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Short Communication

Comparing gun-owning vs non-owning households in terms of firearm and non-firearm suicide and suicide attempts

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ABSTRACT

The goal of this study is to provide, for the United States, estimates for gun-owning and non-owning households in terms of firearm and non-firearm suicides and suicide attempts. To make these ballpark estimates I combine a half-dozen known "facts" about suicide (e.g., households with firearms are at approximately 3× the risk of suicide as households without firearms). Among the six major conclusions are that about 90% of firearm suicides occur among members of gun-owning households, that 75% of suicides among gun-owning families are firearm suicides, but only 20% of suicide attempts among these families are with firearms. This study not only provides estimates of suicides and suicide attempts by gun-owning and non-owning households, but the reasonableness of the estimates provides support for the reasonableness of the half-dozen known "facts" about firearms and suicide.

1. Introduction

Data and fundamental research have been important for many if not most successes in injury and violence prevention (Hemenway, 2009). Unfortunately, for firearms injury and violence prevention, much data deliberately have not been collected by the federal government and much data that have been collected have been made unavailable to researchers (Hemenway, 2017). In addition, federal funders have been only able to provide very limited financial support for firearm research (Winker et al., 2016; Stark and Shah, 2017). Thus much basic information about firearms and firearm owners is currently unknown.

This paper takes an innovative approach to expand our knowledge about guns and gun violence, focusing on gun owners and suicide. It uses a half-dozen pieces of known information and combines them to produce a half-dozen estimates of previously unknown relationships.

There actually has been a fair amount of research on firearm suicide, and much is known about the increased risk of firearm suicide for gun owners in the United States (Miller et al., 2012). But relatively little is known about rates of suicide that occur in gun-owning versus non-gun owning households—for example, suicide fatality data typically do not provide information about whether or not the household contained a gun (Johnson et al., 2010) and case-control studies rarely provide the relevant information. In this paper, I combine "known" results to provide ballpark comparisons of gun-owning and non-owning households in terms of firearm and non-firearm suicides and suicide attempts.

I estimate, for gun-owning households, the annual number of firearm and non-firearm suicides, and the number of attempted firearm and non-firearm suicides. I also do the same for non-owning households. To my knowledge, such estimates have not previously been available in the literature.

For the United States, I provide answers to six questions:

a) for firearm suicides, what percentage occur among members of gun-owning households?
b) for non-firearm suicides, what percentage occur among members of gun-owning households?
c) for members of gun-owning households, what percentage of their suicides are firearm suicides?
d) for members of non-owning households, what percentage of their suicides are firearm suicides?
e) for members of gun-owning households, what percentage of their suicide attempts are with firearms?
f) for members of non-owning households, what percentage of their suicide attempts are with firearms?

2. Methods

Below are a half-dozen "facts" from Vital Statistics and the academic literature about suicide (firearm and non-firearm) and about gun-owning and non-owning households.

1) There have recently been about 45,000 suicide deaths a year in the

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Table 1
Estimated annual number of suicides and suicide attempts (by household gun ownership and whether a firearm was used).

	Numbers of deaths	Numbers of attempts
Firearm suicide among gun-owning households	20,500	23,000
Nonfirearm suicide among gun-owners	6500	93,000
Firearm suicide among non-owning households	2000	2200
Nonfirearm suicide among non-owning households	16,000	230,000

United States (WISQARS)
2) About 1/3 of US households contain firearms (Smith and Son, 2015; Azrael et al., 2017)
3) Households with firearms are at approximately 3× the risk of suicide as households without firearms (Stroebe, 2013; Anglemyer et al., 2014)
4) About half of suicides are firearm suicides (WISQARS). This percentage has been relatively constant for many years (WISQARS)
5) The case fatality rate (CFR) is—ballpark—90% for firearm attempts, 60% for suffocation, and 3% for attempts with all other methods (mostly cutting and overdosing) (Cook, 1991; Spicer and Miller, 2000; Shenassa et al., 2003; Miller et al., 2004). With approximately 11,600 suffocation suicides (CFR = 60%) and 10,500 other suicides (CFR = 3%), the overall CFR for non-firearm suicide is about 7%.
6) Gun-owning and non-owning households are similar in terms of rates of depression, suicide ideation, and suicide attempts (Ilgen et al., 2008; Miller et al., 2009; Betz et al., 2011). I assume for the analysis that the suicide attempt rate is identical for gun-owning and non-owning households; the only difference is the method of suicide, and specifically whether a firearm is used or not.

Let FS be defined as the annual total number of firearm suicides, and NFS be defined as the annual total number of non-firearm suicides. Let FSgunowners be defined as the annual number of firearm suicides among gun-owning families and NFSgunowners be defined as the annual number of non-firearm suicides among gun-owning families Similarly, FSnonowners is defined as the annual number of firearm suicides among non-owning families, and NFSnonowners is defined as the annual number of non-firearm suicides among non-owning families.

Given that gun-owning households are 1/3 of the population and have 3 times the risk of suicide as the non-owning population, this means that 60% of all suicides are among gun-owning households. Of 45,000 suicide deaths, then 27,000 are among gun-owning households, and 18,000 among non-owning households.

From the information provided above, we can create have 4 equations and 4 unknowns.

