Reducing Gun Violence in America

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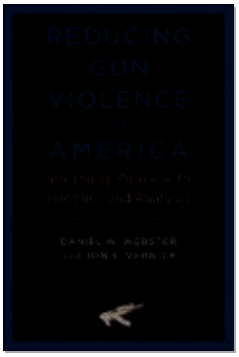

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Firearms and Violent Death in the United States

Matthew Miller, Deborah Azrael, and David Hemenway

Firearm-Related Deaths in the United States

In 2010, there were more than 31,000 firearm deaths in the United States: 62% were suicides, 36% were homicides, and 2% were unintentional (2%) (CDC 2012a). Almost as many Americans die from gunfire as die from motor vehicle crashes (almost 34,000 in 2010). Americans under age 40 are more likely to die from gunfire than from any specific disease (CDC 2012a).

Homicide

The United States is not a more violent country than other high-income nations. Our rates of car theft, burglary, robbery, sexual assault, and aggravated assault are similar to those of other high-income countries (van Kesteren, Mayhew, and Nieuwbeerta 2001); our adolescent fighting rates are also similar (Pickett

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Table 1.1 Homicide, suicide, and unintentional gun deaths among 5–14 year olds: The United States versus 25 other high-income populous countries (early 2003)

	Mortality rate ratio
Homicides	
Gun homicides	13.2
Non-gun homicides	1.7
Total	3.4
Suicides	
Gun suicides	7.8
Non-gun suicides	1.3
Total	1.7
Unintentional firearm deaths	10.3

Source: Richardson and Hemenway 2011

et al. 2013). However, when Americans are violent, the injuries that result are more likely to prove fatal. For example, the U.S. rate of firearm homicide for children 5 to 14 years of age is thirteen times higher than the firearms homicide rate of other developed nations, and the rate of homicide overall is more than three times higher (Table 1.1).

U.S. homicide rates vary cyclically over time. Current rates are at a 30-year low, but as recently as 1991 rates were nearly twice as high (CDC 2012a). Changes in homicide rates over the past several decades are largely attributable to changes in firearm homicide rates, mostly driven by changes in firearm homicide rates among adolescent and young men in large cities (Hepburn and Hemenway 2004, Blumstein and Wallman 2000, Cork 1999, Cook and John 2002).[1]

The U.S. homicide rate is much higher in urban than in rural areas, as are rates of all violent crime. Nine out of ten homicide offenders are male, and 75% of victims are male. African Americans are disproportionately represented among both perpetrators and victims.[2]

Suicide

Compared with other high-income countries, the U.S. adult suicide rate falls roughly in the middle. Among younger persons, however, our suicide mortality is relatively high: for children under 15 years of age, the overall suicide

rate in the United States is 1.6 times that of the average of other high-income countries, largely accounted for by a firearm suicide rate eight times that of the average of these countries (Richardson and Hemenway 2011).

Over the past several decades, suicide rates have been more stable than have rates of homicide (Miller, Azrael, and Barber 2012). Nevertheless, after declining from a peak of 12.9/100,000 in 1986 to 10.4 in 2000, driven largely by a decline in the rate of firearm suicide, the suicide rate has increased over the past decade to 12.4/100,000 in 2010, mostly due to an increase in suicide by hanging (Miller, Azrael, and Barber 2012, CDC 2012a).

Age, sex, race, and other demographic characteristics—including marital status, income, educational attainment, and employment status—all influence suicide mortality (Nock et al. 2008). Suicide rates are higher, for example, for white and Native Americans than for black, Hispanic, and Asian Americans (CDC 2007). A consistent finding across numerous studies is that the strongest individual-level risk factor for a fatal suicidal act is having previously attempted suicide; other strong risk factors include psychiatric and substance abuse disorders (Shaffer et al. 1996).

In contrast to homicide rates, suicide rates are higher in rural than in urban areas almost entirely due to higher rates of firearm suicide in rural areas.

Unintentional Firearm Deaths

Approximately 675 Americans per year were killed unintentionally with firearms between 2001 and 2010 (CDC 2007). Data from the National Violent Death Reporting System show that two-thirds of the accidental shooting deaths occurred in someone's home, about half of the victims were younger than 25 years, and half of all deaths were other-inflicted. In other-inflicted shootings, the victim was typically shot accidentally by a friend or family member—often an older brother (Hemenway, Barber, and Miller 2010).

