," a logistic regression was used to determine whether gender and/or history of military service are predictors of suicide mortality. To answer the second research question, "*To what degree does gender and occupation influence firearm-related suicide mortality?*," a logistic regression was used to determine the degree to which gender and occupation influence firearm-related suicide mortality. For the final research question, "*Is there a possible association between firearm-related suicides, gender, and a history of service in the Armed Forces?,*" a logistic regression was used to determine if military status changed the degree to which gender and occupation influenced firearm-related suicide mortality. For each regression model an adjusted odds ratio and confidence interval was reported.

Results

Participant Demographics

This study examined the influence of gender, occupation, and military status on suicide and firearm-related suicide. It was hypothesized that gender was the strongest predictor of suicide mortality. Additionally, it was hypothesized that gender was the strongest predictor of firearm suicide mortality. Binary logistic regressions, frequencies, and descriptive statistics were used to test the hypothesis. Data was gathered from a Death Statistical Masterfile (DSMF) from a Southern California county for the years of 2005-2017. Two data files were used to examine data; an overall mortality data file and suicide data file were used to examine data on incident cases. The total mortality data file included a sample size of 187, 115 deaths. The suicide mortality data file included a sample size of 2,845 deaths.

Overall in the DMSF morality file, the median age of death was 77 years old. For suicide deaths, the median age was 50 years old. Most suicide-related deaths and those who died of all causes were White or Hispanic, reflecting the demographics of the county. Marital status differed between decedents of all-cause mortality data and suicide-related mortality. Among those who died of suicide-related causes, 32.8% were single at time of death while 10.3% of those who died of all causes were single. Rate of prior military service was similar among decedents of suicide and all-cause mortality (Table 1).

Major Findings

A binary logistic regression was used to assess whether gender and military status were predictors of suicide mortality. There was a significant relationship

between gender, military status, and suicide mortality ($\chi^2(1) = 797.2$, $p \leq .001$). History of military status was the strongest independent predictor of suicide mortality ($p \leq .001$, $\beta = 3.66$). Those with a history of military service were 72.7% less likely to die of suicide compared to those without a history of military service (see Table 2). The findings further show gender as an independent predictor of suicide mortality ($p \leq .001$, $\beta = .272$). Males were 73% more likely to die of suicide compared to females.

The second research question explored the degree to which gender and occupation influence firearm-related suicide mortality. Using binary logistic regression, a significant relationship between gender, occupation, and firearm-related suicide was found ($\chi^2(23) = 199.0$, $p < .001$). Gender and occupation were found to predict firearm-related suicide. Males were 68% more likely to die of firearm related suicide compared to females ($p < .001$, $\beta = .316$). When examining the occupation covariate, legal occupations (e.g. lawyers, judges, court reporters) and health care support (e.g. home health aides, occupational therapy aides, pharmacy aides, dental assistants) occupations were the strongest predictors of firearm-related suicide mortality (see Table 3). All occupation categories found to be significant of firearm-related suicide mortality were: business and financial operation occupations ($p = .017$, $\beta = 2.16$); legal occupations ($p = .019$, $\beta = 3.68$); education, training and library occupations ($p = .037$, $\beta = 1.96$); arts, design and entertainment ($p = .002$, $\beta = 2.47$); health care support occupations ($p = .029$, $\beta = 2.59$); food preparation and serving related occupations ($p = .001$, $\beta = 3.98$); building, grounds, cleaning, and maintenance ($p = .004$, $\beta = 2.19$); personal care and service occupations ($p = .001$, $\beta = 2.98$); sales and related occupations ($p = .006$, $\beta = 1.87$); office and administrative

support occupations ($p = .001$, $\beta = 2.90$); construction and extraction occupations ($p = .001$, $\beta = 2.11$); installation, maintenance, and repair occupations ($p = .020$, $\beta = 1.71$); and transportation and material moving occupations ($p = .003$, $\beta = 2.04$).

