Prevention of Firearm Suicide in the United States: What Works and What Is Possible

J. John Mann, M.D., Christina A. Michel, B.A.

Objective: About 21,000 suicides in the United States in 2014 involved a firearm. The authors reviewed evidence from around the world regarding the relationship between firearm ownership rates and firearm suicide rates and the potential effectiveness of policy-based strategies for preventing firearm suicides in the United States.

Method: Relevant publications were identified by searches of PubMed, PsycINFO, MEDLINE, and Google Scholar from 1980 to September 2015, using the search terms suicide AND firearms OR guns. Excluding duplicates, 1,687 results were found, 60 of which were selected for inclusion; these sources yielded an additional 10 studies, for a total of 70 studies.

Results: Case-control and ecological studies investigating geographic and temporal variations in firearm ownership and firearm suicide rates indicate that greater firearm availability is associated with higher firearm suicide rates. Time-series analyses, mostly from other countries, show that legislation reducing firearm ownership lowers firearm suicide rates. Because the Second Amendment curtails legislation broadly restricting firearm access in the United States, the emphasis is shifted to restricting access for those at risk of harming themselves or others. Most suicides involve guns purchased years earlier. Targeted initiatives like gun violence restraining orders, smart gun technology, and gun safety education campaigns potentially reduce access to already purchased firearms by suicidal individuals. Such measures are too new to have evidence of effectiveness.

Conclusions: Broadly reducing availability and access to firearms has lowered firearm suicide rates in other countries but does not appear feasible in the United States. Approaches restricting access of at-risk individuals to already purchased firearms by engaging the public and major stakeholders require urgent implementation and outcome evaluation for firearm suicide prevention.

Am J Psychiatry 2016; 173:969–979; doi: 10.1176/appi.ajp.2016.16010069

Suicide is a major cause of premature death in the United States. In 2014, suicide was the second leading cause of death among people 10–34 years of age (1). Of the 42,773 suicides that year, 21,334 (49.9%) involved a firearm. Firearms accounted for 33,599 deaths in 2014 (suicides, homicides, accidental deaths, and undetermined), the third leading cause of violent death (1). The United States has the highest per capita rate of gun ownership in the developed world. About 38% of households own at least one gun, making firearms widely available to those at risk of suicidal or homicidal behaviors (2). This review focuses on prevention of firearm suicide but has relevance for other types of firearm deaths.

Means restriction is a major method for reducing suicide rates (3). Examples include barbiturate restriction in Australia, pesticide regulations in Sri Lanka, and detoxification of domestic gas and packaging changes for analgesics in the United Kingdom (4–9). Reducing firearm access for those at risk of suicide may work for several reasons. Firearms are a highly lethal method for attempting suicide, with a mortality rate of 92%, compared with 67% for drowning, 78% for hanging, and 2% for intentional overdoses (10, 11). Because 70% of attempters take less than 1 hour between deciding to kill themselves and the actual attempt (12), they are more likely to use a method that is at hand. The transient nature of a suicidal crisis means that restricting access to more lethal means could allow the crisis to pass or result in an attempt with a less lethal method. About 90% of those who survive even an almost fatal suicide attempt do not go on to die by suicide later in life (13). Thus, surviving a suicide crisis offers a strong chance of long-term survival, and method substitution by a less lethal method often only modestly erodes the gains from restricting access to a more lethal method (14).

In this review, we examine available evidence on the relationship between firearm ownership rates and firearm suicide rates and the potential effectiveness of policy-based strategies for preventing firearm suicides. Previous reviews are now dated (15–17) or only consider part of the available data, such as a meta-analysis of case-control studies (18). Unlike other recent reviews, we examine the relationship between firearm ownership and firearm suicide in case-control, ecological, and time-series studies based on data from the United States and other countries. We extrapolate from more definitive gun control measures implemented elsewhere in considering what can work in the United States given the social context and the constitutional limitations on firearm legislation.

See related features: **CME course** *(p. 1065) and* **AJP Audio** *(online)*

EVIDENCE REVIEW

An electronic data search from 1980 to September 2015 was conducted using PubMed, PsycINFO, and MEDLINE to identify studies of the relationship between firearm availability and firearm suicide. No language or geographic limitations were employed. The terms suicide AND firearms OR guns were searched in the title, keywords, and abstract. After excluding 620 duplicates, we reviewed 1,687 articles, of which 60 were selected for inclusion because they directly examined the relationship between firearm suicide and firearm ownership, gun regulation, or prevention strategies. Excluded papers typically did not examine the relationship between firearm ownership and suicide risk. From the 60 selected articles, an additional 10 articles were identified, for a total of 70 studies (Figure 1). In addition, we searched more broadly using the top 100 hits on Google and Google Scholar for the period 1980–2016, which yielded one additional peer-reviewed article. We cite other sources in the text.

Our review is based on 11 ecological or geographic area comparison studies of firearm ownership and suicide rates in the United States and elsewhere, five U.S. time-series studies of gun ownership and suicide rates, 15 case-control or ecological studies investigating the relationship between household firearm ownership and suicide risk, 13 targeted time-series studies examining the effects of firearm legislation or regulation, and seven studies involving geographic comparison of different legislative approaches across the United States. These studies are listed in Tables 1–5, along with summaries of their main findings. We also examined the relationship between firearm ownership and psychiatric illness and newer approaches to gun control and safety.

FINDINGS

Relationship of Firearm Ownership to Firearm Suicide Rates

The United States has one of the highest firearm ownership rates of all developed nations (69), although precise gun ownership rates are not known because most U.S. states do not require firearm registration. Estimating household gun ownership through national and state-level surveys (21) means that data are not available on a regular or yearly basis. Therefore, proxies (i.e., hunting licenses, fraction of suicides that involve firearms, fraction of homicides that involve firearms, and gun magazine subscription rates in the era prior to online subscriptions) are also used to estimate firearm ownership (22, 70, 71). Approximately 57 million individuals own 283 million firearms (an average of five firearms per owner), and 38% of U.S. households own at least one gun (2). Although epidemiologic studies do not confirm causality, their findings can be consistent with a hypothetical causal model, such as one being examined here, in which firearm suicide rates are hypothesized to be partly driven by firearm availability. Studies in the United States show, at both ecological and individual levels, that greater firearm availability is associated with greater risk of firearm suicide (Tables 1 and 3). Globally, four studies of developed countries (Table 1) found that per capita gun ownership correlates with firearm suicide rates at the national level (26–29).

Ecological Studies

Time-series analyses in four studies examined the relationship between gun ownership and suicide rates in the United States (Table 2). From 1959 to 1979, there were 8,573 more suicides that appear to be attributable to the occurrence of 7,107 more firearm suicides (32, 34). From 1962 to 1975, the annual overall suicide rate rose from 10.9 to 12.9 per 100,000 (34). This rise in firearm suicides occurred in conjunction with the manufacture or importation of more than 6 million additional firearms in the United States (33).

