ORIGINAL PAPER

Gender differences in suicide methods

Valerie J. Callanan · Mark S. Davis

Abstract

Introduction Gender differences in suicide completion rates have been attributed to the differences in lethality of suicide methods chosen by men and women, but few empirical studies have investigated factors other than demographic characteristics that might explain this differential.

Methods Data from the 621 suicides in Summit County, Ohio during 1997–2006 were disaggregated by gender to compare known correlates of suicide risk on three methods of suicide—firearm, hanging and drug poisoning.

Results Compared to women, men who completed suicide with firearms were more likely to be married and committed the act at home. Unmarried men were likelier to hang themselves than married men, but unmarried women were less likely to hang themselves than married women. Men with a history of depression were more likely to suicide by hanging, but women with depression were half as likely to hang themselves compared to the women without a history of depression. Men with a history of substance abuse were more likely to suicide by poisoning than men without such history, but substance abuse history had no influence on women's use of poisoning to suicide. For both sexes, the odds of suicide by poisoning were significantly higher for those on psychiatric medications.

Keywords Suicide methods · Gender · Firearms · Poisoning · Hanging

V. J. Callanan
Department of Sociology, The University of Akron, Akron, USA

M. S. Davis (✉)
Criminal Justice Research Center, The Ohio State University, Columbus, USA
e-mail: davis.198@osu.edu

Introduction

Research on suicide in the United States has consistently found gender differences in suicidal behavior. Most notably, males take their own lives at nearly four times the rate of females and comprise approximately 80% of all suicides, even though female suicide attempt rates are estimated to be three to four times higher than men's [1–3].

One of the primary reasons given for the large gender gap in suicide completion rates is the difference in suicide methods used by males and females. In general, men are more likely to use methods that ensure lethality than are women. The most common suicide method used by men is firearms; current statistics indicate that 56% of males who committed suicide in 2006 used a firearm [1]. In contrast, women are less likely than men to commit suicide with firearms but more likely to commit suicide by poisoning [1]. Since women are more likely to attempt suicide by poisoning, they stand a greater chance of being rescued or resuscitated than men, who typically use firearms, which are more likely to inflict mortal wounds. The gender differences in choice of suicide method contribute to the large gender differential in suicide attempts versus completions. Why women choose less lethal means than men has been attributed to a number of factors, including intent to die, gender socialization, and easy availability of methods.

Although the number of female firearm suicides eclipsed female poisoning suicides during the 1980s and 1990s, the percentage of women that used firearms remained much lower than that of men [3, 4]. For example, during the 1980s and 1990s, male firearm suicide rates peaked at 13.4/100,000 (in 1990), which was nearly six times higher than the peak rate for female firearm suicides (2.3/100,000 in 1981). Recent statistics indicate that poisoning deaths have

increased among women and now are the most common method used [1].

Gender differences in suicide method are further complicated by age differences that vary across gender. Over the time period 1980–1996, the highest rate of female firearm suicides was found among those 45–54 years old (3.8/100,000); among males, the highest rate of firearm suicide (43.8/100,000) was found among those ages 75–84 years [5]. There are also age differences across gender in other methods of suicide [6].

Besides sex and age, other variables may be relevant to the chosen method of suicide. For example, the rates of suicide methods can vary considerably over different historical periods, which may reflect not only lethality of available methods, but also changes in unemployment rates [7, 8], and cultural acceptance of certain methods [9]. While changes in the rates of various suicide methods have been noted in the literature, little research has examined suicide method at the individual level. Of those that have, most typical are investigations of the factors associated with a particular method of suicide. Kosky and Dundas [10], for example, examined all hanging deaths of individuals under the age of 25 that occurred in Queensland, Australia, during 1995 and 1996 and found employment status, prior suicide threats and attempts, psychiatric illness, and marital separation were correlated with hanging suicides. This approach reveals information about individuals that chose hanging, but not if these suicides differ from suicides that did not choose hanging as their means of death. Moreover, few multivariate analyses have compared method of suicide between men and women. Instead, most studies of suicide method treat gender as a control variable, which cannot illuminate gender differences in risk factors.

The gender differential in suicide has been one of most perplexing and controversial issues in the study of suicidal behavior, largely because of gender biases, which have influenced both theory and research. We believe that one key to rejecting such biases is challenging them with empirical studies that examine all possible factors that could account for these differences. The detailed examination of the type and use of suicide methods is one way to help achieve this end.

The aim of this study, therefore, is to assess gender differences in method and place of suicide by comparing factors relevant to suicide risk across subsamples of men and women. This study is unique insofar that it includes a number of factors that have been found to be correlated with suicide risk, but have not been included in studies that examine suicide method. We examine these factors on risk of various suicide methods controlling for gender, and then across gender. In splitting the sample by gender, we are able to assess if predictors of suicide method work equivalently for women and men. We believe a better understanding

gender differences in suicide method can not only advance the research literature, but also could have important implications for suicide prevention.

Gender differences in method of suicide

A review of the extant literature finds that gender differences in suicide method is usually attributed to one of three reasons. The most common perception is that women are more likely to use less lethal methods because they do not really want to kill themselves. According to this line of reasoning, women who attempt suicide are crying for help and are not really motivated to die [3]. Thus, women are more likely to ingest pills or other toxic substances which increases the probability of intervention. While it is true that method influences lethality [2], some dispute the idea that women use less violent means of suicide because they are not really serious about dying. A psychological autopsy of 141 male and female suicide victims by Denning et al. [11], for example, found no gender differences in intent to die using the Beck Suicide Intent Scale [12]. However, other studies using the same scale found that the intent to die was greater for males than for females [13–15].

The second perspective argues that gender socialization decreases the likelihood that women will own, have access to, or be as familiar with firearms compared to men. This suggests that cultural scripts make it more likely that women turn to other suicide methods such as poisoning or drowning [16, 17]. Because there is no national gun registration system in the US, we cannot accurately ascertain gender differences in gun ownership. Data from the General Social Survey (GSS), however, suggests that approximately 12% of women own guns, especially those who live in rural areas and among those who hunt [18]. Approximately 7.5% of women own handguns, and almost 4% own long guns. Even though women are far less likely to own guns than men, many would have access to firearms owned by males with whom they live. Public health studies, e.g. [19, 20] find that suicide risk is strongly elevated with the presence of firearms in the household. Wintemute et al. [20], for example, examined risk of suicide for those that purchased a handgun in California and found that in the first year after purchasing this weapon, 24.5% committed suicide. Of relevance, 75.4% of the women who bought handguns were between the ages of 21 and 44 years old, and of this subset, fully 51.9% committed suicide within the year after purchasing the gun.

The third explanation for the observed gender disparity in the use of suicide methods centers on women's concern with physical disfigurement of their body [21, 22]. Some have suggested that women prefer to leave a "beautiful corpse" because of societal emphasis on female physical appearance [23]. Others suggest that because women are

more concerned with people's feelings than are men, they are less likely to leave a mutilated corpse for their loved ones to find [24]. Thus, women are more likely to use methods that do not disfigure the face, such as drug poisoning.