Firearm Ownership in the United States

The United States has more private guns per capita (particularly more handguns) and higher levels of household gun ownership than other developed countries (Killias 1993, SAS 2007).

Most of what we know about gun ownership levels in the United States over the past several decades comes from the General Social Survey (GSS 2010),

a relatively small biannual survey of U.S. adults. Data from the GSS show that the percentage of households with firearms has fallen from approximately 50% in the late 1970s to 33% today. Changing household demographics are believed to explain the decline in the household ownership of guns chiefly due to a fall in the number of households with an adult male (Smith 2000). Notably, however, the percentage of individuals owning firearms has remained relatively constant over the past several decades (GSS 2010).

The GSS does not speak to the number of guns in civilian hands or the distribution of guns within households. For this information, researchers have turned to data from two medium-sized national surveys conducted a decade apart. These surveys suggest that the number of guns in civilian hands grew from approximately 200 million in 1994 to 300 million in 2004—and that the average gun owner now owns more guns than previously (Hepburn et al. 2007, Cook and Ludwig 1997).

Compared with other Americans, gun owners are disproportionately male, married, older than 40, and more likely to live in nonurban areas. Their long guns (rifles, shotguns) are owned mainly for sport (hunting and target shooting). People who own only handguns typically own the guns for protection against crime (Hepburn et al. 2007, Cook 1979).

In 2001, 2002, and 2004, but not before or since, information on household gun ownership from the General Social Survey was supplemented by information from the National Behavioral Risk Factor Surveillance System (CDC 1997). The BRFSS is of sufficient size (more than 200,000 respondents annually) that household gun ownership could, for the first time, be determined at the state level for all 50 states and for some Metropolitan Statistical Areas.

Prior to these three iterations of the BRFSS, researchers generally used proxies to measure firearm ownership rates at the state and sub-state level. A validation study by Azrael, Philip, and Miller (2004) found that from among all proxies, the fraction of suicides that are committed with firearms (FS/S) correlates most strongly and consistently with cross-sectional survey-based measures of household firearm ownership at the county, state, and regional levels.

Household firearm ownership is probably a good measure of the accessibility of guns used in suicides, since most suicides involving firearms occur in the home (Kellermann et al. 1992, CDC 2012b) and involve a firearm owned by a member of the household (Kellermann et al. 1992). Household gun owner-

ship levels seem also to be the key exposure variable for firearm homicides that take place in the home, where women, children and older adults are particularly likely to be killed. The most common perpetrator in such instances is a family member (CDC 2012b). By contrast, older adolescent and young adult males are more often killed outside the home by guns owned by a non-family member.[3]

In this essay, we focus on studies that assess the relationship between gun prevalence and violent death. As such, the essay does not examine studies of gun carrying nor any literature on illegal gun markets. It also does not address research that investigates the relationship between firearm regulations and violent death. Note, however, that firearm prevalence and firearm regulation are highly collinear. Strong regulations may limit firearm ownership, and low levels of firearm ownership make it easier to pass stronger regulations.

This essay is also not an exhaustive review of the literature examining the association of firearm availability and violent death. (For more comprehensive reviews, see Hepburn and Hemenway 2004, Miller and Hemenway 1999, and Brent 2001.) Rather, it briefly summarizes (a) international ecologic studies comparing the United States to other countries, (b) ecologic studies of U.S. regions, states, and metropolitan areas, and (c) individual case-control and cohort studies.

Studies included in this brief review met a minimal threshold of attempting to control for important confounders: studies had to compare likes to likes. For case-control studies of homicide, that means—at a minimum—controlling for age, gender, and neighborhood; in suicide studies, for age, sex, and psychiatric risk factors for suicidal behavior. For international studies of homicide, it means comparing high-income countries to high-income countries. International comparisons of adult suicide rates are confounded by large differences in religion, culture and recording practices (i.e., the social meaning and cultural acceptance of adult suicide), as evidenced by tenfold differences in suicide rates across high-income nations. Thus, the only international studies of suicide included focus on the suicides of children—which all countries hold to be tragedies. For ecologic studies in the United States, making "like to like" comparisons means comparing states to states with similar levels of urbanization (or, for homicide, similar crime rates), cities to cities, and rural areas to rural areas.[4]

Firearms and Homicide

Ecologic Studies

Killias (1993) evaluated rates of violence in 14 developed countries: 11 in Europe, along with the United States, Canada, and Australia. He used data from the 1989 International Crime Survey, a telephone survey of 14 countries and 28,000 respondents, to measure firearm prevalence. Respondents were asked whether there were any firearms in their household and, if so, whether any were a handgun or a long gun. Military firearms were excluded. In this study, which did not include control variables, rates of firearm ownership and homicide were positively correlated, while rates of firearm ownership and non-firearm homicide were not.