The third research question explored the possible association between gender, occupation, and firearm-related suicide among those with a history of military service. The findings indicate there was a significant relationship between gender, occupation, and firearm-related suicide ($\chi^2(23) = 45.8$, $p < .01$). However, gender was not found to be a significant predictor of firearm-related suicide mortality ($p = .831$, $\beta = 1.18$) (see Table 4). For individuals with a history of military service, the following occupations were significant predictors of firearm-related suicide mortality: business and financial operations occupations ($p = -.049$, $\beta = .326$); arts, design, entertainment, sports, and media occupations ($p = .014$, $\beta = .203$); food preparation and services related occupations ($p = .016$, $\beta = .156$); buildings, grounds, cleaning, and maintenance occupations ($p = .041$, $\beta = .335$); office and administrative support occupations ($p = .020$, $\beta = .263$); military-specific occupations ($p = .029$, $\beta = .380$). Of these occupations arts, design, entertainment, sports, and media; food preparation and servicing related occupations; office and administrative support occupations were the strongest predictors of firearm-related suicide mortality among individuals with a military background.

Discussion

The purpose of this study was to examine the relationship between occupation, gender, and military service history to suicide and firearm-related suicide. Further, this study explored predictors of overall suicide mortality and predictors of firearm-related suicide mortality.

For the first question, it was hypothesized that gender would be the strongest predictor of suicide mortality. The results of this study indicate gender and military service history were significant predictors of suicide mortality ($p < .001$). Males were 3.6 times more likely to commit suicide than females. These findings are supported by Milner et al. (2013) who suggested gender may play a role in the association between suicide and occupations. However, Hawton et al. (2001) found female medical doctors had a higher risk of suicide than males when compared to the general population.

Contrary to the research hypothesis, a history of military service (e.g. infantry officers, air crew members, first line supervisors of air crews), was the strongest independent predictor of suicide mortality ($p < .001$). The findings of this study show those with a history of military service were 70% times more likely to commit suicide by firearms. This finding aligns with current literature which suggested increased rates of suicide within the military or those with past military history stems from an increase mental disorders within the military population. This may be a result of occupational stress in both non-deployed and home station environments (LeardMann, et al., 2013). For example, individuals who have been exposed to traumatic surroundings, such as witnessing deaths and the discharging of weapons,

have been associated with mental health issues among those in the military (Hoge et al., 2006). Hoge, Castro, and Messer (2004) noted 60% of veterans of the Iraq War who screened positive for post-traumatic stress disorder (PTSD), general anxiety, and depression did not seek treatment. Furthermore, individuals with prior military history tend to have greater access to lethal suicide means (Milner, Lippmann, Azrael, & Hennway, 2007). Individuals with a history of greater access and familiarity with lethal suicide methods have higher suicide rates than individuals with little to no access or little to no familiarity with lethal methods (Milner et al., 2017).

When looking at predictors of firearm-related suicide, gender and occupation were independent predictors of firearm-related suicide mortality ($\chi^2(23) = 199.0$, $p < .001$). It was hypothesized that gender would be the strongest predictor of firearm-related suicide; however, the analysis found occupation to be the strongest predictor of firearm-related suicide mortality.

The following broad occupation categories were significant predictors of firearm-related suicide and are consistent with previous studies: arts, design, and entertainment ($p = .002$); health care support occupations ($p = .029$, $\beta = 2.59$); food preparation and serving related occupations ($p = .001$); building, grounds, cleaning, and maintenance ($p = .004$); personal care and service occupations ($p = .001$); sales and related occupations ($p = .006$); office and administrative support occupations ($p = .001$); installation, maintenance, and repair occupations ($p = .020$); and transportation and material moving occupations ($p = .003$). These findings are congruent with studies which show individuals with no immediate access to lethal means or

occupations with low skill levels may be at higher risk for suicide (Milner et al., 2015).

Legal occupations (e.g. lawyers, judges, court reporters) were identified as the strongest occupation-related predictor of firearm-related suicide mortality ($p = .019$). This finding is not consistent with previous studies (Tiesman et al., 2015; Petterson et al., 2018; Stallones, Doenges, Dik, & Valley, 2013) which identified construction and extraction occupations as well as arts, design and media occupations with the highest suicide rates between 2012 and 2015. There are two possible explanations for this discrepancy. First, there may be occupational differences based on geographical locations. Stallones et al. (2013) reviewed data between 2004-2006 in Colorado and suggested high suicide occupation rates may be influenced by the state having higher overall suicide rates compared to other states.

The second explanation includes socioeconomic factors. Phillips and Nugent (2014) conducted a study where they analyzed occupations between the years 2005-2017. Their findings suggested those in legal occupations may have experienced high suicide rates due to economic downturns. They found that suicide among individuals in legal occupations may have been affected by the Great Recession which spanned from 2008 to 2011. Phillips and Nugent (2014) further suggested that suicide rates increase during economic crises.