Since the data used in this study are of suicide completers, we cannot directly test the impact of factors such as intent to die and other motivations that may have influenced choice of suicide method. We can, however, examine if other factors correlated with gender differences in suicide risk are also relevant to gender differences in suicide method, which has not been done heretofore.

Correlates of suicide risk

There are a number of established correlates of suicide risk that vary by gender that might also be correlated with suicide method. First, studies of those who have attempted suicide and lived, whether it was due to an unsuccessful attempt, interruption, or a change of heart, have found these individuals to be at much higher risk of attempting suicide again [25–27]. Although some studies suggest about one-half of suicide attempters were not serious about ending their lives [28], there still exists a subset of those who intended to die, but survived. Further, follow-up studies of suicide attempters find that those that have tried and failed may be inclined to use a more lethal method in subsequent attempts. One study has found that this varies by gender insofar that men with prior attempts are more apt to use more lethal means in subsequent attempts than are women [29]. Because women in the United States are nearly four times more likely to attempt suicide than men, research on gender differences in suicide method should control for prior suicide attempts.

Second, research has consistently found that depression and mood disorders are highly correlated with suicidal behavior [30]. What remains relatively unknown, however, is whether these conditions are correlated with method of suicide, although the one study to date that has examined this question found no relationship [31]. Because depressive disorders are twice as high among suicidal women as men [32], studies of suicide methods should account for the influence of these conditions.

Some studies have found that being on psychiatric medication increases the odds of killing oneself with these medications [33]. This is relevant to gender differences in suicide method because women are twice as likely to be diagnosed with depression and mood disorders as men [34]. This difference appears in adolescence and continues through adulthood, and is found in many cultures and countries [35]. If women are more likely to be diagnosed, they are also probably more likely to be on psychiatric medications. Studies find that women in the US are much more likely to be prescribed medication for depression than are men [36], thus increasing their odds of suicide by drug poisoning and decreasing their likelihood of suicide by other means. Such findings belong under the aegis of the opportunity theory of suicide that argues availability of suicide method is an important predictor of suicide behaviors [8]. Therefore, studies should examine such differential opportunities by controlling for whether the individual had prescribed psychiatric medications at the time of suicide.

The same can be said of controlling for reported history of substance abuse as this is an important covariate of suicide attempts and completions [28–30] and varies by sex. Studies of completed suicides have found that men have higher rates of substance abuse disorder than women [37], although some studies suggest this gender gap is minimal among younger age suicide decedents [26, 38]. All of these gender differences in correlates of suicide risk present opportunities to disentangle the gender differential in suicide methods.

While gender differences in suicide method have long been noted in the suicide literature, relatively few studies have conducted multivariate analyses on method of suicide risk that included more than socio-demographic variables. One recent exception examined the influence of sex and place of death on suicide method using the population of completed suicides in a 3-year period from one county in southern California [39]. The data used in this study are remarkably similar to those of Kposowa and McElvain's data [39] in terms of dates and sample size, thus allowing for a fairly close replication of their test of the gender differential in suicide methods that controlled for gender, age, marital status and place of suicide.[1]

Their analyses treated gender as a control variable, however, which does not reveal potential gender interactions with other factors that may be correlated with various methods of suicide. The data used in this study makes it possible to assess if other factors are correlated with suicide method, and if these factors might contribute to the gender differential in method of suicide. This study splits the sample by gender and regresses three methods of suicide—firearms, hanging and poisoning—on predictive factors of suicide risk found in the research literature to ascertain if these variables work similarly for men and women in their choice of suicide method. To our knowledge, this approach has not been done to date.

---

[1] The study period of Kposowa and McElvain [39] covered 1998–2001, which is subsumed within our study period, and they collected a similar number of usable cases (643) to the data in this study (621).

Data and method

The data used in the analyses come from the population of suicides over a 10-year period (1997–2006) in Summit County, OH. The information used in our study comes from the Summit County Medical Examiner's Office case files.[2] All suspicious and unusual death scenes, including suicides, are investigated by medico-legal board certified death investigators who must also have a police officer certification or a Bachelor's degree in criminal justice. These investigators examine the death scene, and conduct interviews with people at the scene and later with individuals who might have relevant knowledge of the suicide decedent. The bodies of those who die from suspicious or unusual circumstances are required by Ohio law to be autopsied. The state of Ohio requires that all coroners and medical examiners must be licensed physicians, and must complete 32 h of continuing education every 4 years. The Chief Deputy Medical Examiner of Summit County is an M.D. with years of training in forensic pathology, as are the Deputy Medical Examiners on staff.

The breadth of information contained in the case files allowed for an examination of a wide array of factors. Each case file included an investigation report, medical autopsy, and almost always, a toxicology screen. Most of the information used in the analyses comes from the investigation reports, which are much more detailed than death certificates, and often more accurate, as studies using death certificates often have missing data on key variables, such as gender, e.g. [39]. The reports contain information not only about the method of suicide, but also about the suicide scene, such as the presence of alcohol or other drugs, location of the suicide, and an account of the decedent's activities, disposition, and behavior shortly before death. Current and past mental and physical health status and treatment, substance abuse history, as well as family, employment and legal problems are also reported. The information is obtained from interviews with law enforcement and other first responders to the death scene, family members and other intimates, but could also be later obtained from neighbors, friends, and health care providers.

Every investigative report, including the narrative, toxicology screen and portions of the autopsy report were numerically coded by a team of graduate students and the study authors. The coding schemes were developed on a pilot sample of twenty cases in consultation with the Medical Examiner's Office. Each case was independently coded by at least three members of the research team. Meetings between the coders and the study authors were regularly held so that all cases were reviewed and to resolve any coding disagreements.[3] Items without group consensus were coded as missing. Approximately, 20% of all cases were audited by the study authors to check for accuracy of coding and data entry.

The analyses began with bivariate comparisons of men and women for method and place of suicide. This was followed by three multivariate logistic regression analyses in which each outcome variable was modeled in terms of the odds of decedents using a particular method (coded as 1) and all other methods (coded as 0), controlling for gender, place of suicide, age, race, and marital status.[4] Gender is coded with men as 0 and women as 1. Place of suicide is a categorical variable with four conditions, public place, residence, work place, and hotel/motel; public place is the omitted category. Age is a five category variable (<30, 30–44, 45–54, 55–64, and 65 and older); under 30 is the omitted category. Race is a dichotomous variable with non-White coded as 1 and White coded as zero. Marital status is dichotomized into married (0) and non-married (1).

The remaining logistic regressions split the sample by gender to compare the effects of the above variables and five other variables relevant to suicide risk: living alone, history of substance abuse, prior attempts, history of depression, and being on psychiatric medication at the time of suicide on the three methods of suicide. This information came from family members or others close to the decedent as told to and noted in the report by the death investigator on the scene. Each of the five variables is measured dichotomous, with having the condition coded as 1 and the absence of the condition coded as zero, which served as the omitted categories. If the decedent recently had abused alcohol, prescription drug, and illicit drugs they were coded as having a history of drug abuse.[5] History of depression was seldom a clinical diagnosis as most of this information came from close family members or friends instead of physicians.

