

Public Safety Committee
October 11, 2017
Agenda Item No.1

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**SUMMARY OF REMARKS IN SUPPORT OF AGENDA ITEM NO.
1—RECOMMENDATION IN SUPPORT OF SUICIDE
PREVENTION MATERIALS AT GUN SHOPS**

By: Norman A. Dupont

Introduction: I am an attorney who has practiced for most of my career in Los Angeles based law firms. I practice principally in the environmental law field and have represented over the years a number of cities, including Los Angeles, Beverly Hills, Compton, Norwalk, and other cities in the Los Angeles and Orange County areas. I am currently a partner with the law firm of Ring Bender LLP, and a member of the Board of Women Against Gun Violence.

I would like to make three points for the Committee's consideration of this agenda item:

- (1) The Committee should carefully look at scholarly data related to gun ownership and suicides: Unlike other data, which may be scarce or subject to considerable debate, the data about the link between suicides and gun ownership is clear and strong.
- (2) Introduce and provide for the record at this hearing the following scholarly articles or summaries of findings, including:
 - (a) Professor Randolph Roth, OSU professor, "Why Guns are and Are Not the Problem" (2017 publication): [QUOTE]
 - (b) Professor Mitchell, Harvard University, School of Public Health (2009) "The Association between changes in household firearms ownership and rates of suicide in the United States 1981-2002.
 - (c) Harvard University, School of Public Health press release: "Guns in homes strongly associated with Higher rates of suicide" (2007); and

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(d)Harvard University, School of Public Health magazine
reprint: "News: Guns and suicide: A Fatal Link" (2008).

(3) Conclusion: The Committee should respect data assembled by respected social scientists over the past decade that all points to one conclusion—that rates of suicide in the U.S. are strongly correlated to gun ownership. The Committee should take one small step to address that undisputed fact and advance the proposed ordinance out of Committee and to consideration by the City Attorney's office for drafting a final ordinance.

Why Guns Are and Aren't the Problem:
The Relationship between Guns and Homicide in American History

Randolph Roth

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Since World War II, the United States has had by far the highest homicide rate of any affluent nation. It has ranged between 5 and 10 per 100,000 persons per year, while rates in other affluent societies have seldom been higher than 2 per 100,000 persons per year and have usually been 1 per 100,000 or less.¹ The United States also has one of the highest rates of gun ownership in the world and the highest rate of gun violence in the affluent world. Today, at least 35 to 40 percent of households own a firearm,² and nearly 70 percent of homicides of adults—strangers, lovers, acquaintances, or family members—are committed with guns.³

Firearms have been the primary murder weapon in the United States at least since the end of World War I. The nation's first comprehensive mortality statistics show that a majority of homicides of adults were committed with firearms in every region of the country, 1919-1933: 56 percent in New England and over 70 percent in the South and the West. Only America's island territories—Hawaii, Puerto Rico, and the Virgin Islands—

had low rates of gun homicide. Whites were more likely than nonwhites to be murdered with guns, but the difference was less than 10 percent.⁴

However, as scholars from a variety of political perspectives have pointed out, it is not yet clear whether firearms are primarily or even partly responsible for America's high homicide rate. Some societies with low levels of private gun ownership, such as Brazil and the Russian Federation, have extremely high homicide rates, while some societies in which gun ownership is nearly universal, like Switzerland and Israel, have low homicide rates.⁵ Within the United States, state-level data from 1999 to 2005 show no correlation between the proportion of households that own firearms and the homicide rate by firearms (Figure 1). Some states with ownership levels above 50 percent—South Dakota, Idaho, Wyoming, Montana—had relatively low homicide rates by firearms, while some states in which only a quarter of households owned guns—Illinois and Maryland—had relatively high rates. In Washington, D.C., where only 5 percent of households owned a firearm, the homicide rate by firearms was over 25 per 100,000 persons per year. And there was no “substitution effect”: homicide rates by other means were not higher in states with low ownership levels or lower in states with high ownership levels. Today's regional differences in homicide rates are the historical legacy of social, cultural, and political differences that emerged in their present form in the mid- and late-nineteenth century.⁶ They are not a consequence of regional differences in gun ownership.

That is not to say that firearms are benign. There is reason to believe, for example, that high levels of gun ownership have increased the suicide rate substantially in the United States. There is a strong correlation between gun ownership and the suicide rate

with firearms (Figure 2), and no substitution effect. Scholars of public health have drawn the same conclusion from other datasets: access to firearms increases the likelihood of suicide, primarily because firearms are far more likely than drugs, cuts, poison, or carbon monoxide to inflict fatal injuries and to forestall life-saving interventions. Yet even so, the suicide rate in the United States is not extraordinarily high compared to the rates in other societies, many of which have low levels of gun ownership, so the contribution of firearms to America's suicide rate should not be exaggerated.⁷

Given the complexity of these patterns, most criminologists, epidemiologists, and historians have been wary of drawing too strong a connection between the high level of gun ownership in the United States and the nation's homicide rate. And there are sound mathematical reasons for being circumspect. It is impossible, for instance, to measure the precise impact of a single variable on the homicide rate, because statistical methods cannot control for the impact of other important variables. Every explanatory variable of potential importance changes from year to year and place to place, and many are highly correlated with others, making it impossible to isolate the impact of a particular variable, such as gun ownership or gun laws. The only solution to this problem is to match victims of contemporary gun violence against randomly selected individuals with similar risk factors (an approach which more closely approximates a controlled experiment) or, as sociologist Stanley Lieberson suggests, to amass statistics over long periods of time and in various social contexts and look for robust patterns. Few participants in the firearms debate have taken either of these approaches.⁸

In addition, few studies of the impact of firearms distinguish among types of homicide, such as intimate partner murders and murders of unrelated adults, which follow

different patterns and have different causes. And few studies distinguish among the types of firearms available. Some kinds of homicide may be deeply affected by the number and kind of firearms available, and others may not.