A study by Hemenway and Miller (2000) included 26 high-income nations with populations greater than one million. To measure gun availability, the authors used two proxies, including FS/S. No control variables were included in the analysis. Firearm availability was strongly and significantly associated with homicide across the 26 countries.

A follow-up study (Hemenway, Shinoda-Tagawa, and Miller 2002) examined homicide rates among women across high-income countries. The validated proxy (FS/S, or the percentage of suicides committed with a firearm) was used to estimate firearm ownership in each country. Urbanization and income inequality were included as control variables. The United States accounted for 70% of all female homicide victims in the study and had the highest firearm ownership rates. The U.S. homicide rate for women was five times higher than that of all of the other countries combined; its female firearm homicide rate was eleven times higher.

U.S. Studies

Cook (1979) conducted a cross-sectional analysis of 50 large cities in the United States to explore the relationship between gun availability and robbery, including robbery-murder. Using data on the number of robberies in 1975, Cook examined how firearm availability (as proxied by Cook's index) was related to robbery and robbery-murder rates, controlling for measures of the effectiveness of the criminal justice system, population density, and other regional and state differences. Increased gun availability was not associated with overall robbery rates, but it was positively associated with the proportion of robber-

ies that involved a gun—and with the per capita robbery-murder rate, through an increased rate of gun robbery.

Miller et al. (2002) evaluated the relationship between levels of firearm ownership at the state and regional level and the incidence of homicide from 1988 to 1997 for 50 states and 9 regions. At the state level, they used the percentage of suicides with a firearm as a proxy for ownership and they measured gun availability at the regional level with data from the GSS. Five potential confounders were included: poverty, urbanization, unemployment, alcohol consumption, and (non-homicide) violent crime rates. In the multivariate analyses, a positive and significant association between gun ownership and homicide rates was found for the entire population and for every age group (except ages 0–4), primarily due to higher firearm homicide rates.

A similar study (Miller et al. 2007) used survey estimates of household gun ownership for each state from the Behavioral Risk Factor Surveillance System. It examined data from 2001 to 2003 and controlled for state-level rates of aggravated assault, robbery, unemployment, urbanization, alcohol consumption, poverty, income inequality, the percentage of the population that was black, and the percentage of families headed by a single female parent. Again, states with higher rates of household firearm ownership had significantly higher homicide victimization rates for men, for women, and for children. The association was driven by gun-related homicide victimization rates; non-gun-related victimization rates were not significantly associated with rates of firearm ownership.

Individual Level Studies

Ecologic studies provide evidence about whether more guns in the community are associated with more homicides in the community. Case-control and cohort studies provide data more germane to the question of whether a gun in the home increases or reduces the risk of homicide victimization for members of the household.

Kellermann et al. examined approximately 400 homicide victims from three metropolitan areas who were killed in their homes (Kellermann et al. 1993). All died from gunshot wounds. In 83% of the homicides, the perpetrator was identified; among these cases, 95% of the time, the perpetrator was not a stranger. In only 14% of all the cases was there evidence of forced entry. After controlling for illicit drug use, fights, arrests, living alone, and whether the home was rented,

Table 1.2 NVDRS 2005–2010

	Firearm			Non-firearm		
	N	Occurred in a house/apt	Occurred at victim's residence	*N*	Occurred in a house/apt	Occurred at victim's residence
Homicides by age group						
0–4 yrs	81	75%	67%	1,025	90%	77%
5–14 yrs	257	72%	51%	205	78%	67%
15–24 yrs	5,679	37%	16%	1,385	47%	27%
25–34 yrs	4,906	44%	24%	1,479	56%	39%
35–64 yrs	5,003	56%	41%	3,716	62%	50%
65+ yrs	470	74%	69%	719	79%	76%
Suicides by age group						
0–4 yrs	—			—		
5–14 yrs	105	97%	88%	301	91%	88%
15–24 yrs	3,332	75%	64%	3,769	69%	65%
25–34 yrs	4,034	76%	67%	4,743	70%	65%
35–64 yrs	15,634	78%	74%	16,568	72%	70%
65+ yrs	6,019	89%	88%	2,168	80%	83%