Results

Descriptive analyses

Of the 621 confirmed suicides in Summit County, Ohio from 1997 to 2006 480 were male (77.3%) and 141 were

---

[2] IRB approval was obtained from the author's respective universities.

[3] Cohen's Kappa was not estimated given the coding protocol.

[4] Analysis was limited to these three suicide methods because the other methods used had too few cases, which precluded multivariate analyses.

[5] Specific types of substance abuse were not examined due to lack of statistical power.

female (22.7%), which is very close to the gender distribution reported by Kposowa and McElvain (78.2 and 21.8%, respectively), as well as national data from 1999 to 2007 (79.9 and 20.2%, respectively). Given regional differences in the race/ethnicity of populations, comparisons to other areas or even national data are not valid. More than 90% of suicide victims in our sample were White, 7.4% were African American, 0.8% were Asian and 0.6% Hispanic. The study decedents ranged in age from 9 to 91 years old, with a mean age of 45. Twenty-three percent of the suicide decedents in the study sample were under age 30. Those aged 65 or older comprised 18.8% of our cases. Almost 31% were married, over 36% were single, 26.1% were separated, and 6.9% were widowed.

Relevant descriptive information about method and place of suicide is presented in Table 1. Although various methods of suicide are shown in Table 1, subsequent analyses were limited to three (firearms, hanging and poisoning). For both sexes, suicide by use of firearms was the main method of choice and was used in 48.7% of suicides. Hanging was the second most common method (21.4%). Only 10.3% of our sample committed suicide by poisoning. Fewer than 10% of the sample chose carbon monoxide poisoning, jumping from heights, suffocation, or other methods, which included cutting ($n = 7$), putting oneself in front of a train ($n = 11$), and setting oneself on fire ($n = 8$).

Table 1 Differences in method and place of suicide between men and women

	Men	Women	Total
Method of suicide			
Hanging or strangulation	23.1 (111)	15.6 (22)	21.4 (33)
Use of firearms	51.8 (249)	38.3** (54)	48.7 (303)
Poisoning	6.9 (33)	22.0*** (31)	10.3 (64)
Carbon monoxide (CO)	5.6 (27)	6.4 (9)	5.8 (36)
Suffocation	2.1 (10)	5.0 (7)	2.7 (17)
Jump from high place	5.2 (25)	5.7 (8)	5.3 (33)
Other	5.4 (26)	7.1 (10)	5.8 (36)
Total	100.0 (481)	100.0 (141)	100.0 (622)
Place of suicide			
House	78.3 (376)	80.9 (114)	78.9 (490)
Place of business	2.3 (11)	0.7 (1)	1.9 (12)
Public area	17.1 (82)	16.3 (23)	16.9 (105)
Hotel/motel	1.9 (9)	2.1 (3)	1.9 (12)
Other non-public area	0.4 (2)	0 (0)	0.3 (2)
Total	100.0 (480)	100.0 (141)	100.0 (621)

The values are in percentage

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

As expected, there were gender differences in the method of suicide. Although the use of firearms was the most popular method for both men and women, 51.8% of men committed suicide with a firearm ($n = 249$), but only 38.3% ($n = 54$) of women used this method.[6] With respect to the use of long guns versus handguns, we found that although men were more than twice as likely to use long guns as women (22.4 and 11.3%, respectively), both men and women were much more likely to use handguns (77.6 and 88.7%, respectively); these gender differences in type of gun used were not statistically significant. The second most common method among men was hanging (23.1%), followed by poisoning (6.9%). Unlike men, women's second preferred method was poisoning (22.0%), followed by hanging (15.6%).

As shown in Table 1, most suicides occurred at home (78.9%). The second most common place of suicide was in a public area (park or wooded area, bridge, or other public place), which constituted 16.9% of cases; followed by place of business and hotel/motel. There were no significant gender differences in place of suicide. Fewer women committed suicide at a place of business (0.7%) compared to men (2.3%), but among both sexes, this place of death was rare.

Whereas 63.4% of men and 65.0% of women in the southern California sample study died at home, 78.3% of men and 80.9% of women in our Ohio sample committed suicide at home. The differences between the samples may be attributed to differences in coding. Kposowa and McElvain [39] reported place of death in their descriptive statistics, whereas our study records place of suicide. These are not synonymous inasmuch as some of those who commit suicide at home actually die while en route to or at a hospital.[7] Whereas place of death may be important regarding such questions as the efficacy of medical care in specific locations [42], the location of suicide attempt is more properly the focus for analyses of gender, method, and place of suicide.

Although not shown, we also examined gender differences in suicide method and place of suicide conditioned

---

[6] The percentage of men who used firearms to suicide in Summit County during the period 1997–2006 was lower than the percentage of male firearm suicides for the entire state for that time period (51.7 and 57.8%, respectively), whereas the percentage of female suicides in the county who used firearms was higher than female firearm suicides in the state (38.3 and 31.4%, respectively). Of interest, firearms remain the most common means of suicide for females in our population, similar to earlier trends reported by Kaplan et al. [40], but different from more recent statistics that show poisoning has once again become the most common method among women in Ohio (40.3%) as well as the United States (34.6%) [41].

[7] If we remove the cases that died in the hospital, 76.1% of their sample committed suicide at home (408/536), which was very close to the percent of cases in our sample that committed suicide at home.

by age. Of relevance, men 65 and older were nearly twice as likely to use firearms as women in this age category (79.2 vs. 41.2%, respectively). There were also age and gender interactions among those who committed suicide by hanging or poisoning. More than twice as many men between the ages of 30–64 hanged themselves compared to women in this age group (23.0 vs. 10.1%, respectively). In contrast, women between the ages of 30 and 64 were almost three times as likely as men in this age group to use drug poisoning (26.3 and 9.6%, respectively).

There were significant gender and age interactions in place of suicide. Men ages 30–64 were somewhat less likely to commit suicide at home compared to women in this age category; conversely, men 65 and older were more likely to commit suicide at home (95.0%) than women 65 and older (76.5%). Only 4.0% of men ages 65 and older committed suicide in a public place compared to 23.5% of women in this age group.

Multivariate analyses

The first set of logistic regressions examines the risk (odds) of suicide by a given method (for example, hanging) as a function of gender and place of suicide. In these analyses, we controlled for age, race and marital status. Multicollinearity was assessed with variance inflation factors (VIF) and tolerance tests, which did not indicate problems with multicollinearity.[8]

Table 2 presents the logistic regression results. With respect to firearm suicides, women were less likely to use this method, net of other factors; (OR 0.557; CI 0.369, 0.841). Additionally, firearm suicides were more likely to occur among older individuals. Specifically, the odds of those 65 and older of committing firearm suicide were three times higher than the odds of those under 30 (OR 3.097; CI 1.752, 5.474). Non-married individuals were less likely to use firearms than those who were married (OR 0.541; CI 0.364, 0.806), and the odds of committing suicide with a firearm in the home were almost twice as high as the odds of committing firearm suicide in a public place.