This research also found health care support occupations (e.g. home health aides, occupational therapy aides, pharmacy aides, dental assistants) to be a strong predictor of firearm-related suicide ($p = .029$). This finding is not congruent with current research. Stallones, Doenges, Dik, and Valley (2013) found health care

workers and health care support workers had high suicide rates caused by poison versus other forms of death due to occupational exposure.

For the third research question, it was hypothesized that gender would be the strongest predictor of firearm-related suicide among those with a history of military service. The results determined that among those with previous military service gender was not a significant predictor of firearm-related suicide mortality ($p = .831$). These findings are supported by current literature, which suggested gender does not play a role in firearm-related suicide among individuals with a history of military service. Milner et al. (2013) identified females with occupational access to firearms used firearms as a method to commit suicide even though this method can result in possible disfigurement.

There were six occupations found to be significant predictors of firearm-related suicide among those with a history of military service. These were: business and financial operations occupations ($p = .049$); arts, design, entertainment, sports, and media occupations ($p = .014$); food preparation and services related occupations ($p = .016$); buildings and grounds cleaning and maintenance occupations ($p = .041$); and office and administrative support occupations ($p = .020$). It is important to note that five of the occupations are ones without access to lethal means. These findings are congruent with Stallones et al. (2013) who found high suicide rates among individuals in occupations without immediate access to a lethal means.

The occupational findings in this study are supported by current literature, which identified two possible reasons for those in occupations without access to firearms having high suicide rates. Stallones et al. (2013) suggested this may be due

to the ability of these workers to afford the purchase of a firearm. However, Neidhammer, Chastang, Levy, David, Degioanni, and Theorell (2008) proposed firearm-related suicides may be a result of poor working conditions which includes high levels of stress and poor mental health outcomes.

This analysis finds that suicide cases within military-specific occupations were also susceptible to high rates of firearm-related suicide ($p = .029$). These findings are congruent with current research which suggested suicide risk can be higher within military service occupations because of access to firearms, marksmanship training, and the potential to be more aggressive (Turner & Neal, 2003). Furthermore, Stallones et al. (2013) suggested high firearm-related suicide rates among individuals within protective service occupations result from the use of means which they are familiar with, explaining why individuals within this occupation were more likely to choose a firearm to commit suicide.

Public Health Implications

Suicide is a multifaceted issue which requires strategies focused on the prevention of known risk factors (Lewiecki & Miller, 2013). The findings of this study suggest firearm-related prevention methods should focus on both limiting access to firearms and other occupational risk factors, which include adverse working conditions (Milner et al., 2013).

Limiting access to firearms is a complex topic as it involves policy change and continued education. Reducing access to firearms includes extending waiting periods and safe storage requirements. Conner and Zhong (2003) identified lower overall suicide rates within states that had extended waiting periods for gun

purchases, safe storage requirements, and implemented a minimum purchase age of 21. Research has shown restriction of any suicide means can reduce suicide by that specific method and contribute to a reduction in overall suicide rates (Hawton, 2007; Diagle, 2005). The lack of availability of lethal methods of suicide, such as firearms, have been shown to encourage substitution to less lethal means and thereby increasing suicide survival rates (Lewiecki & Miller, 2013). Past research has suggested individuals who had recently purchased a handgun were at an elevated risk of completing suicide within a week of purchase (Wintemute, Parham, Beaumont, Wright, & Drake, 1999).

Workplace education is essential to developing specific suicide prevention messages (Stallones et al., 2013). The average employed adult spends eight hours a day within a work environment, potentially allowing for greater participation in suicide prevention (Hester, 2017). While research on suicide prevention programs is limited, Marsha and Martin (2013) identified a 79% decrease among individuals in law enforcement who participated in a comprehensive suicide prevention program.

Future research may benefit from using more narrowly defined occupational data and controlling for factors such as education and income. This may allow for a better understanding of the relationship between occupation and suicide (Peterson, Stone, & Marsh, 2014). Understanding the association between suicide and occupation is multifaceted and can include any combination of variables including access to firearms, socioeconomic, environmental, and occupational-related factors (Milner et al., 2017). However, key firearm policies should be in place to aid in firearm-related prevention. These policies should focus on mental health screening

for military and non-military personnel before the sale of a firearm. Implementation of waiting periods to purchase firearms would also aid in restriction to access of firearms and subsequently reduce risks of suicide (Lewiecki & Miller, 2013).