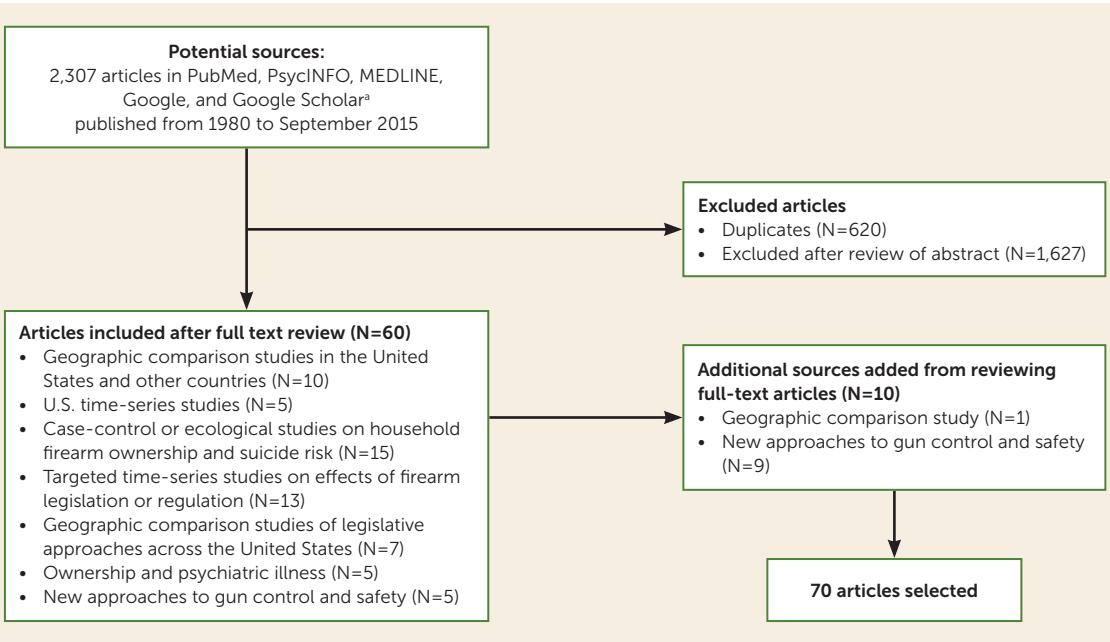
Beginning in the 1980s, this trend reversed (30). Over a 22-year period, household gun ownership dropped from ~46% in 1981 to ~36% in 2002. For every 10% decline in household firearm ownership rate, there was 4.2% decline in firearm suicide rate and a 2.5% decline in overall suicide rate. The reduction was more pronounced for children and adolescents, for whom every 10% decline in firearm ownership was accompanied by an 8.3% drop in firearm suicide rate and a 4.1% drop in overall suicide rate (30). This finding is consistent with studies showing that the relationship between firearm availability and firearm suicide is stronger for younger age groups than for midlife groups (31). During the same period, firearm homicide and overall homicide rates also declined comparably (72).

The substantial geographic variability across the United States has allowed a time- and region-based examination of the firearm-suicide relationship (Table 1) (19–25). Over a 3-year period (2000–2002), the 15 states with the highest household firearm ownership (47%) had almost twice as many suicides (N=14,809) as the six states with the lowest firearm ownership (15%) (N=8,052). This difference in overall suicides is largely accounted for by the difference in firearm suicides (9,749 compared with 2,606). Non-firearm suicides (5,060 compared with 5,446) and the total populations of the two sets of states were comparable (21). During a more recent 2-year period (2008–2009), these findings persisted (19). If the relationship is causal, these findings suggest that a 1% decrease in household firearm ownership could reduce the firearm suicide rate by 3.5% and the overall suicide rate by 1.5%, with greater effects for adolescents (21). By extrapolation, reducing household firearm ownership by 5% could prevent about 3,000 suicides per year in the United States (1).

Case-Control Studies

The relationship between firearm ownership and suicide rates has been examined at the individual level (15 studies; Table 3). Many studies show a greater risk of firearm suicide in households with a gun (40–42, 44–49, 73). There are an estimated 37 firearm suicides for each gun use for self-defense (74). Firearms in the home are associated with a fivefold

FIGURE 1. Flowchart of Study Selection for a Review of Firearm Suicide Prevention Studies



[a] For the Google and Google Scholar searches, numbers of results are not included in the counts reported here.

greater risk of suicide (42), and in firearm-owning households, 90% of suicides involve a firearm (42), compared with 50% of suicides in U.S. households as a whole (18). Firearm suicide rates in male and female veterans are elevated 81% and 188%, respectively, compared with demographically matched nonveterans, and this is attributed to higher gun ownership rates (43).

Studies of household gun ownership and adolescent suicide rates (Table 3) (35–42) vary in sample size, with smaller studies being less reliable, but overall they indicate that a firearm in the home increases the risk of suicide (35–38, 42, 75). Guns are twice as common in homes of adolescent suicides compared with homes of nonfatal suicide attempters or of nonsuicidal psychiatric controls (35, 36). A loaded gun at home is associated with about a 10% higher risk of suicide (42). A locked gun closet, keeping guns unloaded, and locking ammunition or storing it in a different part of the house each reduces the risk of suicide by 55%−73% (73). There is a trend for risk to increase with the number of handguns purchased (15).

Firearm Ownership and Psychiatric Illness

Firearm ownership rates correlate with firearm suicide rates, but not with non-firearm suicides or nonfatal suicide attempts (19), and rates of psychiatric illness in homes with a firearm are comparable with those in homes without a firearm (76–78), indicating that members of households with a firearm are not more suicidal than those without firearms (19, 22, 79, 80). Furthermore, nonfatal suicide attempt rates involve mostly means other than firearms and do not differ between high- and low-gun-ownership regions (19, 21). Firearm ownership rate, independently of underlying rate of nonfatal suicidal behavior, predicts suicide rate (19, 26).

The Effect of Altering Firearm Availability and Ownership Rates on Firearm Suicide Rates Outside the United States

Reducing the availability of firearms has lowered both firearm suicide rates and overall suicide rates outside the United States, but only where firearm suicides are prevalent (Table 4) (14, 27, 51, 52, 54–56, 59). Interrupted time-series analyses have been used to investigate the impact of gun control legislation on firearm-related outcomes. Legislation enacted in 2003–2004 in Switzerland halved the size of the civilian army (men 18–43 years old), instituted a fee to keep service firearms after discharge from the army, and introduced gun licenses (14). Before 2004, about half of all homes in Switzerland had a firearm, and firearms were used in 39% of suicides among men in the 18–43 age group. This legislation was followed by a steady decline in firearm and overall suicide rates in this demographic group. A decline in firearm suicides was not observed in other demographic groups, such as men in the 44–53 age group and women in the 18–44 age group. The Swiss firearm suicide rate and overall suicide rate declined at about the same rate during the period 2003–2008, and the only evidence for method substitution was a small increase in railway suicides that attenuated the decrease in suicide rate by only 22% over 5 years. In the United States, the rate of firearm suicides in 2014 among men in this age group was 11.04 per 100,000, for a total of 6,189 deaths. If the decrease in firearm suicide observed in Switzerland were to apply to this age group in the United States, it would potentially have saved 1,650 lives in 2014 (1).