Women were less likely to commit suicide by hanging compared to men (OR 0.570; CI 0.334, 0.971), which departs from Kposowa and McElvain, who did not find a gender differential. The odds of non-Whites using hanging to suicide were considerably lower than the odds of Whites (OR 0.385; CI 0.168, 0.882). The odds of suicide by hanging decrease with every increase in age category, and

it is more likely to occur in the home compared to public places.

Women were far more likely than men to use drug poisoning to suicide. More specifically, the odds of women using this method of suicide were almost 3.5 times higher than the odds of men (OR 3.486; CI 1.978, 6.143), net of other factors. Poisoning suicides also were higher for those ages 30–54 compared to those under 30. The odds of suicide by poisoning were also related to place. Those who poisoned themselves were far more likely to have done so at home (OR 7.027; 1.653, 29.879), or at a hotel or motel (OR 18.571; CI 2.503, 137.759) compared to the odds of those who poisoned themselves in a public place.

The remaining analyses go beyond most studies of gender differences in suicide method by including other variables that are relevant to gender differences in suicide risk. These additional variables are living alone, history of depression, history of substance abuse, prior suicide attempts, and being on psychiatric medication at the time of the suicide; all are dichotomous variables with 1 indicating presence of the condition and zero the absence. Given wide confidence intervals for some categories of place of suicide, place of suicide was recoded into a dichotomous variable with residence coded as 1 and all other places coded as zero. The first set of analyses includes gender as a control variable in the models.

As seen in Table 3, when these additional variables are introduced, the gender difference in firearm suicides was rendered non-significant, but the effects of age, marital status, and place of suicide retained statistical significance. The only added variable that impacted firearm suicides was prior attempts. That is, the odds of using a firearm to suicide were about half the odds for those with prior attempts than those without prior suicide attempts (OR 0.497; CI 0.298, 0.898).

When the additional variables were added to the model for hanging suicides, all of the coefficients, including gender, retained statistical significance. Like firearm suicides, the only additional factor that impacted suicide by hanging was prior attempts, but unlike firearm suicides, prior attempts increased the odds of hanging (the odds ratios were 2.5 times higher). Finally, place of suicide is rendered insignificant for poisoning suicides when the additional variables are introduced, but gender and age retain statistical significance. Being on psychiatric medication, however, significantly increased the odds of poisoning suicides (OR 4.281; CI 1.919, 9.549).

In order to examine the potential impact of gender interactions with other factors related to suicide risk on the three methods of suicide, the sample was split by gender. To ascertain if the odds ratios for a particular covariate are equivalent across gender, we computed z scores and

---

[8] Although VIF and tolerance are normally associated with tests of multicollinearity of OLS regression models, as Menard [43] argues, [since] "the concern is with the relationship among the independent variables, the functional form of the model for the dependent variable is irrelevant to the estimation of collinearity" (p. 76).

Table 2 Logistic regression estimates of the effect of gender on methods of suicide

Variable	Firearm		Hanging		Poison	
	OR	95% CI	OR	95% CI	OR	95% CI
Female	0.557**	0.369, 0.841	0.570*	0.334, 0.971	3.486***	1.978, 6.143
Age						
30–44	0.713	0.435, 1.168	0.454**	0.267, 0.772	3.153*	1.202, 8.270
45–54	1.194	0.709, 2.011	0.338***	0.184, 0.620	4.908**	1.831, 13.152
55–64	1.929	0.992, 3.752	0.200***	0.081, 0.493	2.259	0.662, 7.711
65 and over	3.097***	1.752, 5.474	0.066***	0.026, 0.167	1.338	0.403, 4.442
Not married	0.541**	0.364, 0.806	1.296	0.764, 2.197	1.828	0.940, 3.555
Non-White	1.709	0.932, 3.134	0.385*	0.168, 0.882	0.957	0.308, 2.978
Place of suicide						
Residence	1.887**	1.172, 3.037	3.770***	1.839, 7.730	7.027**	1.653, 29.879
Work place	0.600	0.146, 2.455	4.993*	1.216, 20.496	–	–
Hotel/motel	0.515	0.118, 2.238	2.506	0.457, 13.750	18.571***	2.503, 137.759
Intercept	0.775		0.216***		0.003***	
Nagelkerke R^2	0.162		0.190		0.188	

OR odds ratio

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Table 3 Odds ratios and confidence intervals of the effects of gender, place of suicide, and other factors on method of suicide

Variable	Firearm ($n = 302$)		Hanging ($n = 133$)		Poison ($n = 64$)	
	OR	95% CI	OR	95% CI	OR	95% CI
Female	0.652	0.409, 1.040	0.480*	0.263, 0.877	3.645***	1.873, 7.093
Age						
30–44	0.925	0.520, 1.644	0.395**	0.213, 0.733	4.897**	1.506, 15.922
45–54	1.531	0.830, 2.823	0.305***	0.151, 0.612	5.903**	1.757, 19.824
55–64	2.855**	1.302, 6.264	0.248**	0.094, 0.658	2.521	0.558, 11.390
65 and over	3.471***	1.752, 6.878	0.088***	0.032, 0.237	2.289	0.542, 9.674
Not married	0.562**	0.349, 0.906	1.402	0.779, 2.523	2.119	0.953, 4.709
Non-White	1.790	0.887, 3.613	0.408*	0.171, 0.974	0.870	0.248, 3.060
Suicide at residence	2.367***	1.376, 4.073	2.504***	1.221, 5.133	1.985	0.657, 5.991
Lived alone	0.833	0.501, 1.385	0.629	0.330, 1.198	1.715	0.809, 3.636
Drug abuse	0.808	0.504, 1.296	1.020	0.559, 1.735	1.813	0.904, 3.635
Prior attempts	0.497**	0.298, 0.828	2.556***	1.455, 4.493	1.312	0.639, 2.694
History of depression	0.945	0.631, 1.415	0.935	0.571, 1.532	0.967	0.499, 1.876
On psychiatric meds	0.546	0.292, 1.023	0.786	0.367, 1.683	4.281***	1.919, 9.549
Intercept	0.689		0.314**		0.004***	
Nagelkerke R^2	0.196	0.220	0.214			

OR odds ratio

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

associated probabilities that the odds ratios for men and women were significantly different,[9] see [44].

As seen in Table 4, for both sexes, the odds of committing suicide with firearms increase among those ages 45 and older but the gender gap is largest among the oldest

suicides. The odds for men 65 and older were almost four times greater than the odds for men under 30 (OR 3.74), but the odds for women 65 and older were about twice as high as women under 30 (OR 2.27); this gender difference is marginally significant (z score = −1.613, $p < 0.10$). There were also other gender interactions on the likelihood of firearm suicide. Men were more likely to commit suicide

---

[9] $Z = (b_1 - b_2)/\sqrt{(SEb_1^2 + SEb_2^2)}$.