Eqs. (1) and (2) are the number of deaths among gun-owning and among non-owning families

$$\text{FSgunonwers} + \text{NFSgunowners} = 27{,}000 \quad (1)$$

$$\text{FSnonowners} + \text{NFSnonowners} = 18{,}000 \quad (2)$$

Eq. (3) is the fact that about half of all suicides are firearm suicides

$$\text{FSgunowners} + \text{FSnonowners} = \text{NFSgunowners} + \text{NFSnonowners} \quad (3)$$

Eq. (4) is the 'fact' that gun owners and non-owners have identical rates of suicide attempts. The equation equates the number of suicide attempts, recognizing that there are twice as many non-gun owning families as gun-owning families. It takes the number of fatalities divided by the CFR as the number of attempts.

$$2[\text{FSgunowners}/0.9 + \text{NFSgunowners}/0.07] = \text{FSnonowners}/0.9 + \text{NFSnonowners}/0.07 \quad (4)$$

Two of the six "facts" come from the Vital Statistics and are well-accepted as largely accurate (i.e. the number of suicides and the percentage that are firearm suicides). The other four assumptions are best estimates. As a sensitivity analysis, to determine how changes in the underlying "facts" might influence the results, I examine, one-at-a-time, the results for seven changes in the underlying assumptions:

(1) The case fatality rate for firearms is 80% rather than 90%.
(2) The case fatality rate for non-firearms is 5% rather than 7%.
(3) The case fatality rate for non-firearms is 10% rather than 7%.
(4) Households with firearms have 2× the risk of suicide rather than 3× compared to non-owning households.
(5) The percentage of households with firearms is 40% rather than 33%.
(6) Gun-owning households are 50% more likely to attempt suicide rather than equally likely.
(7) Non-gun-owning households are 50% more likely to attempt suicide rather than equally likely.

3. Results

The solution for the 4 unknowns is: Among gun-owning households, there are approximately 20,500 firearm suicides (Table 1) and 6500 non-firearm suicides. Among non-owning households, there are approximately 2000 firearm suicides and 16,000 non-firearm suicides.

Among gun-owning households, there are approximately 23,000 suicide attempts with a firearm and 93,000 attempts with other methods. Among non-owning household, there are approximately 2200 suicide attempts with a firearm and 230,000 attempts with other methods.

The answer to the questions posed are:

a) for firearm suicides, about 90% occur among members of gun-owning households.
b) for non-firearm suicides, about 30% occur among members of gun-owning households.
c) for members of gun-owning households, about 75% of suicides are firearm suicides.
d) for members of non-owning households, about 10% of suicides are firearm suicides.
e) for members of gun-owning households, about 20% of suicide attempts are with firearms.
f) for members of non-owning households, about 1% of suicide attempts are with firearms.

The results of the sensitivity analysis are given in Table 2. The largest changes are for the number of gun suicides in gun owning versus non-gun owning households. If gun owning households have only 2× the suicide risk of non-owners rather than 3× the risk, the number of gun suicides among gun owning households falls from 20,500 to 15,670 (so that 70% of all gun suicides occur in gun owning households rather than 90%). Conversely, if gun owners have 3× the suicide risk and the percentage of household with firearms is 40% rather than 33%, the number of gun suicides among gun owning households rises to 22,050 (or 98% of gun suicides occur in gun owning households). If both changes were accurate (not shown), the results would be that 77% of gun suicides occur in gun owning households.

Table 2
Sensitivity analysis for the estimated annual number of suicide deaths.

	0	1	2	3	4	5	6	7
Firearm suicide among gun-owning households	20,500	20,650	20,200	21,000	15,670	22,050	18,100	20,700
Nonfirearm suicide among gun-owners	6500	6350	6800	6000	6830	7950	8900	6300
Firearm suicide among non-owning households	2000	1850	2300	1500	6830	450	4400	1800
Nonfirearm suicide among non-owning households	16,000	16,150	15,700	16,500	15,670	14,500	13,600	16,200

0. Original assumptions. 1. Case fatality rate for firearms at 80% rather than 90%. 2. Case fatality rate for non-firearms at 5% rather than 7%. 3. Case fatality rate for non-firearms at 10% rather than 7%. 4. Households with firearms have 2× the suicide risk rather than 3× the risk of non-firearm households. 5. 40% of household have firearms rather than 33%. 6. Households with firearms are 50% more likely to attempt suicide rather than equally likely. 7. Households without firearms are 50% more likely to attempt suicide rather than equally likely.

4. Discussion

This paper provides the first rough estimates regarding gun-owning and non-owning households with respect to firearm and non-firearm suicide in the United States. These estimates do not come from new data or new studies that try directly to measure these relationships, but by combining existing data in a different way than has been done before.

The main findings are these. While gun-owning households make up one third of the population, they account for 60% of the suicides. Approximately 90% of firearm suicides occur among members of gun-owning families and 75% of suicides in gun-owning household are with firearms. Yet only about 20% of suicide attempts for members of gun-owning households involve a firearm.

For members of non-owning households, only 1% of suicide attempts involve a firearm, but firearm suicides still account for 10% of their suicide deaths.

These results are, of course, ballpark estimates and would be somewhat different to the extent that any of the 'facts' are incorrect. For example, the CFR may not be entirely accurate, the relative risk of suicide in gun-owning households may be somewhat different than 3, the percentage of household with firearms is only an estimate, and gun-owning and non-owning households may not have the exact same risk of attempting suicide.

The sensitivity analysis shows the results of changing any one of the assumptions. The effects could be larger or smaller by making multiple changes. Some of the biggest effects of the tested alternative assumptions are on the percentage of gun suicides occurring in gun-owning versus non-gun owning households. Two of the assumptions that matter most in this regard are about the relative risk of suicide among gun-owning and non-owning households and the percentage of household with firearms.

Overall, I would argue that the original estimates seem reasonable. They give confidence that the underlying 'facts' are also reasonable and consistent with each other. Most important, the computed estimates in this paper provide a useful perspective on understanding the differences in firearm and non-firearm suicide and suicide attempts between gun-owning and non-owning families. If, in the future, more direct measures give very different estimates, that should make us question some or all of the six "facts" about guns and suicide that we currently think we know.

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