TABLE 1. Regional Variations in Firearm Ownership and Suicide Rates Within the United States and Internationally

Source	Regions Compared	Findings
Miller et al., 2013 (19)	50 U.S. states	Firearm ownership explains 67% of variance in firearm suicides, 42% of variance in suicides, and less than 2% of variance in non-firearm suicides. The states with the 16 highest and the 6 lowest rates of gun ownership do not differ in number of suicide attempts, but differ in suicides (11,428 compared with 6,038) and firearm suicides (7,275 compared with 1,697).
Miller et al., 2013 (20)	U.S. cities	Difference in suicides in high-gun areas compared with low-gun areas (18,674) over a 12-year period, attributable to differences in firearm suicides (18,526), with little difference in non-firearm suicides (138).
Miller et al., 2007 (21)	50 U.S. states	A 1% difference in household firearm prevalence was associated with a relative difference of 3.5% in firearm suicide rates and 1.4% in suicide rates. The states with the 15 highest and the 6 lowest rates of gun ownership have a similar number of non-firearm suicides but differ in the number of suicides (14,809 compared with 8,052) and firearm suicides (9,749 compared with 2,606).
Miller et al., 2002 (22)	9 U.S. geographic regions and 50 states	Firearm suicide rates are 3.8 times higher in high-gun states compared with low-gun states.
Kaplan and Geling, 1998 (23)	9 major U.S. geographic regions	Positive correlation between firearm ownership and firearm suicide rates for white males (r_s=0.77), white females (r_s=0.83), and black males (r_s=0.76), but not black females.
Markush and Bartolucci, 1984 (24)	9 major U.S. geographic regions	Association between gun prevalence and firearm suicide rates (r_p=0.90).
Corr, 2014 (25)	United States, Europe, Asia	For U.S. armed forces active component members, firearms accounted for 61.1% and 97.2% of suicides within the United States and in combat zones, respectively, but only 5.4% of suicides in Europe and Asia. For firearm suicides in the United States, 6.3% used a military weapon, compared with 94.2% in combat zones.
Bangalore and Messerli, 2013 (26)	27 countries	Positive correlation between guns per capita per country and rate of firearm-related deaths (r_p=0.80), but not mental illness rates.
Ajdacic-Gross et al., 2006 (27)	13 countries	Longitudinal analysis confirmed main effect on firearm suicides due to household gun ownership rates ($p<0.001$).
Killias, 1993 (28)	14 countries	Positive correlation between gun ownership and overall suicide (r_s=0.52) and firearm suicide (r_s=0.90) rates.
Lester, 1990 (29)	20 countries	Gun ownership, as measured by the percentage of firearm homicides, positively correlates with firearm suicide rates (r_p=0.38).

High firearm ownership rates, along with high rates of major depression, substance use disorders, and post-traumatic stress disorder, all conditions that carry a suicide risk, raise the risk of firearm suicide in veterans. The overall suicide rate is more than four times higher among active soldiers stationed in the United States compared with Europe, and the use of a non-military-issue firearm for suicide is 11/100,00 per year in the United States and zero in Europe (25). Firearm suicides while on leave in the United States involve personal guns, but on base or during deployment, they involve military-issue weapons (25). The lowering of suicide rates in the Israel Defense Forces by discontinuing the practice of soldiers taking their weapon home on leave (51) demonstrates the potential of firearm restriction for reducing suicide rates in the military, but it is likely to be less effective among U.S. service personnel on leave because of higher rates of personal gun ownership (43).

Gun reform in Australia was enacted over several years but became much stricter in 1996 in response to a mass shooting that took 35 lives (56). The new laws required that firearms be registered to their licensed owners, prohibited private gun sales, and required a justification beyond just self-defense for firearm ownership. Police conducted large-scale gun buybacks that removed about one-fifth of the country's guns from circulation. Starting before the 1996 reforms, and then perhaps accelerating after the 1996 reforms, there was a steady decline in national firearm suicide rates, but there is disagreement over means substitution by hanging (53, 56, 81). Non-firearm suicide rates also declined, indicating that other factors were also operating (81). In the 18 years preceding the gun control reforms, there were 13 mass shootings in Australia, compared with none in the following 18 years, but the overall firearm homicide rate was not changed (56, 81).

In New Zealand, less than 20% of suicides use firearms, less than half the rate in the United States. Legislation was introduced in 1992 in New Zealand in response to a lone gunman killing 13 people with a military-type assault weapon in 1990. This legislation required stricter licensing for gun ownership and locked storage for guns and ammunition. Police confirmed compliance by home visits. Before the legislation was enacted, firearm suicide accounted for 18% of all suicides in New Zealand, but by 2010, firearm suicide dropped to 8% of all suicides. The overall youth suicide rate declined transiently (1993–1996) (55). Strict gun control appears to reduce firearm suicides, but national rates are reduced only in those countries where gun ownership rates are higher and firearm suicides constitute a larger proportion of the overall suicide rate.

Methods to Reduce Firearm Suicide Rates in the United States and Potential Effects on Overall Suicide Rates

Successful gun control efforts in Switzerland, Australia, Canada, and New Zealand have proven impossible to duplicate in the United States. Because of Second Amendment rights, variations in state laws and regulations, and the opposition of gun rights advocates, such efforts have generally resulted in inaction or in a few states passing limited gun control or safety laws.

TABLE 2. Time-Series Analyses of Gun Ownership and Suicide Rates in the United States

Source	Period	Findings
Miller et al., 2006 (30)	1981–2002	A 10% decrease in household firearm ownership was associated with a 4.2% decrease in firearm suicide rates (8.3% in adolescents) and a 2.5% decrease in suicide rates (4.1% in adolescents).
Birckmayer and Hemenway, 2001 (31)	1979–1994	A 10% decrease in household firearm ownership was associated with an 8.2% decrease in firearm suicide rates and a 3.0% decrease for overall suicide rates. Effect stronger for ages 15–24 years.
Clarke and Jones, 1989 (32)	1959–1984	An association was observed between firearm suicide rates and handgun ownership (Beta=0.68, p=0.001), but not long gun ownership.
Boyd, 1983 (33)	1953–1978	A steady increase in overall suicide rate was almost entirely attributable to a rise in firearm suicide rate. No data on firearm ownership.
Boor, 1981 (34)	1962–1975	Suicide rates rose from 10.9 to 12.9/100,000 per year. Firearm suicide rates increased from 5.1 to 7.0, and non-firearm suicides decreased from 5.8 to 5.7. No data on firearm ownership.

Reducing access to firearms by at-risk individuals. The U.S. Supreme Court, in *District of Columbia v. Heller, 554 U.S. 570 (2008)*, upheld an individual's 2nd Amendment right to possess firearms, forcing gun control advocates to shift their legislative focus from broad-based to targeted restrictions. In response to mass killings, three states enacted legislation allowing temporary seizure and restriction of firearms for people deemed at risk of harming themselves or others, irrespective of psychiatric diagnosis (82–84). Although these policies were developed to prevent mass shootings, they also have the potential to reduce firearm suicides by restricting firearm access to those at risk of suicide. However, evaluation of their impact on suicide is needed (85). Media attention on mass shooters has exaggerated the appearance of a relationship between mental illness and firearm violence (86). Most individuals with psychiatric illness are never violent toward others, and psychiatric diagnosis alone is a poor predictor of future firearm violence (87). Policies focused on restricting firearm access based on dangerous behaviors, instead of psychiatric diagnosis, are more effective at reducing firearm violence (88, 89). Unlike interpersonal violence, suicide is a complication of psychiatric illness in almost 90% of cases (90, 91). However, it is difficult to develop policies to restrict firearm access for individuals at risk of suicide because of a psychiatric illness while respecting patient confidentiality and not discouraging psychiatric treatment.