These problems can be addressed by taking a historical view of the relationship between firearms and homicide. History shows that gun ownership has not been the primary determinant of America's homicide rate. Gun ownership has been widespread in the United States from colonial times to the present, but the rates for various kinds of homicide have fluctuated widely, from extremely high levels to extremely low levels, just as they have in Western Europe, where gun ownership has never been widespread. The availability of guns does not determine whether the base rate of a particular kind of homicide is high or low. But the evidence shows that the availability of guns—especially modern, breech-loading firearms—has pushed the homicide rate in the United States beyond what it would have otherwise been, especially in times when the homicide rate has been extraordinarily high.

In the colonial and revolutionary period, over half of all households owned a working gun. On the eve of the Revolution, the proportion ranged from 41 percent of male wealthholders in the middle colonies to 50 percent in New England and 69 percent in the South. A few households owned pistols, but most owned muskets or fowling pieces, used for hunting, warfare, vermin control, and policing slaves. The poor were less likely to own firearms than the wealthy, but a third of the poorest fifth of wealth holders still owned a gun.⁹ Gun ownership has not been studied as thoroughly between the 1820s and the end of World War II, so the regional and demographic distributions of firearms during that period aren't known. But domestic production and imports of affordable

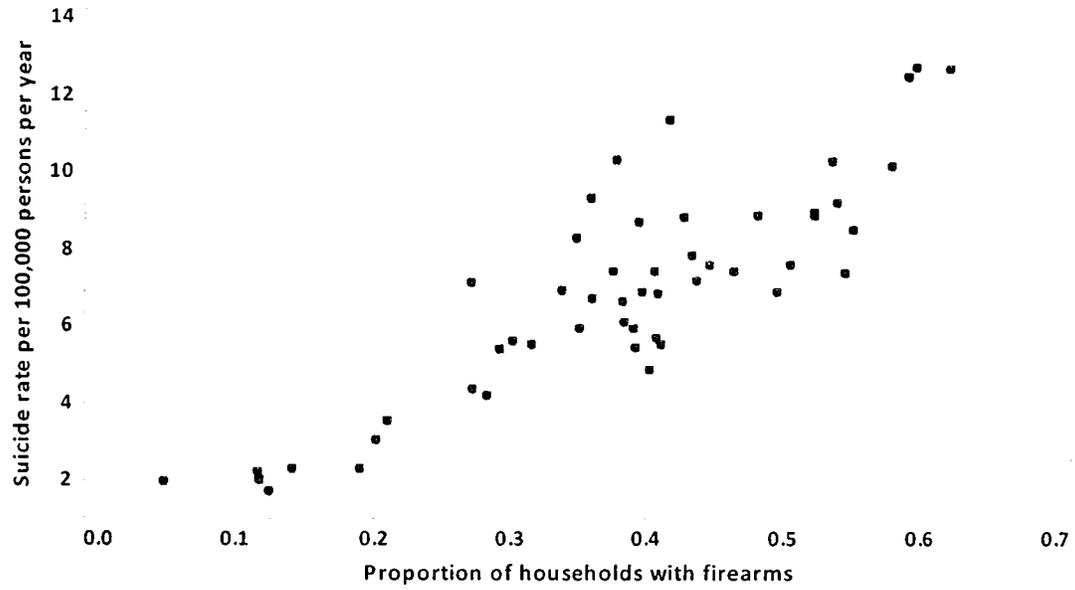
firearms were sufficient to sustain high levels of gun ownership into the 1950s and 1960s, when it still stood at half of all households.¹⁰

Unlike gun ownership, however, America's murder rate has varied widely over the past four centuries. Homicide rates among unrelated adults in the early and mid-seventeenth century were horrific—120 per 100,000 adults per year in New England and New Netherlands, 250 per 100,000 in Virginia, and 450 per 100,000 in Maryland—a far cry from the 7 or 8 per 100,000 adults that has prevailed in the United States since the late 1990s. But those rates dropped precipitously in the late seventeenth and early eighteenth centuries. By the mid-eighteenth century, rates in the slave South were moderate compared to rates in Canada and Western Europe, and those in New England and Pennsylvania were low. And after the Revolution, even though rates rose in the slave South and remained high on contested frontiers, rates fell in the North and the mountain South to the lowest levels in the Western world—perplexing for those who believe the United States has always been a homicidal nation. Rates jumped everywhere in the United States, however, from the Mexican War through Reconstruction. Rates did not reach the catastrophic levels of the seventeenth century, but they were high enough to make the United States the most homicidal affluent nation in the world only a few years after it had been one of the least.