Table 4 Odds ratios and confidence intervals of firearms suicides by gender

Variable	Men (n = 248)		Women (n = 54)		z score
	OR	95% CI	OR	95% CI	
Age					
30–44	0.965	0.503, 1.852	0.828	0.221, 3.110	−1.156
45–54	1.160	0.571, 2.356	2.994±	0.816, 10.991	−0.063
55–64	2.742*	1.079, 6.967	3.921	0.732, 21.010	−0.800
65 and older	3.735***	1.736, 8.032	2.273	0.425, 12.146	−1.613±
Not married	0.529*	0.302, 0.926	0.900	0.307, 2.637	−0.382
Non-White	1.614	0.720, 3.616	2.111	0.425, 10.484	−0.840
Suicide at residence	2.490**	1.351, 4.590	1.159	0.303, 4.440	−1.763*
Lived alone	1.015	0.577, 1.099	0.391	0.101, 1.509	−1.943*
History of drug abuse	0.840	0.492, 1.432	0.851	0.280, 2.593	−0.903
Prior attempts	0.586±	0.312, 1.099	0.364*	0.138, 0.957	−1.380±
History of depression	1.020	0.638, 1.629	0.806	0.339, 1.915	−1.060
Psychiatric medication	0.442*	0.213, 0.999	0.829	0.206, 3.328	−0.412
Intercept	0.658		0.721		
Nagelkerke R^2	0.206		0.208		

OR odds ratio

± $p \leq 0.10$, * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Table 5 Odds ratios and confidence intervals of hanging suicides by gender

Variable	Men (n = 111)		Women (n = 22)		z score
	OR	95% CI	OR	95% CI	
Age					
30–44	0.524±	0.263, 1.043	0.126**	0.028, 0.563	−2.480**
45–54	0.452*	0.210, 0.971	0.045**	0.007, 0.308	−3.473***
55–64	0.377±	0.129, 1.107	0.037*	0.003, 0.487	−3.690***
65 and older	0.120***	0.041, 0.353	0.054*	0.004, 0.698	−2.152**
Not married	2.218*	1.129, 4.359	0.364	0.086, 1.533	−2.845***
Non-White	0.428±	0.166, 1.101	0.509	0.041, 6.273	−1.154
Suicide at residence	–	–	–	–	–
Lived alone	0.502±	0.249, 1.012	2.463	0.385, 15.744	−0.847
History of drug abuse	1.070	0.597, 1.918	1.234	0.324, 4.695	−0.712
Prior attempts	2.719**	1.426, 5.184	3.563*	1.024, 12.397	0.447
History of depression	1.066	0.628, 1.809	0.470	0.142, 1.551	−1.756*
Psychiatric medication	–	–	–	–	–
Intercept	0.366		1.909		
Nagelkerke R^2	0.213		0.317		

OR odds ratio

± $p \leq 0.10$, * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

in a residence (OR 2.49) than elsewhere, and were more likely to live alone than women. Among both sexes, the odds of using a firearm to suicide were significantly lower among those who had prior suicide attempts than those who did not (OR 0.442 for men and 0.364 for women), but women with prior attempts were slightly less likely than men to use a firearm (z score = −1.380, p < 0.10).

Table 5 presents the logistic regression coefficients and corresponding odds ratios for suicide by hanging among men and women. Place of suicide and being on psychiatric

Table 6 Odds ratios and confidence intervals of poisoning suicides by gender

Variables	Men ($n = 33$)		Women ($n = 31$)		z score
	OR	95% CI	OR	95% CI	
Age					
30–44	3.628	0.700, 18.798	7.002*	1.113, 44.049	−0.676
45–54	8.639**	1.684, 44.323	3.410	0.500, 23.237	−2.276**
55–64	3.448	0.410, 28.982	1.424	0.150, 13.502	−2.380**
65 and older	2.834	0.439, 18.315	1.339	0.109, 16.490	−2.244*
Not married	2.068	0.727, 5.886	1.923	0.509, 7.269	−1.174
Non-White	0.388	0.038, 3.994	1.468	0.245, 8.789	−0.119
Suicide at residence	1.621	0.440, 5.975	3.714	0.393, 35.144	−0.517
Lived alone	1.682	0.655, 4.317	3.102	0.711, 13.532	−0.498
History of drug abuse	2.781*	1.129, 6.853	0.985	0.270, 3.603	−2.100*
Prior attempts	0.805	0.261, 2.480	2.221	0.702, 7.028	−0.063
History of depression	0.839	0.345, 2.041	0.922	0.298, 2.847	−0.921
On psychiatric meds	5.291***	1.925, 14.450	5.296*	1.046, 26.815	−1.158
Intercept	0.004***		0.007**		
Nagelkerke R^2	0.191		0.234		

OR odds ratio, *CI* confidence interval

$^{\pm}$ $p \leq 0.10$, * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

medication were excluded from the analyses because none of the women in this subset hanged themselves outside of a residence or were on psychiatric medications. To make relevant comparisons, these variables were also excluded from the regression conducted on the male subsample.[10]

The odds of committing suicide by hanging decreased with age for both sexes, but had more of an effect on women. As seen in Table 5, for every age category above 30, the odds of women committing suicide by hanging were lower than the odds for men. Further, marital status is relevant and shows significant gender interaction. That is, men who were not married were more likely to hang themselves than married men, whereas unmarried women were less likely to use hanging than women who were married (OR 2.218 and 0.364, respectively; z score = −2.845, $p < 0.001$). Prior attempts increased the odds of hanging for both men and women; there were no statistical gender differences in the effect of prior attempts.

Table 6 displays the logistic regression coefficients and associated odds ratios for men and women that used poison to suicide. One of the largest predictors is age; between both genders, the odds of using poisoning are higher for those ages 30 and older. Among women, however, the odds are significantly lower than the odds for men ages 45 and older. For example, men between the ages of 45 and 54 are more likely to use poison themselves than men under 30

(OR 8.639); this effect was twice as large as it was among women (OR 3.410); z score = −2.276, $p < 0.01$. Men with a reported history of drug and/or alcohol abuse were more likely to suicide by poisoning than men without such a history (OR 2.781), but substance abuse history had no bearing on women's use of poisoning to suicide (z score for differences in OR −2.100, $p < 0.05$). Finally, both men and women that were on psychiatric medications at the time of suicide were significantly more likely to suicide by poisoning than those who were not on psychiatric medications (OR 5.291 for men and 5.296 for women).

Because the odds of suicide by poisoning are elevated for those who are on psychiatric medications at the time of death, we attempted to ascertain if level of psychiatric supervision moderated this relationship. Importantly, we found (not shown) that the odds of committing suicide by poisoning for those who are taking psychiatric medications while under psychiatric outpatient care are no greater than the odds of those who are taking medications but not under psychiatric supervision.

Discussion

Using data gleaned from the case files of deaths ruled as suicide by the Summit County Medical Examiner's Office, we extended prior research on suicide populations with detailed information on prior suicide attempts, living arrangements, reported mental health, history of substance abuse, and being on psychiatric medication. While many of

---

[10] A model was run on the male subsample that included these factors, but neither place of suicide or being on psychiatric medication was related to suicide hangings among men.

these factors operated similarly for men and women, there were several important gender differences.