Targeted regulation, enacted in California in 2014 in response to the Isla Vista mass shooting, employed a "gun violence restraining order" (GVRO) (85). The GVRO models the legal process for domestic violence restraining orders, a strategy for preventing domestic violence adopted by all 50 U.S. states and the District of Columbia. The GVRO allows family members, significant others, and law enforcement personnel to formally request confiscation of firearms belonging to a person who may hurt him- or herself or others (85). A temporary or permanent GVRO is issued by the court, after which police are authorized to remove guns in the individual's possession. If the order is permanent, it also prohibits the individual from purchasing firearms, through the National Instant Criminal Background Check System (NICS), for 1 year. After this 1-year period, affected individuals are eligible for a court review of risk, which may be followed by either continuation or cessation of the GVRO (85).

Many individuals at risk of suicide have either undiagnosed or untreated psychiatric illness, and it is assumed that a family member or loved one may be best placed to notice alarming behaviors. Family members initiating a GVRO process could prevent firearm suicide and potentially lead to individuals receiving appropriate treatment. A limitation is that many families are unaware of the degree of psychopathology in at-risk individuals. Other potential gatekeepers are primary care physicians, who see almost half of all suicides within 30 days of their suicide, offering an opportunity for prevention (92). Guns used for suicide are bought a mean of 11 years before the suicide (15), so the implication for prevention is that it is more important for suicide prevention to restrict access to already owned guns by depressed suicidal persons than it is to prevent them from purchasing a gun (93).

A similar policy in Indiana has an advantage over the California GVRO in that it permits police officers to seize firearms from individuals deemed dangerous, before receiving court approval (83). After a firearm seizure, the acting officer is required to submit evidence explaining why the individual was believed to be dangerous. Even if the firearm is returned, the seizure serves as a "cooling off" period, allowing the suicidal crisis to pass (83).

The GVRO's approach to restricting new gun purchases by at-risk individuals is also valuable, but it is limited by federal law to background checks via the NICS index, and reporting is mandatory only for firearm purchases made through licensed

TABLE 3. Availability of Firearms in the Home and Suicide Risk in the United States and Europe

Source	Study Type	Population	Findings
Brent et al., 1988 (35)	Case-control	27 adolescent suicides, 56 suicidal adolescents	A gun in the home was associated with suicide (odds ratio=2.7).
Brent et al., 1991 (36)	Case-control	47 adolescent suicides, 47 adolescent suicide attempters, 47 adolescent nonattempters	A gun in the home was associated with suicide (odds ratio=2.1).
Brent et al., 1993 (37)	Case-control	67 adolescent suicides, 67 adolescent comparison subjects	A gun in the home was associated with suicide (odds ratio=4.4). A handgun in the home was associated with suicide (odds ratio=9.4).
Shah et al., 2000 (38)	Case-control	36 adolescent suicides, 36 adolescent comparison subjects	A gun in the home was associated with firearm suicide (odds ratio=3.9).
Werenko et al., 2000 (39)	Ecological	184 adolescent suicides	Adolescent suicide rates were twofold higher in New Mexico compared with the general U.S. adolescent suicide rate; 67% used firearms and 75% of firearms belonged to a family member.
Sloan et al., 1990 (40)	Ecological	Suicides in King County, Wash., and Vancouver, B.C.	Individuals ages 15–24 had a greater relative risk of suicide (1.38) and firearm suicide (3.14) in King County compared with Vancouver. No difference in suicide rates for other age groups.
Lahti et al., 2014 (41)	Ecological, 38 years	Male suicides in North and South Finland	Firearm suicide rates in North Finland compared with South Finland were 2.6-fold higher in young adults and 1.9-fold higher in adults. No difference in rates of non-firearm suicide. Gun ownership rates in North Finland are double the rates in South Finland.
Kellermann et al., 1992 (42)	Case-control	442 adolescent and adult suicides, 438 comparison subjects	A gun in the home was associated with suicide (odds ratio=4.8), and a loaded gun was more strongly associated with suicide (odds ratio=9.2).
Kaplan et al., 2009 (43)	Ecological	U.S. veteran compared with nonveteran suicides	Veterans were more likely to use firearms compared with male (odds ratio=1.3) and female (odds ratio=1.6) nonveterans.
Weibe, 2003 (44)	Case-control	1,959 adult suicides, 13,535 comparison subjects	A gun in the was home associated with suicide (odds ratio=3.4) and firearm suicide (odds ratio=16.9).
Dahlberg et al., 2004 (45)	Case-control	1,049 adult suicides, 535 nonsuicide deaths	A gun in the home was associated with both male suicide (odds ratio=10.4) and female suicide (odds ratio=2.3).
Kung et al., 2005 (46)	Case-control	702 adult suicides, 1,995 nonsuicide deaths	Homes of suicides were more likely than nonsuicide homes to have a gun (odds ratio=2.6).
Conwell et al., 2002 (47)	Case-control	86 elderly suicides, 86 comparison subjects	A gun in the home was associated with suicide (odds ratio=2.3). A gun stored unlocked was more strongly associated with suicide (odds ratio=9.5).
Grassel et al., 2003 (48)	Case-control	213,466 adults deaths in California in 1998; 4,728 were firearm related deaths and 1,546 were firearm suicides	Purchase of a handgun within 3 years of death was associated with suicide (odds ratio=6.8) and firearm suicide (odds ratio=12.5).
Cummings et al., 1997 (49)	Case-control	353 suicides, 1,756 comparison subjects	Family handgun purchase was associated with suicide (odds ratio=1.9).

dealers (82). Because 30%−40% of firearm sales take place in secondary markets, where buyers and sellers are unlicensed (94), extending mandatory reporting to all firearm sales and optimizing the completeness of the NICS national database is essential for maximizing the effectiveness of GVRO legislation background checks (82, 95).

Strong local support from stakeholders, collaboration with experts in the field, and media engagement helped get the GVRO legislation passed in California (89). After firearm seizure legislation is passed, the public must be educated, with a special focus on families with a family history of suicide. In Indiana and Connecticut, ex post facto review of firearm seizure reports revealed that suicide risk was the most common reason for firearm seizure (83). The modest number of firearm seizures in both states indicates that these laws are not very effective (83). It is too soon to evaluate the GVRO in California. Enhancing awareness of such seizure laws through both suicide and firearm safety prevention groups may increase their impact on firearm suicide.