The rates of family and intimate partner murders did not follow the same pattern as rates among unrelated adults, but they too changed markedly over time. Rates of family and intimate partner homicide were extremely low from colonial times through the early national period, but they increased several-fold in the 1830s and 1840s and have remained elevated by colonial standards ever since. But again, the rates changed at a time

Figure 2

Suicide Rate with Firearms
versus Percentage of Households with Firearms, 1999-2005



R-squared: 74.8 percent.

Notes

The sources for the data in this essay are described in Randolph Roth, *American Homicide* (Cambridge: The Belknap Press of Harvard University Press, 2009), 477-487.

The data are available from the Historical Violence Database, sponsored by the Criminal Justice Research Center at Ohio State University

(<http://cjrc.osu.edu/researchprojects/hvd/>). For an extended version of the figures and tables in this essay, see Randolph Roth, *Why Guns Are and Aren't the Problem Supplement* (2017), which is also available from the Historical Violence Database. Those tables and figures will be cited in the essay as *WGAAP Supplement*.

¹ Douglas L. Eckberg, "Estimates of Early-Twentieth-Century U.S. Homicide Rates: An Econometric Forecasting Approach," *Demography* 32 (1995): 1-16; World Health Organization, *World Report on Violence and Health* (Geneva: World Health Organization, 2002); and World Health Organization, "Mortality Database" (Geneva: World Health Organization, 1950-), available at <http://www.who.int/whosis/mort/download/en/index.html>.

² According to the Behavioral Risk Factor Surveillance System Survey of 2001 conducted by the National Centers for Disease Control, 36 percent of American households own a firearm. Accessed at www.cdc.gov/brfss in June, 2008. Several earlier surveys, however, including Gallup polls, found higher rates of gun ownership. See Gary Kleck, *Targeting Guns: Firearms and Their Control* (New York: Aldine de Gruyter,

1997), 98-9; and Kleck, *Point Blank: Guns and Violence in America* (New York: Aldine de Gruyter, 1991), 17-63.

³ Centers for Disease Control and Prevention, National Center for Health Statistics. Compressed Mortality File 1999-2005. CDC WONDER On-line Database, compiled from Compressed Mortality File 1999-2005 Series 20 No. 2K, 2008. Accessed at <http://wonder.cdc.gov/cmfi-icd10.html> in December, 2008; and I. James Alan Fox, Uniform Crime Reports [United States]: Supplementary Homicide Reports, 1976-2003 [Computer file]. Compiled by Northeastern University, College of Criminal Justice. ICPSR04351-v1. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [producer and distributor], 2005-11-22.

⁴ *WGAAP Supplement* Figures 1 and 2. Bureau of the Census (1921-1935) *Mortality Statistics, 1900-1936*. Washington, D. C.: Government Printing Office.

⁵ *WGAAP Supplement* Figure 3. On firearms ownership, see Graduate Institute of International Studies, Geneva, *Small Arms Survey 2007* (Cambridge: Cambridge University Press, 2007); and Anna Alvazzi del Frate, Jan J.M. van Dijk, John van Kesteren, and Pat Mayhew, International Crime Victimization Survey (ICVS), 1989-2000 [Computer file]. ICPSR version. Netherlands: University of Leiden/Turin, Italy: United Nations Interregional Crime and Justice Research Institute (UNICRI) [producers], 2002. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2003. On homicide and suicide rates, see *World Report on Violence and Health* (Geneva: World Health Organization, 2002): 1-121, 183-206; and the Mortality

Database of the World Health Organization at <http://www.who.int/whosis/en/>, accessed in December, 2006.

⁶ Randolph Roth, *American Homicide* (Cambridge: The Belknap Press of Harvard University Press, 2009).

⁷ *WGAAP Supplement* Figures 5 and 7. There is no correlation between the proportion of households that own firearms and the homicide rate without firearms ($r^2 = .01$) or the suicide rate without firearms ($r^2 = .02$). For analyses of these patterns, see Mark Duggan, "Guns and Suicides," in Jens Ludwig and Philip J. Cook, eds., *Evaluating Gun Policy: Effects on Crime and Violence* (Washington, D. C.: Brookings Institution Press, 2003): 41-73; Mark S. Kaplan and Olga Geling, "Firearms Suicides and Homicides in the United States: Regional Variations and Patterns of Gun Ownership," *Social Science Medicine* 46 (1998): 1227-1233; Gary Kleck and Don B. Kates, *Armed: New Perspectives on Gun Control* (Amherst, New York: Prometheus Books, 2001), 31-106; and Matthew Miller, Deborah Azrael, L. Hepburn, David Hemenway, and S. J. Lippmann, "The Association between Changes in Household Firearm Ownership and Rates of Suicide in the United States, 1981-2002," *Injury Prevention* 12 (2006): 178-182.

⁸ Charles F. Wellford, John V. Pepper, and Carol V. Petrie, eds., *Firearms and Violence: A Critical Review* (Washington, D. C.: National Academies Press 2005); Janet Weiner, Douglas J. Wiebe, Therese S. Richmond, et al., "Reducing Firearm Violence: A Research Agenda," *Injury Prevention* 13 (2007): 80-84; Charles C. Branas, Therese S. Richmond,

Dennis P. Culhane, Thomas R. Ten Have, and Douglas J. Wiebe, "Investigating the Link between Gun Possession and Gun Assault," *American Journal of Public Health* 99 (2009): 2034-2040; and Stanley Lieberman, *Making It Count: The Improvement of Social Research and Theory* (Berkeley: University of California Press, 1985), 200-217.