Study Limitations

The findings in this study are subject to a few limitations. The first limitation is consistent with previous research studies which indicate occupations recorded on q death certificate may be inaccurate due to the secondary nature of the information. However, authors of past studies have concluded the misclassification of information is not substantial enough to alter trends within the data (Mohler & Earls, 2001).

Another limitation of this study is the sample size. A power analysis was conducted and indicated that since suicide represents about 1% of all deaths, the sample size would need to be greater than the 187,000 subjects analyzed. A significantly larger sample size was not attainable for this study.

Finally, this study did not include age in the regression model. Age should have included due to the possible confounding relationship between age and suicide-related mortality. Adjusting for age may be an important methodological addition as suicide and firearm-related suicide varies by age (Nock et al., 2008).

Conclusion

The results of this study indicate gender is not the strongest predictor of overall suicide mortality. History of military service was the strongest predictor of overall suicide mortality. Furthermore, gender and occupation are strong predictors of firearm-related suicide. Gender was not a strong predictor of firearm-related mortality when examining mortality among individuals with a history of military service.

Future research may seek to adjust for age as well as refine occupational groupings. A further understanding of predictors, which lead to overall suicide and firearm-related suicide, would aid in decreasing the mortality rate for this population. Understanding the predictors of suicide mortality can aid in early prevention and potentially save lives. Research on predictors of occupational suicide could lead to more comprehensive workplace training which could lead to reduced job stress, early detection of suicide ideation, and assistance through employee health programs.

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Appendix A: Tables

Table 1
Description of all-cause and suicide-related mortality, 2005-2017

All-Cause Mortality			Suicide Mortality		
Variable	**Frequency**	**Percent**	**Variable**	**Frequency**	**Percent**
Age	73*		**Age**	50*	
Education			**Education**		
8th grade	6,367	3.4	8th grade	38	1.3
10th grade	5,777	3.1	10th grade	87	3.1
Associate	9,983	5.3	Associate	175	6.2
Bachelor	18,338	9.8	Bachelor	300	10.5
HS Graduate	69,821	37.3	HS Graduate	1,062	37.3
Masters	6,867	3.7	Masters	96	3.4
Some College	34,418	18.4	Some College	589	20.7
Race/Ethnicity			**Race/Ethnicity**		
Asian-Pl	,5845	3.1	Asian-Pl	104	3.7
Black	11,393	6.1	Black	90	3.2
Hispanic	33,616	18.0	Hispanic	560	19.7
Native Am	994	.5	Native Am	18	.6
White	134,426	71.8	White	2,059	72.4
Marital Status			**Marital Status**		
Divorce	29,717	15.9	Divorce	602	21.2
Married	75,794	40.5	Married	1,038	36.5
Single	19,251	10.3	Single	934	32.8
Widowed	60,310	32.2	Widowed	223	7.8
Military Status			**Military Status**		
No	137,960	73.7	No	2,204	77.5
Yes	48,010	25.7	Yes	616	21.7

*Mean Value Reported

Table 2
Summary of logistic regression analysis for variables predicting suicide-related mortality

Predictor	**B**	**SEB**	**β**	**CI**
Constant	5.104	.060	.006	
Gender	1.300	.053	.272	(.245, .302)
Military Status	-1.30	.067	3.66	(3.128, 4.180)

Note: R2 = .004(Cox-Snell), .039(Nagelkerke). Males and those with a history of military service are referent groups. *p <.05

Table 3

Summary of logistic regression analysis for variables predicting firearm-related suicide mortality