Multifaceted or broader gun control legislation. Broader existing state firearm restrictions may reduce gun availability and thereby affect firearm suicide rates. States vary greatly in the stringency of such firearm laws. A review in 2005 concluded that there was insufficient evidence to support the effectiveness of state gun control legislation in reducing

TABLE 4. Time-Series Effect of Firearm Legislation or Regulation on Suicide Rates Within Geographic Locations or the Military

Source	Region	Legislation or Regulation	Postimplementation Outcome
Crifasi et al., 2015 (50)	United States	Permit-to-purchase (PTP) laws were enacted in Connecticut and repealed in Missouri.	Decrease in firearm suicide rates (15.4%) associated with implementation of Connecticut's PTP law. Repeal of PTP law in Missouri associated with an increase in firearm suicide rates (16.1%).
Reisch et al., 2013 (14)	Switzerland	Swiss army size halved and increased fee for retaining guns after military service.	Rates decreased 27% for firearm suicide in affected demographic group (men ages 18–43).
Lubin et al., 2010 (51)	Israel	Israel Defense Forces required that soldiers not take their firearms home on weekend leave.	Overall suicide rate decreased by 40% due to fewer firearm suicides.
Gagné et al., 2010 (52)	Province of Quebec	Bill C-17 (Canada) required that applicants complete a safety course, undergo background checks, and undergo a mandatory 28-day waiting period.	Annual percentage change in firearm suicide rates for men ages 15–34 before the bill was −2.7% and after the bill, −11.1%.
Klieve et al., 2009 (53)	Australia	Private firearm sales and semiautomatic weapons were banned. A genuine reason for ownership (excluding "self-defense") and firearm registration were required. A massive buyback program removed one-fifth of guns from circulation.	Annual decline in firearm suicides was 3.9% before implementation and 7.1% after implementation (p=0.01).
Kapusta et al., 2007 (54)	Austria	Purchase required a reason for ownership, psychological testing, minimum age of 21, background check, safe firearm storage, and a 3-day "cooling-off" period.	Decrease in firearm suicide rates of 4.7% per year.
Beautrais et al., 2006 (55)	New Zealand	Firearm owners must be licensed. License issued after applicants pass a test on firearm regulations, use, safety, and storage and a police interview and safe gun storage home inspection.	Rates of firearm suicide reduced by 66% in adolescents and 39% in adults.
Chapman et al., 2006 (56)	Australia	Private firearm sales and semiautomatic weapons were banned. A genuine reason for ownership (excluding "self-defense") and firearm registration were required. A massive buyback program removed one-fifth of guns from circulation.	No mass shootings. Overall suicide rates decreased 4.4% per year.
Rosengart et al., 2005 (57)	United States	Reviewed impact of five gun laws: law allowing carrying of a concealed weapon, 21-year age minimum for handgun purchase and possession, limit on handgun purchase frequency (1 per month), and ban on sale of cheaply constructed handguns.	No laws associated with a significant change in suicide rates.
Webster et al., 2004 (58)	United States	Examined youth-focused firearm laws mandating a minimum age for the purchase or possession of handguns and child access prevention (CAP) laws requiring safe storage.	CAP laws associated with an 8.3% decrease (rate ratio=0.92) in suicide rates for 14- to 17-year-olds.
Bridges, 2004 (59)	Canada	Bill C-17 required that applicants complete a safety course, undergo background checks, and undergo a mandatory 28-day waiting period.	Percentage of firearm suicides decreased from 31.2% to 24.5%.
Ludwig and Cook, 2000 (60)	United States	Examined effect of Brady Handgun Act (waiting periods and background checks for handgun sales).	Brady Law associated with 6% lower firearm suicide rates only in adults age 55 and older.
Loftin et al., 1991 (61)	United States	The District of Columbia adopted a law banning the purchase, sale, transfer, or possession of handguns by civilians. Registration of firearms, background checks, and gun safety standards were mandated.	Decrease in firearm suicides by 23%, with no evidence of substitution. No change in suicide rates in the surrounding cities where the firearm laws were not altered.

firearm-related deaths (17). However, recent studies in the United States (50, 62–67) and elsewhere (96) (Tables 4 and 5) are more encouraging about the benefits of multifaceted stricter firearm restrictions. Firearm restrictions, including permit to purchase (PTP), waiting periods, safe storage, background checks, and registration guidelines, are associated with both lower firearm suicide rates and overall suicide rates (62–68). Implementation of PTP laws in Connecticut was associated with a 15% reduction in the firearm suicide rate, and repeal of PTP laws in Missouri was associated with a 16% increase in the firearm suicide rate (50).

Gun safety education. Nonlegislative strategies to prevent firearm suicides have been proposed. One approach uses education-based collaboration with family members of suicidal individuals, gun safety groups, and partners like firearm dealers (97, 98). A commonly held misconception is that if one method of suicide is restricted, suicidal individuals will find

TABLE 5. Comparison of Gun Legislation and Suicide Rates Across the United States

Source	Design	Findings
Anestis and Anestis, 2015 (62)	Examined impact of four handgun laws across all 50 states: waiting periods, background checks, gun locks, and open carry policies.	Background checks, gun locks, and open carry policies were associated with lower firearm suicide and overall suicide rates.
Anestis et al., 2015 (63)	Examined impact of three handgun laws across all 50 states: permit to purchase, registration, and license to own a handgun.	Handgun laws were associated with lower firearm suicide and overall suicide rates.
Fleeger et al., 2013 (64)	States scored based on the restrictiveness of their firearm laws, with higher scores indicating more stringent laws.	States in the highest quartile of stringency (e.g., Mass., Calif., N.J., Conn.) had an age-adjusted incident rate ratio for firearm suicides of 0.63 compared with states in the lowest quartile (e.g., Utah, Okla., La., Ky.).
Rodríguez Andrés and Hempstead, 2011 (65)	Firearm regulations were categorized into three groups: general prohibitions (e.g., permit requirements), behavioral problems, and purchaser's criminal history.	Firearm regulations designed to decrease overall gun availability reduced male suicides, but regulations seeking to prohibit high-risk individuals from owning firearms had little effect.
Price et al., 2004 (66)	Firearm laws divided into five categories: crime deterrence, government control, possession, safety, and sales restrictions laws. States classified as had the law enacted, did not have it enacted, or partially had it enacted.	Combination gun laws ($r_p=-0.74$) and each of the five categories of gun laws (range: -0.43 to -0.65) correlated negatively with firearm suicide rates.
Conner and Zhong, 2003 (67)	States were categorized as restrictive, modest, or unrestrictive, according to their firearm legislation.	States with unrestrictive or modestly restrictive firearm laws had higher suicide incidence rate ratios compared with states with restrictive laws (1.64 and 1.55 for women; 1.51 and 1.49 for men, respectively).
Boor and Bair, 1990 (68)	State handgun laws that place restrictions on buyers (e.g., waiting period) and sellers (e.g., license to purchase handgun) were examined.	Suicide rates were lowest in states with restrictive laws for buyers ($r_p=-0.54$) and sellers ($r_p=-0.45$).

another way to commit suicide (99). In fact, means restriction can save many lives because the suicide crisis resolves for many individuals before an alternative method is identified. Even in cases where an alternative method is identified, most methods other than firearms dramatically reduce the likelihood that the suicide attempt will be fatal (11). It is critical to educate people about the transient nature of suicidal crises and the potential lifesaving effects of restricting firearm access through safer storage or temporary off-site storage for individuals at risk of suicide and especially for adolescents (97). Means restriction counseling by gatekeepers like primary care physicians, mental health clinicians, and emergency department personnel for families with an adolescent at risk of suicide is against the law in Florida, demonstrating how challenging suicide prevention is in the United States (100, 101). Compliance has been inadequately studied, but one study found that only a quarter of the families of depressed adolescents heeded the clinician's recommendations to remove firearms from the household for the duration of treatment (102).