⁹ James Lindgren and Justin Lee Heather, "Counting Guns in Early America." *William and Mary Law Review* 43 (2002): 1777-1841; Randolph Roth, "Guns, Gun Culture, and Homicide: The Relationship between Firearms, the Uses of Firearms, and Interpersonal Violence in Early America." *William and Mary Quarterly*, 3rd ser., 59 (2002): 224-234; and Roth, "Guns, Murder, and Probability: How Can We Decide Which Figures to Trust?" *Reviews in American History* 35 (2007): 166-168.

¹⁰ Eric H. Monkkonen, *Murder in New York City* (Berkeley: University of California Press, 2001): 26-54; and Kleck, *Targeting Guns*, 98-99.

¹¹ Herschel C. Logan, *Cartridges: A Pictorial Digest of Small Arms Ammunition* (New York: Bonanza Books, 1959), 11-40, 180-183.

¹² *WGAAP Supplement* Figures 8 and 9.

¹³ Suffolk Files 139618 and 140773, Massachusetts Archives, Boston; and *New Hampshire Gazette* (Portsmouth), 9 April 1791.

The association between changes in household firearm ownership and rates of suicide in the United States, 1981–2002

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Objective: To explore whether recent declines in household firearm prevalence in the United States were associated with changes in rates of suicide for men, women, and children.

Methods: This time series study compares changes in suicide rates to changes in household firearm prevalence, 1981–2002. Multivariate analyses adjust for age, unemployment, per capita alcohol consumption, and poverty. Regional fixed effects controlled for cross sectional, time invariant differences among the four census regions. Standard errors of parameter estimates are adjusted to account for serial autocorrelation of observations over time.

Results: Over the 22 year study period household firearm ownership rates declined across all four regions. In multivariate analyses, each 10% decline in household firearm ownership was associated with significant declines in rates of firearm suicide, 4.2% (95% CI 2.3% to 6.1%) and overall suicide, 2.5% (95% CI 1.4% to 3.6%). Changes in non-firearm suicide were not associated with changes in firearm ownership. The magnitude of the association between changes in household firearm ownership and changes in rates of firearm and overall suicide was greatest for children: for each 10% decline in the percentage of households with firearms and children, the rate of firearm suicide among children 0–19 years of age dropped 8.3% (95% CI 6.1% to 10.5%) and the rate of overall suicide dropped 4.1% (2.3% to 5.9%).

Conclusion: Changes in household firearm ownership over time are associated with significant changes in rates of suicide for men, women, and children. These findings suggest that reducing availability to firearms in the home may save lives, especially among youth.

In 2002, 17 108 of the 31 655 Americans who committed suicide used a firearm (54%). Men accounted for 80% of all suicides and 88% of all firearm suicides, but over 40% of all completed suicides by women and children also involved guns.¹ Individual-level case control and cohort studies in the United States suggest that the presence of a gun in the home^{2–13} and purchase of firearms from a licensed dealer^{14–15} are risk factors for suicide. Drawing causal inferences about the gun-suicide connection from existing case control studies has, however, been questioned on the grounds that these studies do not adequately control for the possibility that members of gun owning households are inherently more suicidal than members of non-gun owning households, that some individuals intent on suicide might purchase a firearm just to commit suicide, and that the association may be confounded by differential recall bias of firearm ownership and comorbid conditions (cases *v* controls).^{16–17}

Ecologic studies provide a complementary approach to studying the possible relation between firearm ownership and suicide. These studies have consistently found a positive association between cross sectional measures of firearm prevalence and firearm suicide.^{17–26} Findings with respect to the association between firearm prevalence and rates of overall suicide, however, have been mixed, depending largely on the way firearm prevalence has been measured.^{16–27} Ecologic studies of the firearm-suicide connection have been criticized for using proxies to measure firearm prevalence that may be biased and, as with case control studies, on the grounds that cross sectional differences in suicidal tendencies might confound the relation between firearm prevalence and suicide.¹⁶

The possibility that people living in homes with guns are inherently more suicidal than people living in homes without

guns has been addressed in case control studies by controlling for individual level psychopathology^{2–13} and in ecologic studies by controlling for aggregate level psychopathology.^{28–29} Nevertheless, questions remain about unmeasured characteristics that might simultaneously be associated with firearm prevalence and suicide risk. One approach to mitigating potential cross sectional confounding is to conduct longitudinal analyses, albeit at the potential cost of introducing secular distortions. To date, however, no prospective, individual-level cohort studies have examined the firearm-suicide connection.

The only previous time series to directly evaluate the relation between firearm ownership and suicide³⁰ used aggregate national data on firearm ownership, 1959–84, and found a significant bivariate relation between firearm ownership and firearm suicide, but no relation between firearm ownership and overall suicide. Other ecologic time series studies abandoned direct estimates of firearm prevalence, evaluating instead the relation between firearm legislation and subsequent rates of suicide, with mixed results.^{31–41}

Over the past decade, surveys show that the percentage of Americans living in households with firearms declined far more than it had over the previous three decades.⁴² The ongoing General Social Survey, for example, found that compared to the 1960s, 1970s, 1980s, and early 1990s when roughly one in two Americans lived in homes with firearms, by 2000 the fraction had fallen to one in three. The current study is the first of which we are aware to exploit recent

Abbreviations: GEE, generalized estimating equations; GSS, General Social Survey, WISQARS, Web-based Injury Statistics Query and Reporting System.

longitudinal variation in firearm prevalence to explore whether changes in firearm prevalence have been accompanied by significant changes in suicide by firearms, by other means, and overall.