This study found that firearms are the most common method of suicide for both men and women. While this is not a surprising result for male suicides, this differs from Kposowa and McElvain [39] who found that firearm suicide was the second most common suicide method among women (roughly 26%), whereas poisoning was the most common method. In contrast, over 38% of female suicides in our sample were committed by firearms, making it the most common method employed, but still much lower than the percentage of male firearm suicides. Since our data come from Summit County, Ohio and theirs from southern California, this raises the possibility of regional differences in suicide methods for women but to our knowledge, no study has been published that examines gender differences in suicide methods by state.[11]

We also found a significant gender difference in suicide by hanging or strangulation; net of other factors, the odds of women using this method were half that of the odds for men. Women were far more likely to suicide by drug poisoning than men, although nearly twice the proportion of women used this method in southern California as women in Summit County, OH (40 and 22%, respectively).

Our study also confirmed the age differences in suicide method noted by prior studies [40, 46]. The risk of suicide by hanging decreases with age for both men and women, perhaps reflective of the physical exertion required to commit suicide in this manner. Conversely, the risk of firearm suicide increases with age, and even more so for older men. Finally, the risk of suicide by drug poisoning is lowest among those under 30, irrespective of gender.

We also found significant gender and age interactions across all suicide methods. The odds of firearm suicide were high among both women and men 65 and older, but were significantly higher for men than for women. Suicide by hanging decreased with age for both genders, but this decrease was even greater for women than it was for men. Last, the odds of using poison to suicide were higher for both men and women 45 and older, but even higher for men than for women.

The results also indicate method of suicide differs by place. We found that individuals are more likely to suicide at home than in a public place, irrespective of method. This consistent finding punctuates the importance of the home as a focus of preventive strategies. For example, suicide research has established that the odds of firearm suicide are elevated with the presence of a gun in the home [47, 48].

Given the extraordinarily high rates of suicide among older males, and also that the highest rates of firearm suicides are found among older women, prevention efforts that target warnings to this age group about the risk associated with the presence of firearms in the home might reap significant results [46]. There is research that suggests that the elimination of first-choice method may not necessarily lead suicidal individuals to substitute a second method [49, 50; but see 51]. Employees of agencies and organizations that serve the at-home elderly population should be educated to assess the risk to occupants with firearms in the home. The restriction of access to firearms, however, must be weighed against the personal protection concerns of this group, a rapidly growing segment of the US population.

Not all suicide methods are as easily addressed. Hanging, one of more lethal methods, was employed by more than one-fifth of the suicides in this study. In any given location, there are numerous materials such as ropes, cords, and fabric from which a ligature can be fashioned, as there are several structures from which a ligature can be suspended. Suicide prevention in such cases is thus a greater challenge, and it may be that it should focus on identifying and addressing mental health symptoms or other etiological factors.

For both women and men, being on psychiatric medications was a significant predictor of suicide by drug poisoning. Because we did not have information from the prescribing doctor, we could not ascertain if the prescribed drugs were those that killed the decedent. However, even if we had these data, we would not be able to distill whether taking psychotropic drugs elevates the risk of suicidal ideation and subsequent action, as discussed by Pomerantz [52], or if the prescription drug simply provided a means to an end. Although recent research tends to find that antidepressants reduces the risk of suicidal ideation [53–55], it may also provide a greater risk for suicide by these medications. Future research should attempt to disentangle these risks [56]. Regardless, mental health professionals already recognize the important role they can play in working with primary care physicians and psychiatrists who prescribe psychotropic medications [57].

Given the relationship between being on psychiatric medication and committing suicide with poison, at least some preventive implications are clear. Those living with, or caring for individuals on psychiatric medications should consider restricting access to the available supply. This is routinely used effectively in institutional settings and, like firearms, could help restrict access to easy means. Likewise, other available poisons such as cleaning solvents could be locked away until needed. Although such measures may seem extreme, "suicide-proofing" a household, much like "child-proofing," may save lives. This is particularly true for women, who are much more likely than

---

[11] Kaplan and Geling [45] found that female firearm suicide rates were higher in the Pacific region that included California than in the East North Central region that included Ohio. But aggregating data by region may obscure differences in firearm ownership, possession and use that could vary by state or smaller geographic areas.

men to have been prescribed medications for psychiatric problems [36], although that was not the case for the study sample.

Prior suicide attempts emerged as a puzzling variable in these analyses. Both men and women who used firearms to suicide were significantly less likely to have had prior suicide attempts. We also found the opposite to be true of suicide by hanging: prior attempts increased the odds of using this method of suicide. Exactly why this occurs cannot be discerned from our data, but there are a couple of possible explanations that future studies could explore. It could be that attempters who are not resolute about taking their lives avoid the use of firearms, a highly lethal method. Hanging might be considered by those who attempt suicide multiple times as a method from which they might survive, as they have in the past. Conversely, those who are extremely serious about ending their lives undertake a single attempt that employs lethal means such as firearms. Interviews with attempters could reveal the reasons for their choice of method, and detailed psychological autopsies might shed light on such rationales for completers.

Being married and committing the suicide at home increased the odds of firearm suicide among men, but these factors had no influence on female firearm suicides. Among women, the odds of committing firearm suicide were lower for those who lived alone, but living situation had no influence on firearm suicides among men. With respect to hanging, unmarried men were much more likely to use this method than married men were, but there was no relationship between marital status and suicide by hanging among women. Finally, men who had a history of substance abuse were somewhat more likely to suicide by drug poisoning than men without substance abuse histories; there was no relationship between substance abuse history and drug poisoning among women.

Other variables might help explain gender differentials in suicide that were not part of this analysis. Physiological factors, for example, could dictate in part the choice of method. Specifically, if women are more likely to have shorter arms, and long arms are a prerequisite for pulling the trigger on a shotgun or rifle, then it follows that women may be more likely to choose handguns. Much the same argument can be made for caliber of weapons used to commit suicide. Is it possible, for instance, that women are more likely to use smaller caliber handguns (e.g., .22 or .25), whereas men seem to favor larger calibers (e.g., 9 mm or 0.357)? Data such as those available through the National Violent Death Reporting System may facilitate the examination of such questions.

The social learning of suicide through popular culture may also play a role in the gender differential. In films, men are far more likely to use firearms than are women [58]. Alternatively, women are frequently depicted poisoning themselves. Inasmuch as social behavior mimics cinematic behavior, we perhaps should not be surprised at such differentials.

There are a number of limitations of this study that should be noted. The data cover just 10 years of suicide in an urban county located in the North Central region of the United States, which do not permit us to make inferences regarding suicides in other geographic regions or to time periods outside 1997–2006. If we think that changing gender roles over time could account for greater use of firearms by women committing suicide, then it would be instructive to examine data covering several decades. Such a longitudinal look at gender and suicide method might help identify certain sociological variables, such as labor force participation, related to changes in female firearm suicides.

As rich as the data from the medical examiner were, they presented limitations. For one, these did not include certain types of information that could have theoretical or practical importance. For example, the documents we used did not consistently record who owned the firearm or exactly where and how it was stored, precluding analyses with this information. Future studies should attempt to ascertain the specifics of ownership, possession, and storage because limiting the accessibility of firearms is important [39, 59]. This is particularly true in the case for older men. It has been argued that removing firearms from the households of older adults would prevent suicides [30]. There is research, which suggests that the elimination of first-choice method may not necessarily lead suicidal individuals to substitute a second method [49, 50]. If a firearm is not easily accessible when the individual decides to commit suicide, the lack of preferred method could result in saving a life.