In response to a series of suicides in New Hampshire using newly purchased firearms, a recent initiative analyzed the potential of educating gun shop owners to prevent firearm suicides by learning to recognize suicidal customers and instead of selling them a gun, encouraging them to seek help, as well as by educating existing customers about the importance of safe or off-site gun storage if a member of the household is at risk of suicide (98). Roughly half of approached gun shops agreed to participate in the suicide prevention campaign. The willingness to participate was related to changing the gun retailers' beliefs about the inevitability of suicide (98). Tennessee has initiated a similar program, but no results are available (http://tspn.org/gun-safety-project). Another public health approach involves a social media marketing campaign modeled on the Ad Council's Drunk Driving Prevention campaign, "Friends Don't Let Friends Drive Drunk." This campaign would promote firearm safety as a social norm and urge friends and family of those at risk of suicide to temporarily store guns belonging to the individual in crisis, just as they would with a drunk friend's car keys (98). While the effectiveness of such initiatives is unknown, efforts to change social values have contributed to the success of campaigns to encourage the use of seat belts, the practice of safe sex to prevent the spread of AIDS, and smoking cessation. Similar efforts in the domain of firearm safety emphasizing the value of safe storage and restricting firearm access for depressed and suicidal family and friends may lower firearm suicide rates when combined with referral for psychiatric help.

Smart gun technology. Personalization or smart gun technology, such as fingerprint recognition, is a powerful tool that limits firearm access to the owner or permitted users (95). Although personalization technology is advocated for preventing criminals from using stolen firearms, it will potentially also reduce firearm suicides. About 40% of adolescents with psychiatric illness are living in a home with reported easy access to a firearm, and such technology can protect this large at-risk population (79). Legislation mandating personalization of firearms should mitigate concerns over allowing gun owners access to their own firearms and the

impact of inadequate compliance with safe storage recommendations. One survey reported that 44% of Americans support government funding for research and development of personalized guns (86), and another survey found that 40% of gun owners would consider trading in old guns if safer technology became available (103). In reality, this approach has already met with such resistance that the one gun of this type currently on the U.S. market is sold only through the manufacturer's web site because no gun stores would agree to carry it (103). Increased stakeholder support is needed for wider marketing of personalized guns, and this requires a change in social values regarding safe ownership and use of guns.

Successful implementation of personalization technology for new guns needs to be extended to guns already in circulation by modifying them or trading them in for newer smart guns because of the huge number of firearms in circulation already. Restrictions on gun sales to at-risk individuals would have a limited immediate impact on firearm suicides in the United States relative to most countries because so many guns are already in circulation. Gun buyback programs have substantially reduced the number of firearms in other countries, but U.S. gun buyback programs have not, and consequently have failed to prevent firearm deaths (56, 104). The high firearm suicide mortality demands that current and new prevention approaches be implemented rapidly and outcomes measured (1). If personalization technology becomes common, it can prevent a household's firearms from being used for suicide by family members other than the owner. Other strategies, such as educating gun shop staff about detection of suicide risk in their customers, are limited in their ability to protect gun owners, because less than 10% of the firearms used in suicides are purchased within 2 weeks of the suicide (15, 98), and the median interval between handgun purchase and suicide by the victim or another family member is 11 years, with the greatest risk in the first year after purchase (15). Reducing suicide risk for the actual gun owner will require broader GVRO-type approaches.

CONCLUSIONS

Shockingly, 21,334 lives were lost in 2014 to firearm suicide in the United States. Promising prevention methods must consider that firearm suicide overwhelmingly involves guns that are already purchased. Preventing at-risk individuals from having access to such guns requires targeted legislation like GVROs, safer storage, and smart-gun technology. Protecting gun owners requires better education of families and gun store owners. Effective implementation of such measures in U.S. society will require more legislative and social action than has been seen thus far. Society must come to value gun safety more in order to better protect depressed and suicidal individuals, and this requires public education and legislation requiring safer gun storage and smart-gun technology on all new firearms sold. All such initiatives must be accompanied by systematic evaluation of their effectiveness. Ultimately, such program evaluation and lifting of the ban on federal funding of research on firearm violence will help improve efforts to reduce firearm suicide mortality.

AUTHOR AND ARTICLE INFORMATION

From the Division of Molecular Imaging and Neuropathology, New York State Psychiatric Institute, New York; and the Department of Psychiatry, Columbia University, New York.

Address correspondence to Dr. Mann (jjm@columbia.edu).

Dr. Mann receives royalties from the Research Foundation for Mental Hygiene for commercial use of the Columbia Suicide Severity Rating Scale. Ms. Michel reports no financial relationships with commercial interests.

Received Jan. 19, 2016; revision received April 24, 2016; accepted May 2, 2016; published online July 22, 2016.

REFERENCES

1. Centers for Disease Control and Prevention: WISQARS: Fatal Injury Reports, National and Regional, 1999–2014. http://webappa.cdc.gov/sasweb/ncipc/mortrate10_us.html
2. Hepburn L, Miller M, Azrael D, et al: The US gun stock: results from the 2004 national firearms survey. Inj Prev 2007; 13:15–19
3. Mann JJ, Apter A, Bertolote J, et al: Suicide prevention strategies: a systematic review. JAMA 2005; 294:2064–2074
4. Gunnell D, Fernando R, Hewagama M, et al: The impact of pesticide regulations on suicide in Sri Lanka. Int J Epidemiol 2007; 36: 1235–1242
5. Hawton K, Bergen H, Simkin S, et al: Long term effect of reduced pack sizes of paracetamol on poisoning deaths and liver transplant activity in England and Wales: interrupted time series analyses. BMJ 2013; 346:f403
6. Oliver RG, Hetzel BS: Rise and fall of suicide rates in Australia: relation to sedative availability. Med J Aust 1972; 2:919–923
7. Lester D: Effects of detoxification of domestic gas on suicide in the Netherlands. Psychol Rep 1991; 68:202
8. Kreitman N: The coal gas story: United Kingdom suicide rates, 1960–71. Br J Prev Soc Med 1976; 30:86–93
9. Lester D: The effect of the detoxification of domestic gas in Switzerland on the suicide rate. Acta Psychiatr Scand 1990; 82: 383–384
10. Chapdelaine A, Samson E, Kimberley MD, et al: Firearm-related injuries in Canada: issues for prevention. CMAJ 1991; 145:1217–1223
11. Spicer RS, Miller TR: Suicide acts in 8 states: incidence and case fatality rates by demographics and method. Am J Public Health 2000; 90:1885–1891
12. Simon OR, Swann AC, Powell KE, et al: Characteristics of impulsive suicide attempts and attempters. Suicide Life Threat Behav 2001; 32(suppl):49–59
13. Owens D, Horrocks J, House A: Fatal and non-fatal repetition of self-harm: systematic review. Br J Psychiatry 2002; 181:193–199
14. Reisch T, Steffen T, Habenstein A, et al: Change in suicide rates in Switzerland before and after firearm restriction resulting from the 2003 "Army XXI" reform. Am J Psychiatry 2013; 170:977–984
15. Miller M, Hemenway D: The relationship between firearms and suicide: a review of the literature. Aggress Violent Behav 1999; 4:59–75
16. Brent DA: Firearms and suicide. Ann N Y Acad Sci 2001; 932: 225–239
17. Hahn RA, Bilukha O, Crosby A, et al: Firearms laws and the reduction of violence: a systematic review. Am J Prev Med 2005; 28(suppl 1):40–71
18. Anglemyer A, Horvath T, Rutherford G: The accessibility of firearms and risk for suicide and homicide victimization among household members: a systematic review and meta-analysis. Ann Intern Med 2014; 160:101–110