Note: Unknowns for age (0.7%), house/apt (1.4%), home (3.6%) were set aside.

the presence of a gun in the home remained strongly associated with an increased risk for homicide in the home. Gun ownership was most strongly associated with an increased risk of homicide by a family member or intimate acquaintance.[5]

Whereas most men are murdered away from home, most children, older adults, and women are murdered at home (Table 1.2). A gun in the home is a particularly strong risk factor for female homicide victimization—with the greatest danger for women coming from their intimate partners.

The heightened risk of femicide is illustrated in a subgroup analysis of female homicide victimization from Kellermann's 1993 case-control study of homicide in the home. A spouse, a lover, or a close relative murdered most of the women decedents, and the increased risk for homicide from having a gun in the home was attributable to these homicides (Bailey, Flewelling, and Rosenbaum 1997). A case-control study by Wiebe et al. (2003) also found that the risk of homicide associated with living in a home with guns was particularly high for women (who were almost three times more likely to become homicide victims compared with women living in homes without guns). Here too, a gun in the home was a risk factor for homicide by firearm but not for homicide by other means.

Other case-control studies have also found that a gun in the home is a risk for homicide in the home, with especially heightened risk for women (Cummings et al. 1997, Dahlberg, Ikeda, and Kresnow 2004). Results from perpetrator-based case-control homicide studies also find that gun ownership is a risk for homicide perpetration. For example, a study of women murdered by intimate partners found that compared with a control group of living battered women, a gun in the house was present for 65% of perpetrators of murder versus 24% of perpetrators of nonfatal abuse. Access to a firearm by the battered woman had no protective effect (Campbell et al. 2003).

Cohort Studies

There are no studies that follow a large cohort of individuals with known characteristics, comparing homicide victimization rates of those with a gun in the home and those without.

Firearm Prevalence and Suicide

Firearm suicide rates and overall suicide rates in the United States are higher where guns are more prevalent (Miller, Hemenway, and Azrael 2007, Kubrin and Wadsworth 2009). By contrast, rates of suicide by methods other than firearms are not significantly correlated with rates of household firearm ownership (Miller, Hemenway, and Azrael 2007). This pattern has been reported in ecologic studies that have adjusted for several potential confounders, including measures of psychological distress, alcohol and illicit drug use and abuse, poverty, education, and unemployment (Miller, Azrael, and Barber 2012, Miller, Hemenway, and Azrael 2007).

Household firearm ownership has also been consistently found to be a strong predictor of suicide risk in studies that examined individual-level data. U.S. case-control studies find that the presence of a gun in the home or purchase from a licensed dealer is a risk factor for suicide (Bailey et al. 1997, Brent et al. 1993, Brent et al. 1994, Brent et al. 1991, Brent et al.1988, Conwell et al. 2002, Cummings et al. 1997, Kellermann et al. 1992, Grassel et al. 2003, Kung, Pearson, and Lui 2003, Wiebe 2003). The relative risk is large (two- to tenfold), depending on the age group and, for younger persons, how firearms in the home are stored (Miller and Hemenway 1999, Brent et al. 1991, Kellermann et al. 1992).

The only large U.S. cohort study to examine the firearm–suicide connection found that suicide rates among California residents who purchased handguns

from licensed dealers were more than twice as likely to die by suicide as were age/sex matched members of the general population, not only immediately after the purchase but throughout the six-year study period (Wintemute et al. 1999). Here, too, the increase in suicide risk was attributable entirely to an excess risk of suicide with a firearm (Wintemute et al. 1999).

Drawing causal inferences about the relation between firearm availability and the risk of suicide from existing case-control and ecologic studies has been questioned on the grounds that these studies may not adequately control for the possibility that members of households with firearms are inherently more suicidal than members of households without firearms (NRC 2005). Additional cited limitations include the possibility of differential recall (by cases compared with controls) of firearm ownership and comorbid conditions, and reverse causation (whereby suicidal persons purchase firearms with the idea of committing suicide).