It must be noted that the analysis of suicide by drug poisoning is particularly problematic. Classification of a drug poisoning death as suicide, accidental, or undetermined is controversial inasmuch as it could be a social construction, which perpetuates gendered explanations. For example, recent research suggests potential misclassification of suicides may account for apparent racial and ethnic gaps in suicide [60]. Gender differences, therefore, might attenuate or disappear if the true cause of death is known.

Finally, the data regarding psychological problems such as substance abuse and depression must be interpreted with caution since they are not clinical diagnoses but information gleaned from family and friends. While this may introduce error into our measures, we argue that much gained from analyses that use such data. These data allow us to examine those labeled as substance abusers or suffering from depression by lay people, which can add to the literature. Studies of mental health problems and suicide

completers have typically used samples of clinically diagnosed individuals, e.g. [61, 62]. Thus, studies such as ours may shed light on individuals who appear to have mental health problems that did not seek treatment. Moreover, this approach is also justified given the gender, race, class, and age differentials in seeking treatment for mental health problems [63, 64].

A richer picture of the interrelationship among gender, suicide method and other variables could be painted with data such as those collected through psychological autopsies. Despite the challenges inherent in an approach that relies on contacting survivors and other informants [65, 66], it is possible that these kinds of data would permit the analyst to tease out subtleties not discernable with death certificate or medical examiner data alone. For example, it may be that mental health diagnosis and treatment history figure significantly in the interplay between gender and selection of suicide method. Alternatively, it is possible that romantic relationship status, again not part of typical archival data sources on suicide, plays a role in the selection of suicide method. All these questions argue for the concatenation of multiple, individual-level datasets in order to expand the analytical possibilities and develop a fuller understanding of suicide.

Finally, this study also illustrates the importance of examining gender differences, not merely controlling for gender. We found several variables that operated differently for men and women; treating gender as a control variable masked these differences and often rendered other factors insignificant. This is of particular importance for understanding women's suicide behaviors. Since women are far less likely to commit suicide than men are, data sets of completed suicides will have far more men than women. Thus, analyses that merely control for gender will more likely reflect predictors that are relevant for men, but may not be for women, and could lead to erroneous prevention strategies and policies. Clearly, suicide research would greatly benefit from unpacking the relationships between suicide behavior and gender.

This study reinforces not only the importance of replication in science, but also the role of social science in the service of suicide prevention and education. It is through this approach that we will get closer to research findings that help reduce the incidence and prevalence of suicide.

References

1. Centers for Disease Control and Prevention (2009) Suicide fact sheet http://www.cdc.gov/violenceprevention/pdf/Suicide-FactSheet-a.pdf. Accessed 8 Dec 2009

2. Krug EG, Dahlberg LL, Mercy JA, Zwi AB, Lozano R (2002) World report on violence and health. World Health Organization, Geneva

3. Moscicki E (1994) Gender differences in completed and attempted suicides. Ann Epidemiol 4:152–158

4. Cannetto SS, Lester D (1995) The epidemiology of women's suicidal behavior. In: Canetto SS, Lester D (eds) Women and suicidal behavior. Springer, New York, pp 35–57

5. Romero MP, Wintemute GJ (2002) The epidemiology of firearm suicide in the United States. J Urban Health 79:39–48

6. Tadros G, Salib E (2000) Age and methods in fatal self harm (FSH). Is there a link? Int J Geriatr Psychiatry 15:848–852

7. Cantor C, Neulinger K (2000) The epidemiology of suicide and attempted suicide among young Australians. Aust N Z J Psychiatry 34:370–387

8. Stack S (2000) Suicide: a 15-year review of the sociological literature. Part I: cultural and economic factors. Suicide Life Threat Behav 30:145–162

9. Marks MS, Geling O (1999) Sociodemographic and geographic patterns of firearm suicide in the United States, 1989–1993. Health Place 5:179–185

10. Kosky RJ, Dundas P (2000) Death by hanging: implications for prevention of an important method of youth suicide. Aust N Z J Psychiatry 34:836–841

11. Denning DG, Conwell Y, King D, Cox C (2000) Method choice, intent and gender in completed suicide. Suicide Life Threat Behav 30:282–288

12. Beck AT, Schuyler D, Herman I (1974) Development of suicidal intent scales. In: Beck AT, Resnick HLP, Letteri DJ (eds) The prediction of suicide. Charles Press, Bowie, pp 45–46

13. Haw C, Hawton K, Houston K, Townsend E (2003) Correlates of relative lethality and suicidal intent among deliberate self-harm patients. Suicide Life Threat Behav 33:353–364

14. Nock MK, Kessler RC (2006) Prevalence of and risk factors for suicide attempts versus suicide gestures: analysis of the National Comorbidity Survey. J Abnorm Psychol 115:616–623

15. Townsend E, Hawton K, Harriss L, Bale E, Bond A (2001) Substances used in deliberate self-poisoning 1985–1997: trends and associations with age, gender, repetition and suicide intent. Soc Psychiatry Psychiatr Epidemiol 36:228–234

16. Cannetto SS, Sakinofsky I (1998) The gender paradox in suicide. Suicide Life Threat Behav 28:1–23

17. McIntosh JL, Santos JF (1982) Changing patterns in methods of suicide by race and sex. Suicide Life Threat Behav 12:221–233

18. Smith TW, Smith RJ (1995) Changes in firearm ownership among women, 1980–1994. J Crim Law Criminol 86:133–149

19. Kellermann AL, Rivara FP, Somes G, Reay DT, Francisco J, Banton JG, Prodzinski J, Fligner C, Hackman BB (1992) Suicide in the home in relation to gun ownership. N Engl J Med 327:467–472

20. Wintemute GJ, Parham CA, Beaumont JJ, Wright M, Drake C (1999) Mortality among recent purchasers of handguns. N Engl J Med 341:1583–1589

21. Lester D (2000) Why people kill themselves. Charles Thomas, Springfield

22. Stack S, Wasserman I (2009) Gender and suicide risk: the role of wound site. Suicide Life Threat Behav 39:13–20

23. Schmeling A, Strauch H, Rothschild MA (2001) Female suicides in Berlin with the use of firearms. Forensic Sci Int 124:178–181

24. Kaplan AG, Klein RB (1989) Women and suicide. In: Jacobs D, Brown HN (eds) Suicide: understanding and responding: Harvard Medical School perspectives. International Universities Press, Madison, pp 257–282

25. Barber ME, Marzuk PM, Leon AC, Portera L (1998) Aborted suicide attempts: a new classification of suicidal behavior. Am J Psychiatry 155:385–389

26. Rich CL, Ricketts JE, Fowler RC, Young D (1988) Some differences between men and women who commit suicide. Am J Psychiatry 145:718–722