METHODS

Mortality data

Suicide mortality data were obtained through the Centers for Disease Control and Prevention's Web-based Injury Statistics Query and Reporting System (WISQARS).¹ These data, which were available for the years 1981–2002, were aggregated into four census regions (Northeast, Midwest, South, and West). Suicide data, grouped by firearm (ICD-9 E-codes E955.0–.4, ICD-10 E-codes X72–X74) and non-firearm methods (ICD-9 E-codes E950–E954 and E955.5–E959; ICD-10 E-codes X60–X71, X75–X84, Y87.0, and U03), were further stratified by gender and age (≤ 19 , 20–34, 35–64, and ≥ 65 years). Though coding differences between ICD-9 and ICD-10 preclude cross era longitudinal analyses for many causes of death, comparability ratios for suicide are nearly 1.0 and do not adversely affect our data.⁴³

Independent variables

Analyses adjusted for age, unemployment, per capita alcohol consumption, poverty, and region of the country. Historical unemployment rate data were obtained from the Bureau of Labor Statistics online database.⁴⁴ Yearly data on regional per capita alcohol consumption were compiled by the National Institute on Alcohol Abuse and Alcoholism.⁴⁵ The percent of the population below poverty in each year of the study period was found in the Historical Poverty Table derived from the US Census Bureau's Current Population Survey.⁴⁶

Estimates of regional household firearm ownership rates are from the General Social Survey (GSS).⁴² GSS household gun ownership data were available for the years 1982, 1984, 1985, 1987–1991, 1993, 1994, 1996–2002; estimates of household gun ownership for missing years were imputed using the average of the adjacent years. For the population as a whole we derived firearm ownership estimates based on all respondents (that is, pooled responses from male and female respondents), the most common measure used in previous work using this survey.

The decrease in the prevalence of household firearm ownership derived using responses from both sexes does not necessarily reflect the actual change in household firearm

ownership for either sex. For example, if married men left their wives beginning in 1990, and took their guns with them, all else equal, the percentage of men living in households with guns would not change, but the percentage of women in households with guns would drop dramatically. To more accurately capture the exposure to household firearms for men and for women separately, we derived household firearm prevalence estimates for women using responses in the GSS from women only (and for men, using responses from men only). We also derived estimates of household firearm ownership for homes with children based on responses of adults who reported living in households with children 18 years of age or younger.

Parsing our exposure measure in this way has additional advantages. It allowed us to account for the well established observation that firearm prevalence estimates for two-adult households based on survey responses from males only are significantly higher than estimates derived using responses from women only.^{47,48} It also takes into account the possibility that this gender related reporting gap may change over time. In addition, it reflects the assumption that a household gun used in a suicidal act is a gun the suicidal individual knew was in the home.

Because our independent variable "household firearm ownership" takes on different values for each region-year depending on whether it is based on responses from both sexes jointly or separately, our point estimates in regressions on the population as a whole are not directly comparable to point estimates from regressions on males and females separately.

Analyses

To account for the non-independence of repeated measures from the same census region over time, we used generalized estimating equations (GEE) models in our multivariate analyses.⁴⁹ These models build upon generalized linear models and are designed to estimate accurate regression coefficients for longitudinal data by allowing specification of both the link function and correlation structure. Standard errors of the regression parameters are computed using the Huber-White sandwich estimator of variance to account for the within-region correlation of outcome using GEE.^{50,51} Results are as if there were a cluster option and we specified clustering on region. Regional fixed effects models were used to account for unobserved time invariant factors that might

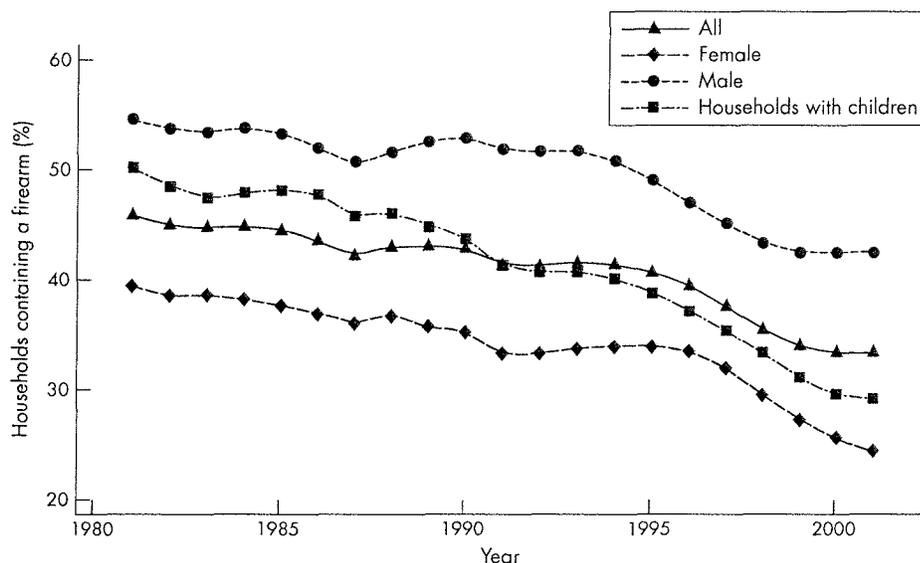


Figure 1 Three year rolling averages of household gun prevalence in the United States, 1981–2002.