It is very unlikely, however, that the strong association between firearms and suicide reported consistently in U.S. studies is either spurious or substantially overstated. First, individual-level studies have often controlled for measures of psychopathology (Bailey et al. 1997, Brent et al. 1994, Brent et al. 1993, Brent et al. 1988, Conwell et al. 2002, Cummings et al. 1997, Kellermann et al. 1992, Wiebe 2003).

Second, directly answering the reverse causation critique, the risk of suicide associated with a household firearm pertains not only to gun owners but to *all* household members (Cummings et al. 1997, Kellermann et al. 1992, Wintemute et al. 1999); the relative risk is larger for adolescents than for the gun owner; and for the gun owner the risk persists for years after firearms are purchased (Cummings et al. 1997, Kellermann et al. 1992, Wintemute et al. 1999).

Third, studies that have examined whether people who live in homes with guns have higher rates of psychiatric illness, substance abuse, or other known suicide risk factors generally fail to find any indication of heightened risk (Oslin et al. 2004, Kolla, O' Connor, and Lineberry 2011). For example, four case-control studies found comparable rates of psychiatric illness and psychosocial distress among households with versus without firearms (Kellermann et al. 1992, Ilgen et al. 2008, Miller et al. 2009, Sorenson and Vittes 2008, Betz, Barber, and Miller 2011).

Fourth, there appears to be a hierarchy of suicide risk among children and young adults, depending on how securely household firearms are stored, suggesting a dose-response relationship (Grossman et al. 2005).

Finally, the consistency in magnitude, direction, and specificity of method-related risk observed in both the many individual-level and ecologic studies (the latter not being subject to recall bias or the reverse causation criticism) leads to only one conclusion: a gun in the home increases the likelihood that a family member will die from suicide.

Unintentional Firearm Deaths

Not surprisingly, ecologic and case-control studies find that where there are more guns and more guns poorly stored, there are more unintentional firearm deaths (Miller, Azrael, and Hemenway 2001, Wiebe 2003, Grossman et al. 2005). U.S. children aged 5 to 14 have eleven times the likelihood of being killed accidentally with a gun compared with similarly aged children in other developed countries (Table 1.2) (Richardson and Hemenway 2011).

Conclusion

The United States, with its many guns and highly permissive gun laws, faces a far more serious problem of lethal firearms violence than other high-income nations. The relative magnitude of our problem is illustrated in Table 1.1. This table, which compares U.S. children aged 5–14 with children of other developed countries, illustrates the stark fact that U.S. children are *thirteen* times more likely to die from a firearm homicide and *eight* times more likely to a die of a firearm suicide than children in comparable developed nations. There is no evidence that U.S. children are more careless, suicidal. or violent than children in other high-income nations. Rather, what distinguishes children in the United States from children in the rest of the developed world is the simple, devastating fact that they die—mostly by firearms—at far higher rates.

Within the United States itself, the evidence is similarly compelling: where there are more guns, there are more violent deaths—indeed, many more. The magnitude of this relationship is illustrated in Table 1.3, which compares the number of lives lost between 2001 and 2007 to homicide, suicide, and unintentional firearm accidents by sex and age groups in states with the highest compared with the lowest gun ownership rates. The consistency of findings across different populations, using different study designs, and by different researchers is striking. No credible evidence suggests otherwise.

Table 1.3 Violent deaths in states with the highest versus lowest gun ownership levels (BRFSS 2004); Mortality Data WISQARS 1999–2007