27. Steer RA, Beck AT, Garrison B, Lester D (1988) Eventual suicide in interrupted and uninterrupted attempters: a challenge to the cry-for-help hypothesis. Suicide Life Threat Behav 18:119–128

28. Kessler RC, Borges G, Walters EE (1999) Prevalence of and risk factors for lifetime suicide attempts in the National Comorbidity Survey. Arch Gen Psychiatry 56:617–626

29. Skogman K, Alsen M, Ojehagan A (2004) Sex differences in risk factors for suicide after attempted suicide: a follow-up study of 1052 suicide attempters. Soc Psychiatry Psychiatr Epidemiol 39:113–120

30. Conwell Y, Brent D (1995) Suicide and aging: I. Patterns of psychiatric diagnosis. Int Psychogeriatr 7:149–181

31. Grava G, Ceroni GB, Rucci P, Scudellari P (2006) Suicidal behavior and personality structure. Suicide Life Threat Behav 36:569–577

32. Kessler RC, McGonagle KA, Zhao S, Nelson CB, Hughes M, Eschleman S et al (1994) Lifetime and 12-month prevalence of DSM-III-R psychiatric disorders in the United States: results from a national comorbidity survey. Arch Gen Psychiatry 51:8–19

33. Jick SS, Dean AD, Jick H (1995) Antidepressants and suicide. Br Med J 310:315–318

34. Cyranowski JM, Frank E, Young E, Shear K (2000) Adolescent onset of the of the gender difference in lifetime rates of major depression. Arch Gen Psychiatry 57:21–27

35. Hankin BL, Abramson LY (2001) Development of gender differences in depression: An elaborated cognitive vulnerability-transactional stress theory. Psychol Bull 127:773–796

36. Norman J (2004) Gender bias in the diagnosis and treatment of depression. Int J Ment Health 33:32–43

37. Henrikksson MM, Hellivi MA, Marttunen MJ, Heikkinnen ME, Isometsa ET, Kuoppasalmi KI, Lonnqvist JK (1993) Mental disorders and comorbidity in suicide. Am J Psychiatry 150:935–940

38. Martunnen MJ, Henriksson MM, Hillevi MA, Heikkinen ME, Isometsa ET, Lonnqvist JK (1995) Suicide among female youth: Characteristics and comparisons with males in age groups 13 to 22 years. J Am Acad Child Adolesc Psychiatry 34:1297–1307

39. Kposowa AJ, McElvain JP (2006) Gender, place, and method of suicide. Soc Psychiatry Psychiatr Epidemiol 41:435–443

40. Kaplan MS, Adamek ME, Geling O, Calderon A (1997) Firearm suicide among older women in the U.S. Soc Sci Med 44:1427–1430

41. Centers for Disease Control and Prevention (2009) WISQARS injury mortality reports. http://www.cdc.gov/injury/wisqars/. Accessed 3 Oct 2010

42. Rawlinson C, Crews P (2003) Access to quality health services in rural areas. Emergency medical services. Rural Healthy People 2010: a companion document to healthy people 2010. The Texas A&M University System Health Science Center, School of Rural Public Health, Southwest Rural Health Research Center, College Station

43. Menard SW (2002) Applied logistic regression analysis, 2nd edn. Sage, Thousand Oaks

44. Altman DG, Bland JM (2003) Interaction revisited: the difference between two estimates. Br Med J 326:219

45. Kaplan MS, Geling O (1998) Firearm suicides and homicides in the United States: regional variations and patterns of gun ownership. Soc Sci Med 46:1227–1233

46. Conwell Y, Duberstein PR, Connor K, Eberly S, Cox C, Caine ED (2002) Access to firearms and risk for suicide in middle-aged and older adults. Am J Geriatr Psychiatry 10:407–416

47. Dahlberg LL, Ikeda RM, Kresnow M (2004) Guns in the home and risk of a violent death in the home: Findings from a national survey. Am J Epidemiol 160:929–936

48. Kellermann AL, Somes G, Rivara FP, Lee RK, Vanton JG (1998) Injuries and deaths due to firearms in the home. J Trauma 45:263–267

49. Kreitman N, Platt S (1984) Suicide, unemployment, and domestic gas detoxification in Britain. J Epidemiol Community Health 38:1–6

50. Lester D (1990) The effects of detoxification of domestic gas on suicide in the United States. Am J Public Health 80:1–2

51. Daigle MS (2005) Suicide prevention through means restriction: assessing the risk of substitution. A critical review and synthesis. Accid Anal Prev 37:625–632

52. Pomerantz JM (2008) FDA warning about suicidality: Balancing risk and benefit. Drug Benefit Trends 20:149–150

53. Brent D (2007) Antidepressant and suicidal behavior: cause or cure? Am J Psychiatry 164:989–991

54. Isacsson G, Bergman U, Rich CL (1996) Epidemiological data suggest antidepressant reduce suicide risk among depressives. J Affect Disord 41:1–8

55. Spijker J, de Graaf R, ten Have M, Nolen WA, Speckens A (2010) Predictors of suicidality in depressive spectrum disorders in the general population: Results of the Netherlands Mental Health Survey and Incidence Study. Soc Psychiatry Psychiatr Epidemiol 45:513–521

56. Donovan S, Kelleher MJ, Lambourn J, Foster T (1999) The occurrence of suicide following the prescription of antidepressant drugs. Arch Suicide Res 5:181–192

57. Mikula L, Bronson A, Reitman D (2007) Do antidepressant medications really increase suicide risk for adolescents? Reflections on the FDA's black box warning. Behav Ther 30:99–103

58. Stack S, Bowman B (2009) Suicide in movies: gender and choice of suicide method. In: Stack S, Lester D (eds) Suicide and the creative arts. Nova Science Publishers, New York, pp 57–61

59. Oslin DW, Zubritsky C, Brown G, Mullahy M, Puliafico A, Ten Have T (2004) Managing suicide risk late in life: access to firearms as a public health risk. Am J Geriatr Psychiatry 12:30–36

60. Rockett IRH, Wang S, Stack S, De Leo D, Frost JL, Ducatman AM, Walker RL, Kapusta ND (2010) Race/ethnicity and potential suicide misclassification: window on a minority suicide paradox? BMC Psychiatry 10:1–8

61. DeJong T, Overholser JC, Stockmeier CA (2010) Apples to oranges? A direct comparison between suicide attempters and suicide completers. J Affect Disord 124:90–97

62. Bradvick L (2007) Violent and nonviolent methods of suicide: different patterns may be found in men and women with sever depression. Arch Suicide Res 11:255–264

63. Sen B (2004) Adolescent propensity for depressed mood and help seeking: race and gender differences. J Ment Health Policy Econ 7:133–145

64. Sussman L, Robins L, Earls F (1987) Treatment-seeking for depression by black and white Americans. Soc Sci Med 24:187–196

65. Hawton K, Appleby L, Platt S, Foster T, Cooper J, Malmberg A, Simkin S (1998) The psychological autopsy approach to studying suicide: a review of methodological issues. J Affect Disord 50:269–276

66. Pouliot L, De Leo D (2006) Critical issues in psychological autopsy studies. Suicide Life Threat Behav 36:491–510