19. Miller M, Barber C, White RA, et al: Firearms and suicide in the United States: is risk independent of underlying suicidal behavior? Am J Epidemiol 2013; 178:946–955
20. Miller M, Warren M, Hemenway D, et al: Firearms and suicide in US cities. Inj Prev 2015; 21:e116–e119
21. Miller M, Lippmann SJ, Azrael D, et al: Household firearm ownership and rates of suicide across the 50 United States. J Trauma 2007; 62:1029–1034
22. Miller M, Azrael D, Hemenway D: Household firearm ownership and suicide rates in the United States. Epidemiology 2002; 13: 517–524
23. Kaplan MS, Geling O: Firearm suicides and homicides in the United States: regional variations and patterns of gun ownership. Soc Sci Med 1998; 46:1227–1233
24. Markush RE, Bartolucci AA: Firearms and suicide in the United States. Am J Public Health 1984; 74:123–127
25. Corr WP 3rd: Suicides and suicide attempts among active component members of the US armed forces, 2010–2012: methods of self-harm vary by major geographic region of assignment. MSMR 2014; 21:2–5
26. Bangalore S, Messerli FH: Gun ownership and firearm-related deaths. Am J Med 2013; 126:873–876
27. Ajdacic-Gross V, Killias M, Hepp U, et al: Changing times: a longitudinal analysis of international firearm suicide data. Am J Public Health 2006; 96:1752–1755
28. Killias M: International correlations between gun ownership and rates of homicide and suicide. CMAJ 1993; 148:1721–1725
29. Lester D: The availability of firearms and the use of firearms for suicide: a study of 20 countries. Acta Psychiatr Scand 1990; 81:146–147
30. Miller M, Azrael D, Hepburn L, et al: The association between changes in household firearm ownership and rates of suicide in the United States, 1981–2002. Inj Prev 2006; 12:178–182
31. Birckmayer J, Hemenway D: Suicide and firearm prevalence: are youth disproportionately affected? Suicide Life Threat Behav 2001; 31:303–310
32. Clarke RV, Jones PR: Suicide and increased availability of handguns in the United States. Soc Sci Med 1989; 28:805–809
33. Boyd JH: The increasing rate of suicide by firearms. N Engl J Med 1983; 308:872–874
34. Boor M: Methods of suicide and implications for suicide prevention. J Clin Psychol 1981; 37:70–75
35. Brent DA, Perper JA, Goldstein CE, et al: Risk factors for adolescent suicide: a comparison of adolescent suicide victims with suicidal inpatients. Arch Gen Psychiatry 1988; 45:581–588
36. Brent DA, Perper JA, Allman CJ, et al: The presence and accessibility of firearms in the homes of adolescent suicides: a case-control study. JAMA 1991; 266:2989–2995
37. Brent DA, Perper JA, Moritz G, et al: Firearms and adolescent suicide: a community case-control study. Am J Dis Child 1993; 147: 1066–1071
38. Shah S, Hoffman RE, Wake L, et al: Adolescent suicide and household access to firearms in Colorado: results of a case-control study. J Adolesc Health 2000; 26:157–163
39. Werenko DD, Olson LM, Fullerton-Gleason L, et al: Child and adolescent suicide deaths in New Mexico, 1990–1994. Crisis 2000; 21:36–44
40. Sloan JH, Rivara FP, Reay DT, et al: Firearm regulations and rates of suicide: a comparison of two metropolitan areas. N Engl J Med 1990; 322:369–373
41. Lahti A, Keränen S, Hakko H, et al: Northern excess in adolescent male firearm suicides: a register-based regional study from Finland, 1972–2009. Eur Child Adolesc Psychiatry 2014; 23:45–52
42. Kellermann AL, Rivara FP, Somes G, et al: Suicide in the home in relation to gun ownership. N Engl J Med 1992; 327:467–472
43. Kaplan MS, McFarland BH, Huguet N: Firearm suicide among veterans in the general population: findings from the National Violent Death Reporting System. J Trauma 2009; 67:503–507
44. Wiebe DJ: Homicide and suicide risks associated with firearms in the home: a national case-control study. Ann Emerg Med 2003; 41: 771–782
45. Dahlberg LL, Ikeda RM, Kresnow MJ: Guns in the home and risk of a violent death in the home: findings from a national study. Am J Epidemiol 2004; 160:929–936
46. Kung HC, Pearson JL, Wei R: Substance use, firearm availability, depressive symptoms, and mental health service utilization among white and African American suicide decedents aged 15 to 64 years. Ann Epidemiol 2005; 15:614–621
47. Conwell Y, Duberstein PR, Connor K, et al: Access to firearms and risk for suicide in middle-aged and older adults. Am J Geriatr Psychiatry 2002; 10:407–416
48. Grassel KM, Wintemute GJ, Wright MA, et al: Association between handgun purchase and mortality from firearm injury. Inj Prev 2003; 9:48–52
49. Cummings P, Koepsell TD, Grossman DC, et al: The association between the purchase of a handgun and homicide or suicide. Am J Public Health 1997; 87:974–978
50. Crifasi CK, Meyers JS, Vernick JS, et al: Effects of changes in permit-to-purchase handgun laws in Connecticut and Missouri on suicide rates. Prev Med 2015; 79:43–49
51. Lubin G, Werbeloff N, Halperin D, et al: Decrease in suicide rates after a change of policy reducing access to firearms in adolescents: a naturalistic epidemiological study. Suicide Life Threat Behav 2010; 40:421–424
52. Gagné M, Robitaille Y, Hamel D, et al: Firearms regulation and declining rates of male suicide in Quebec. Inj Prev 2010; 16:247–253
53. Klieve H, Barnes M, De Leo D: Controlling firearms use in Australia: has the 1996 gun law reform produced the decrease in rates of suicide with this method? Soc Psychiatry Psychiatr Epidemiol 2009; 44:285–292
54. Kapusta ND, Etzersdorfer E, Krall C, et al: Firearm legislation reform in the European Union: impact on firearm availability, firearm suicide, and homicide rates in Austria. Br J Psychiatry 2007; 191:253–257
55. Beautrais AL, Fergusson DM, Horwood LJ: Firearms legislation and reductions in firearm-related suicide deaths in New Zealand. Aust N Z J Psychiatry 2006; 40:253–259
56. Chapman S, Alpers P, Agho K, et al: Australia's 1996 gun law reforms: faster falls in firearm deaths, firearm suicides, and a decade without mass shootings. Inj Prev 2006; 12:365–372
57. Rosengart M, Cummings P, Nathens A, et al: An evaluation of state firearm regulations and homicide and suicide death rates. Inj Prev 2005; 11:77–83
58. Webster DW, Vernick JS, Zeoli AM, et al: Association between youth-focused firearm laws and youth suicides. JAMA 2004; 292: 594–601
59. Bridges FS: Gun control law (Bill C-17), suicide, and homicide in Canada. Psychol Rep 2004; 94:819–826
60. Ludwig J, Cook PJ: Homicide and suicide rates associated with implementation of the Brady Handgun Violence Prevention Act. JAMA 2000; 284:585–591
61. Loftin C, McDowall D, Wiersema B, et al: Effects of restrictive licensing of handguns on homicide and suicide in the District of Columbia. N Engl J Med 1991; 325:1615–1620
62. Anestis MD, Anestis JC: Suicide rates and state laws regulating access and exposure to handguns. Am J Public Health 2015; 105: 2049–2058
63. Anestis MD, Khazem LR, Law KC, et al: The association between state laws regulating handgun ownership and statewide suicide rates. Am J Public Health 2015; 105:2059–2067
64. Fleegler EW, Lee LK, Monuteaux MC, et al: Firearm legislation and firearm-related fatalities in the United States. JAMA Intern Med 2013; 173:732–740
65. Rodríguez Andrés A, Hempstead K: Gun control and suicide: the impact of state firearm regulations in the United States, 1995–2004. Health Policy 2011; 101:95–103