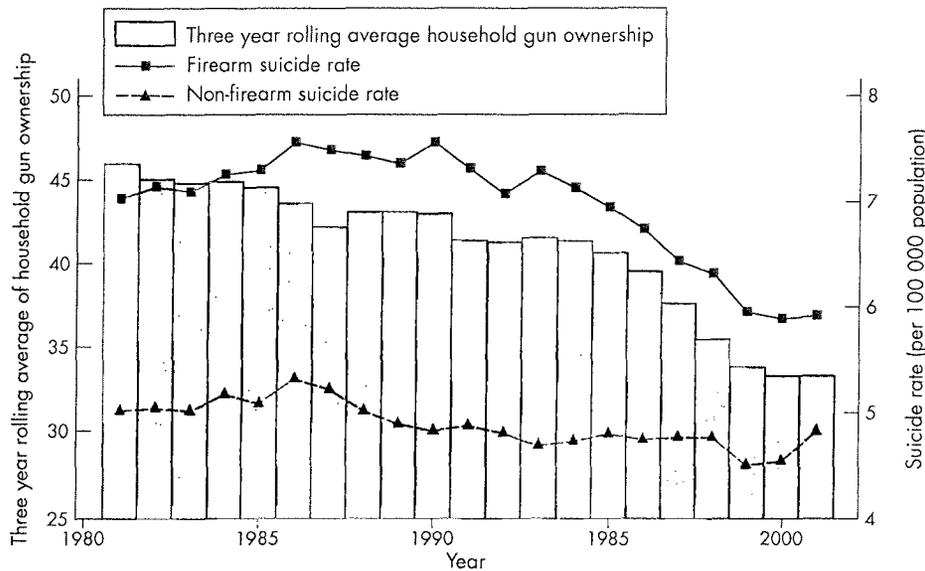


Figure 2 Household gun ownership levels and rates of firearm and non-firearm suicide mortality: United States, 1981–2002.

explain regional differences in rates of suicide. All models adjust for age, unemployment, per capita alcohol consumption, and poverty.

We present results of log-log regressions to express the percent change in the dependent variable (for example, firearm suicide rate) for a 10% change in household firearm ownership. Results obtained using GEE are similar to those obtained using regional fixed effects negative binomial models that adjust for serial autocorrelation over time within each census region (not shown).

RESULTS

Over the 22 year study period, household firearm ownership rates declined across all four regions, with declines averaging 1.5% per year for the nation as a whole (in absolute terms, 0.6 percentage points per year) (fig 1). The absolute percentage of men who report living in homes with firearms was always greater than both the percentage of women who report living in homes with firearms and the percentage of adults with children living in homes with firearms. The relative decline in the percentage of men who report living in homes with firearms was slightly less than the decline for women and for children, averaging, respectively 1.3%, 2.1%, and 2.7% per year (fig 1).

For the nation as a whole, declines in the percentage of American households containing firearms were accompanied by declines in rates of suicide by firearm (fig 2); changes in non-firearm suicide rates were not significantly related to changes in household firearm prevalence. The steepest declines in household firearm prevalence and in firearm

suicide occurred over the second decade of the study period (figs 1 and 2).

In multivariate analyses, each 10% decline in firearm prevalence was accompanied by significant declines in suicide by firearm and suicide overall: firearm suicide rates dropped by 4.2% (95% CI 2.3% to 6.1%) and total suicide rates by 2.5% (95% CI 1.4% to 3.6%) (table 1). The rate of non-firearm suicide was not significantly related to changes in firearm prevalence for the population as a whole, for men, for women, or for children. The magnitude of association between the relative changes in household firearm ownership and rates of suicide due to firearms did not differ significantly across gender. The magnitude of the association between changes in household firearm prevalence and rates of firearm and overall suicide was greatest for children: for each 10% decline in the percentage of households containing both children and firearms, the rate of firearm suicide among children 0–19 years of age dropped 8.3% (95% CI 6.1% to 10.5%) and the rate of overall suicide dropped 4.1% (2.3% to 5.9%).

DISCUSSION

Consistent with previous individual level studies,^{2–12 14 15} as well as with some^{17 18 20–24 29 32} but not all^{19 25} cross sectional ecologic studies, we find that higher rates of firearm ownership are associated with higher rates of overall suicide. For all groups, the relation between changes in household firearm ownership and changes in overall rates of suicide is due to the association between changes in firearm ownership and changes in suicide by firearms (that is, changes in

Table 1 Longitudinal association between household gun ownership and suicide mortality: percent decrease in mortality rate for each 10% decrease in household firearm ownership level (1981–2001), adjusted for age, unemployment, poverty, per capita alcohol consumption, and region of the country