	High-gun states[a]	Low-gun states[b]	Ratio
Aggregate population of adults, 2001–2007	356 million	358 million	1.0
Proportion of households with firearms	50%	15%	3.3
Percentage of adult population reporting depression, past 12 months (NSDUH 2008–2009)	3.7%	3.7%	1.0
Percentage of adult population reporting suicidal ideation, past 12 months (NSDUH 2008–2009)	6.6%	6.5%	1.0
Number of nonlethal violent crimes in 2010 (UCR 2010)	165,739	148,287	1.1
Suicide			
Women			
Firearm suicide	4,148	563	7.4
Non-firearm suicide	4,633	4,575	1.0
Total suicide	8,781	5,138	1.7
Men			
Firearm suicide	26,314	7,163	3.7
Non-firearm suicide	11,592	12,377	0.9
Total suicide	37,906	19,540	1.9
Men ages 15–29			
Firearm suicide	5,803	1,308	4.4
Non-firearm suicide	3,192	2,671	1.2
Total suicide	8,995	3,979	2.2
5–14 year olds			
Firearm suicide	166	15	11.1
Non-firearm suicide	225	154	1.5
Total suicide	391	169	2.3
Adults 65+ years old			
Firearm suicide	6,374	1,714	3.7
Non-firearm suicide	1,182	2,270	0.5
Total suicide	7,556	3,984	1.9
Homicide			
Men			
Firearm homicide	13,755	7,799	1.8
Non-firearm homicide	5,031	3,963	1.3
Total homicide	18,786	11,762	1.6
Women			
Firearm homicide	3,165	998	3.2
Non-firearm homicide	2,855	2,132	1.3
Total homicide	6,020	3,130	1.9

Table 1.3 (Continued)

	High-gun states[a]	Low-gun states[b]	Ratio
5–14 year olds			
Firearm homicide	259	100	2.6
Non-firearm homicide	212	169	1.3
Total homicide	471	269	1.8
Men 15–29			
Firearm homicide	6,971	4,900	1.4
Non-firearm homicide	1,187	1,334	0.9
Total homicide	8,158	6,234	1.3
Adults 65+ years old			
Firearm homicide	620	139	4.5
Non-firearm homicide	794	534	1.5
Total homicide	1,414	673	2.1
Unintentional firearm deaths	109	677	6.2

Note: All data are from 1999–2007 because cell counts were suppressed beginning in 2008; terrorism-related homicides are not counted.

[a]Louisiana, Utah, Oklahoma, Iowa, Tennessee, Kentucky, Alabama, Mississippi, Idaho, North Dakota, West Virginia, Arkansas, Alaska, South Dakota, Montana, Wyoming

[b]Hawaii, New Jersey, Massachusetts, Rhode Island, Connecticut, New York

Firearm policy is often focused on guns used in crime. What is notable about the studies reviewed here, however, is the consistency of the story they tell about *all* firearms—not just those used in crime. In the United States, there are more firearm suicides than firearm homicides, and women, children, and older adults are more likely to die by gunfire from a household gun (typically, legally acquired and possessed) than from illegal guns.

The first step in ameliorating a public health problem is to identify what the problem is. For the purposes of this essay, the problem is that, year after year, many more Americans are dying by gunfire than people in any other high-income nation. Good firearm policy has the potential to reduce the toll of lethal firearm violence in the United States. Efforts to reduce this uniquely American problem will, however, be less effective than they could be if good policy is not accompanied by a shift in the kind of discussions politicians, academicians, and citizens engage in about firearms. Science can provide the content—and better science based on better data, better content. The best chance for durable and large-scale reductions in lethal violence in the United States is for all of us to commit to keeping the conversation about the costs and benefits of guns in American society civil, ongoing, and factually grounded.

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NOTES

1. Researchers attribute the decline in the 1990s to different causes, including reduced unemployment, increased policing, and a decline in and stabilization of illegal drug markets (Wintemute 2000). Declines in the last decade have not yet been well explained.

2. Homicide rates have been consistently higher in the southern and western regions of the United States. This is especially true for firearm homicides (CDC 2012a).

3. Measuring the availability of guns in the context of these homicides is more problematic, not least because researchers (Webster, Vernick, and Hepburn 2001, MAIG 2008) have shown that guns involved in these deaths often move across state lines from states with permissive gun laws to states with fewer guns and stronger laws.

4. Studies included in this review were those previously included in review articles by two of the authors, updated to include new articles meeting the criteria specified in these reviews which have appeared in the research literature since the time those review papers were published.

5. The study did not provide evidence about whether a gun from the home was used in any of the homicides. However, the idea that a gun in the home increased the risk of death was supported by several observations. First, the link between gun ownership and homicide was due entirely to a strong association between gun ownership and homicide by firearm; homicide by other means was not significantly linked to having a gun in the home. Second, gun ownership was most strongly associated with homicide at the hands of a family member or intimate acquaintance (i.e., guns were not significantly linked to an increased risk of homicide by non-intimate friends, unidentified persons, or strangers). Third, there was no evidence of a protective effect of keeping a gun in the home—even in the small subgroup of cases that involved forced entry.

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