66. Price JH, Thompson AJ, Dake JA: Factors associated with state variations in homicide, suicide, and unintentional firearm deaths. J Community Health 2004; 29:271–283
67. Conner KR, Zhong Y: State firearm laws and rates of suicide in men and women. Am J Prev Med 2003; 25:320–324
68. Boor M, Bair JH: Suicide rates, handgun control laws, and sociodemographic variables. Psychol Rep 1990; 66:923–930
69. Graduate Institute of International Studies, Geneva (ed): Completing the count: civilian firearms, in Small Arms Survey 2007: Guns and the City. Cambridge, UK, Cambridge University Press, 2007, pp 39–71
70. Siegel M, Ross CS, King C 3rd: A new proxy measure for state-level gun ownership in studies of firearm injury prevention. Inj Prev 2014; 20:204–207
71. Duggan M: More guns, more crime. J Polit Econ 2001; 109:1086–1114
72. Siegel M, Ross CS, King C 3rd: The relationship between gun ownership and firearm homicide rates in the United States, 1981–2010. Am J Public Health 2013; 103:2098–2105
73. Grossman DC, Mueller BA, Riedy C, et al: Gun storage practices and risk of youth suicide and unintentional firearm injuries. JAMA 2005; 293:707–714
74. Kellermann AL, Reay DT: Protection or peril? An analysis of firearm-related deaths in the home. N Engl J Med 1986; 314: 1557–1560
75. Bukstein OG, Brent DA, Perper JA, et al: Risk factors for completed suicide among adolescents with a lifetime history of substance abuse: a case-control study. Acta Psychiatr Scand 1993; 88: 403–408
76. Sorenson SB, Vittes KA: Mental health and firearms in community-based surveys: implications for suicide prevention. Eval Rev 2008; 32:239–256
77. Miller M, Barber C, Azrael D, et al: Recent psychopathology, suicidal thoughts, and suicide attempts in households with and without firearms: findings from the National Comorbidity Study Replication. Inj Prev 2009; 15:183–187
78. Hemenway D, Miller M: Association of rates of household handgun ownership, lifetime major depression, and serious suicidal thoughts with rates of suicide across US census regions. Inj Prev 2002; 8:313–316
79. Simonetti JA, Mackelprang JL, Rowhani-Rahbar A, et al: Psychiatric comorbidity, suicidality, and in-home firearm access among a nationally representative sample of adolescents. JAMA Psychiatry 2015; 72:152–159
80. Betz ME, Barber C, Miller M: Suicidal behavior and firearm access: results from the second injury control and risk survey. Suicide Life Threat Behav 2011; 41:384–391
81. Baker J, McPhedran S: Gun laws and sudden death: did the Australian firearms legislation of 1996 make a difference? Br J Criminol 2006; 47:455–469
82. Swanson JW, Felthous AR: Guns, mental illness, and the law: introduction to this issue. Behav Sci Law 2015; 33:167–177
83. Parker GF: Circumstances and outcomes of a firearm seizure law: Marion County, Indiana, 2006–2013. Behav Sci Law 2015; 33: 308–322
84. Silver J, Fisher WH, Silver E: Preventing persons affected by serious mental illnesses from obtaining firearms: the evolution of law, policy, and practice in Massachusetts. Behav Sci Law 2015; 33:279–289
85. Frattaroli S, McGinty EE, Barnhorst A, et al: Gun violence restraining orders: alternative or adjunct to mental health-based restrictions on firearms? Behav Sci Law 2015; 33:290–307
86. Barry CL, McGinty EE, Vernick JS, et al: After Newtown: public opinion on gun policy and mental illness. N Engl J Med 2013; 368: 1077–1081
87. Swanson JW, McGinty EE, Fazel S, et al: Mental illness and reduction of gun violence and suicide: bringing epidemiologic research to policy. Ann Epidemiol 2015; 25:366–376.
88. McGinty EE, Frattaroli S, Appelbaum PS, et al: Using research evidence to reframe the policy debate around mental illness and guns: process and recommendations. Am J Public Health 2014; 104: e22–e26
89. Horwitz J, Grilley A, Kennedy O: Beyond the academic journal: unfreezing misconceptions about mental illness and gun violence through knowledge translation to decision-makers. Behav Sci Law 2015; 33:356–365
90. Arsenault-Lapierre G, Kim C, Turecki G: Psychiatric diagnoses in 3275 suicides: a meta-analysis. BMC Psychiatry 2004; 4:37
91. Isometsä ET: Psychological autopsy studies: a review. Eur Psychiatry 2001; 16:379–385
92. Luoma JB, Martin CE, Pearson JL: Contact with mental health and primary care providers before suicide: a review of the evidence. Am J Psychiatry 2002; 159:909–916
93. Gibbons RD, Brown CH, Hur K, et al: Suicidal thoughts and behavior with antidepressant treatment: reanalysis of the randomized placebo-controlled studies of fluoxetine and venlafaxine. Arch Gen Psychiatry 2012; 69:580–587
94. Siebel BJ: The case against the gun industry. Public Health Rep 2000; 115:410–418
95. Bloomberg MR, Webster DW, Vernick JS: Reducing Gun Violence in America: Informing Policy With Evidence and Analysis. Baltimore, Johns Hopkins University Press, 2013
96. Santaella-Tenorio J, Cerdá M, Villaveces A, et al: What do we know about the association between firearm legislation and firearm-related injuries? Epidemiol Rev 2016; 38:140–157
97. Barber CW, Miller MJ: Reducing a suicidal person's access to lethal means of suicide: a research agenda. Am J Prev Med 2014; 47(suppl 2):S264–S272
98. Vriniotis M, Barber C, Frank E, et al: A suicide prevention campaign for firearm dealers in New Hampshire. Suicide Life Threat Behav 2015; 45:157–163
99. Miller M, Azrael D, Hemenway D: Belief in the inevitability of suicide: results from a national survey. Suicide Life Threat Behav 2006; 36:1–11
100. Runyan CW, Brown TL, Brooks-Russell A: Preventing the invisible plague of firearm suicide. Am J Orthopsychiatry 2015; 85:221–224
101. Kuehn BM: Battle over Florida legislation casts a chill over gun inquiries. JAMA 2015; 313:1893–1895
102. Brent DA, Baugher M, Birmaher B, et al: Compliance with recommendations to remove firearms in families participating in a clinical trial for adolescent depression. J Am Acad Child Adolesc Psychiatry 2000; 39:1220–1226
103. Healy M: "Smart" guns may help prevent violence—if they can make it on the US market. Los Angeles Times, June 15, 2015
104. Braga AA, Wintemute GJ: Improving the potential effectiveness of gun buyback programs. Am J Prev Med 2013; 45:668–671