	% Decrease in firearm suicide rate (95% CI)	% Decrease in non-firearm suicide rate (95% CI)	% Decrease in overall suicide rate (95% CI)
Total population	4.2% (2.3%–6.1%)***	0.3% (–1.4%–2.3%)	2.5% (1.4%–3.6%)***
Males	3.4% (2.8%–4.1%)***	1.1% (–0.7%–2.9%)	2.3% (1.7%–2.9%)***
Females	3.4% (1.9%–4.9%)***	–0.5% (–1.9%–1.9%)	1.0% (0.4%–1.6)**
Children (0–19 years of age)	8.3% (6.1%–10.5%)***	–0.4% (–2.9%–2.1%)	4.1% (2.3%–5.9%)***

non-firearm suicide are not related to changes in rates of firearm ownership). Our finding that the magnitude of association between household firearm ownership and suicide is particularly high for children is consistent with previous empirical work,^{10 19 23 53} and with the hypothesis that suicide acts by youth are more likely to be impulsive and therefore more likely to be affected by the means at hand.^{54 55}

Our findings are also consistent with some^{31–33} but not all,^{30 34} previous national longitudinal studies (all but one of which examined the relation between suicide rates and firearm related legislation rather than the relation between suicide rates and firearm prevalence directly). Relative to previous US studies, our longitudinal study focused on a time period during which there was a marked downward trend in household firearm prevalence. This statistical advantage made it less likely that an actual association between firearm prevalence and rates of suicide would be obscured by random error involved in measuring firearm prevalence. This advantage may explain, in part, why we found a significant relation between changes in firearm prevalence and rates of suicide when the only previous US study to directly investigate the association between firearm prevalence and suicides found none.³⁰ In addition, that previous study did not control for other factors and used firearm ownership data from two different sources (Gallop and NORC polls) over a period during which firearm prevalence changed little relative to the measurement error associated with estimating prevalence.

The current study is the first longitudinal evaluation we are aware of to specifically render the exposure of interest—household firearm prevalence—separately for men, women, and children. By doing so we are better able to account for the possibility that changes in household firearm prevalence might differ for these distinct groups (as might have occurred, for example, because of changes in household composition over time). In addition, we are able to control for potential regional variation in rates of change in firearm prevalence and suicide over time.

Although our ecologic approach avoids the case control problem of recall bias (for example, cases being more likely to accurately recall a firearm in the home than controls), this benefit comes at the possible interpretative cost of assuming that group-level associations reflect individual risk factors (that is, the ecologic fallacy).⁵⁶ The greatest threat to the validity of our findings in this respect is that we do not know whether firearm suicide victims actually lived in homes with guns. Findings from case control studies, however, suggest that firearm suicide victims overwhelmingly use guns from their own home.^{2–12 14 15} For example, in one study of suicides in the home¹⁰ and in another of adolescent suicides in and out of the home,⁶ approximately 90% of victims used a gun if they lived in a home with a gun. In addition, fewer than 10% of all firearm suicides involved a firearm from a home other than the victim's household.¹⁰

Our analyses adjust for rates of poverty, unemployment, per capita alcohol consumption, the age distribution of the population, and census region, but many other factors may affect suicide rates. We could think of no obvious covariates that, were they included, would a priori explain the specificity of our findings—that changes in firearm suicide (but not non-firearm suicide) correlate with changes in firearm ownership. The covariate we most would have liked to directly account for in our analyses is one that captured annual changes in suicidality over time. Unfortunately, no such data are available. However, the largest study ever to address secular trends in the mental health of Americans found no national changes in suicidal tendencies between 1990 and 2000⁵⁷—precisely the period of our study during which suicide rates (and firearm ownership) declined most steeply. In addition, previous cross sectional ecologic studies

have found that measures of psychopathology (for example, major depression, serious suicidal thoughts) do not appear to be associated with rates of household firearm ownership⁵⁹ and that controlling for suicide attempt rates does not mitigate the gun-suicide connection.⁵⁵

Our study has additional limitations. Although we used survey measures of household firearm ownership, this measure does not provide potentially important information about many characteristics of firearm availability that may be related to the rate of suicide deaths. For example, our measure does not provide information about the relative prevalence of handguns and long guns, the number of firearms in a gun owning household, firearm storage practices, access to illegal firearms, familiarity with firearms, the caliber of gun(s), how often guns are used for other purposes such as hunting or target practice, or changes in the social acceptability of suicide by firearms over time. In addition, survey research has found that many women, some living in two-adult households with guns, may not have accurate information about whether a gun is present in their home.^{48 58} That we find significant associations between suicide and firearm prevalence regardless of whether prevalence estimates are derived from men or women or all respondents suggests that reporting differences by gender do not account for our results.

Despite these limitations, we find changes in household firearm ownership over time were associated with significant changes in rates of suicide for men, women, and children, controlling for the region of the country in which they lived and independent of rates of unemployment, poverty, and alcohol consumption. The relation between changes in household firearm ownership and overall rates of suicide is due to the association of firearm ownership and suicide by firearms (that is, changes in non-firearm suicide are not related to changes in firearm ownership). Consistent with our findings, a recent systematic review of all suicide prevention studies published between 1966 and 2005⁵⁹ concluded that restricting access to lethal means is one of only two suicide prevention strategies shown to prevent suicide. This conclusion, however, is at odds with the view held by many Americans—that restricting access to highly lethal means is unlikely to save many lives.⁶⁰

The presumption is that anyone serious enough about suicide to use a gun or jump off a bridge will inevitably find another way to take his own life. Results from our longitudinal study, combined with findings from previous case control, cohort, and ecologic studies fundamentally undercut this presumption. In a nation where over half of all suicides are due to guns, restricting ready access to household firearms is likely to save many lives, especially among children.

Key points

Consistent with previous cross sectional case control and ecologic studies, this time series analysis finds a significant relation between household firearm ownership and rates of suicide overall and by firearms.