Predictor	B	SEB	β	CI
Constant	-.398	.19	.67	
Gender	1.1	.13	3.1*	(2.4, 4.1)
Occupation				
Business & Financial Operations Occupations	-.52	.30	.59	(.32, 1.0)
Computer & Mathematical Operations	-.77	.32	.46*	(.24, .86)
Architecture & Engineering Occupations	.23	.34	1.2	(.64, 2.4)
Life, Physical & Social Science Occupations	-.45	.50	.63	(.23, 1.6)
Community & Social Service Occupations	-.53	.49	.58	(.22, 1.5)
Legal Occupations	-1.3	.55	.27*	(.09, .80)
Education, Training and Library Occupations	-.67	.32	.50*	(.27, .95)
Arts, Design, Entertainment, Sports & Media Occupations	-.90	.29	.40*	(.22, .71)
Healthcare Practitioners & Technical Occupations	-.39	.28	.67	(.38, 1.1)
Health Care Support Occupations	-.95	.43	.38*	(.16, .90)
Protective Service Occupations	.35	.27	1.4	(.83, 2.4)
Food Preparation & Serving Related Occupations	-1.3	.33	.25*	(2.0,.48)
Building Grounds Cleaning & Maintenance	-.78	.27	.45*	(.26, .78)
Personal Care & Service Occupations	-1.0	.34	.33*	(.17, .65)
Sales & Related Occupations	-.62	.22	.53	(.34, .83)
Office & Administrative Support Occupations	-1.0	.28	.34*	(.19, .60)
Farming, Fishing and Forestry Occupations	-.42	.37	1.5	(.65, 1.3)
Constructive and Extraction Occupations	-.75	.22	.47*	(.37, .72)
Installation, Maintenance, and Repair Occupations	-.54	.23	.58*	(.37, .91)
Production Occupations	-.14	.24	.87	(.53, 1.4)
Transportation and Material Moving Occupations	-.71	.24	.48*	(.30, .78)
Military Specific Occupations	-.37	.33	.68	(.35, 1.3)

Note: R2 = .076(Cox-Snell), .103(Nagelkerke). Males and those in the management occupation serve as the referent group. *p <.05

Table 4

Summary of logistic regression analysis for variables predicting firearm-related suicide among those with a history of military service

Predictor	**B**	**SEB**	**β**	**CI**
Constant	-.20	.83	.81	
Gender	-.16	.788	1.1	(.25, 3.96)
Occupation				
Business & Financial Operations	-1.1	.571	.32*	(.32, .90)
Occupations				
Computer & Mathematical Operations	-.40	.60	.66	(.40, .40)
Architecture & Engineering Occupations	.49	.64	1.6	(.56, .18)
Life, Physical & Social Science Occupations	-.31	.92	.73	(.06, .78)
Community & Social Service Occupations	20.1	15191.5	.99	(.08, 3.11)
Legal Occupations	-1.7	.92	.18	(.00, 00)
Education, Training and Library	-1.1	.65	.30	(.34, 12.44)
Occupations				
Arts, Design, Entertainment, Sports &	-1.5	.65	.20*	(.35, 4.22)
Media Occupations				
Healthcare Practitioners & Technical	-.06	.60	.93	(.54, 6.40)
Occupations				
Health Care Support Occupations	-1.0	1.4	.36	(.12, 1.27)
Protective Service Occupations	-.27	.47	.75	(.06, 17.61)
Food Preparation & Serving Related	-1.8	.76	.15*	(.21, 1.19)
Occupations				
Building Grounds Cleaning & Maintenance	-1.0	.53	.33*	(.56, 10.50)
Personal Care & Service Occupations	-.31	.78	1.1	(.42, 3.06)
Sales & Related Occupations	-.53	.42	.58	(.11, 2.32)
Office & Administrative Support	-1.3	.57	.26*	(.30, 1.39)
Occupations				
Farming, Fishing and Forestry Occupations	.37	1.1	1.4	(.49, 4.22)
Constructive and Extraction Occupations	-.34	.44	.71	(.02, 2.50)
Installation, Maintenance, and Repair	-.47	.42	.62	(.24, 1.19)
Occupations				
Production Occupations	.48	.50	1.6	(.28, 1.29)
Transportation and Material Moving	-.54	.45	.58	(.09, .58)
Occupations				
Military Specific Occupations	-.96	.44	.38*	(.28, 1.49)

Note: R2 = .074 (Cox-Snell), .101(Nagelkerke). Males and those in the management occupation serve as the referent group. *p <.05

Appendix B: IRB Approval

RE: IRB Review
IRB No.: 095-1819-NHSR

Project: Examining the Research between Firearm Suicides: Gender and Occupation

Date Complete Application Received: 4/17

Principle Investigator: Shanice Hunt
Faculty Advisor: Marshare Penny

College/Department: CHS

IRB Determination: Not Research with Human Participants – IRB review has determined that this project does not meet the federal guidelines for research with human participants (definitions available in the IRB handbook), and is thus not regulated by the IRB. We will retain copy of your submission, and this determination letter.

Future Correspondence: If you have any questions about this determination, please refer all queries to irb@calbaptist.edu, being sure to include all PIs, Co-PIs, and Faculty Advisors (as relevant) and reference the assigned IRB number.

Date: April 22, 2019