Changes in household firearm ownership over time are associated with significant changes in rates of suicide for men, women, and children.

These findings suggest that reducing availability to firearms in the home may save lives, especially among youth.

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Guns in Homes Strongly Associated with Higher Rates of Suicide

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Suicidal Acts Using Firearms Highly Lethal Compared to Other Means

For immediate release: Tuesday, April 10, 2007

Boston, MA -- In the first nationally representative study to examine the relationship between survey measures of household firearm ownership and state level rates of suicide in the U.S., researchers at the Harvard School of Public Health (HSPH) found that suicide rates among children, women and men of all ages are higher in states where more households have guns. The study appears in the April 2007 issue of *The Journal of Trauma*.

"We found that where there are more guns, there are more suicides," said [Matthew Miller](#), Assistant Professor of Health Policy and Management at HSPH and lead author of the study.

Suicide ranks as one of the 15 leading causes of death in the U.S.; among persons less than 30 years old, it is one of the top three causes of death. In 2004, more than half of the 32,439 Americans who committed suicide used a firearm.

Miller and his colleagues Steven Lippmann, [David Hemenway](#) and [Deborah Azrael](#), used survey data to estimate rates of household firearm ownership in each of the 50 states and examined whether rates of suicide were related to rates of household gun ownership. They controlled for measures of poverty, urbanization, unemployment, drug and alcohol dependence and abuse, and mental illness. The researchers found that states with higher rates of household firearm ownership had significantly higher rates of suicide by children, women and men. In the 15 states with the highest levels of household gun ownership, twice as many people committed suicide compared with the six states with the lowest levels, even though the population in both groups was about the same.

The association between firearm ownership and suicide was due to higher gun-related suicides; non-gun-related suicide rates were not significantly associated with rates of firearm ownership. Also, suicide attempts using firearms, which constitute just 5% of all fatal and non-fatal attempts, are highly lethal-- more than 90% of all suicidal acts by firearm are fatal. By comparison, individuals who use drugs to attempt suicide, which constitute 75% of all attempts, die in the attempt less than 3% of the time.

The researchers recommend that firearm owners take steps to make their homes safer. "Removing all firearms from one's home is one of the most effective and straightforward steps that household decision-makers can take to reduce the risk of suicide," says Miller. "Removing firearms may be especially effective in reducing the risk of suicide among adolescents and other potentially impulsive members of their home. Short of removing all firearms, the next best thing is to make sure that all guns in homes are very securely locked up and stored separately from secured ammunition. In a nation where more than half of all suicides are gun suicides and where more than one in three homes have firearms, one cannot talk about suicide without talking about guns," he adds.

The bottom line, says Miller, is that "people are less likely to die from attempting suicide when they don't have access to guns in homes."

The study was supported by the Joyce Foundation.

For interested media, individual state data on firearm ownership and suicides is available on request.

"Household Firearm Ownership and Rates of Suicide Across the 50 United States," Matthew Miller, Steven J. Lippmann, Deborah Azrael, David Hemenway, *The Journal of Trauma*, April 2007, 62: 1029-1035.

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Harvard School of Public Health is dedicated to advancing the public's health through learning, discovery, and communication. More than 300 faculty members are engaged in teaching and training the 900-plus student body in a broad spectrum of disciplines crucial to the health and well being of individuals and populations around the world. Programs and projects range from the molecular biology of AIDS vaccines to the epidemiology of cancer; from risk analysis to violence prevention; from maternal and children's health to quality of care measurement; from health care management to international health and human rights. For more information on the school visit: www.hsph.harvard.edu

News

Guns and suicide: A fatal link

[Spring 2008]

In the United States, suicides outnumber homicides almost two to one. Perhaps the real tragedy behind suicide deaths—about 30,000 a year, one for every 45 attempts—is that so many could be prevented. Research shows that whether attempters live or die depends in large part on the ready availability of highly lethal means, especially firearms.

A study by the Harvard School of Public Health of all 50 U.S. states reveals a powerful link between rates of firearm ownership and suicides. Based on a survey of American households conducted in 2002, HSPH Assistant Professor of Health Policy and Management Matthew Miller, Research Associate Deborah Azrael, and colleagues at the School's Injury Control Research Center (ICRC), found that in states where guns were prevalent—as in Wyoming, where 63 percent of households reported owning guns—rates of suicide were higher. The inverse was also true: where gun ownership was less common, suicide rates were also lower.

The lesson? Many lives would likely be saved if people disposed of their firearms, kept them locked away, or stored them outside the home. Says HSPH Professor of Health Policy David Hemenway, the ICRC's director: “Studies show that most attempters act on impulse, in moments of panic or despair. Once the acute feelings ease, 90 percent do not go on to die by suicide.”

But few can survive a gun blast. That's why the ICRC's Catherine Barber has launched *Means Matter*, a campaign that asks the public to help prevent suicide deaths by adopting practices and policies that keep guns out of the hands of vulnerable adults and children. For details, visit www.meansmatter.org.

Barber, who co-directed the National Violent Injury Statistics System, has also developed free, self-paced, online workshops to help public officials, mental health service providers, and community groups put together suicide prevention programs and policies. To take advantage of this joint effort by HSPH and the Suicide Prevention Resource Center, visit <http://training.sprc.org>. — *Karin Kiewra*

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