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# Are Household Firearms Stored Safely? It Depends on Whom You Ask

Deborah Azrael, MS; Matthew Miller, MD, MPH, ScD; and David Hemenway, PhD

**ABSTRACT.** *Objective.* To determine gun storage practices in gun-owning households with children.

*Design.* National random digit-dial telephone survey of 2521 households conducted in March 1999 through July 1999. This study uses a subsample of 434 households with children <18 years old in which a respondent reported either: 1) personally owning a gun, or 2) living in a gun-owning household but not owning a gun themselves. Respondents were asked whether any household gun was currently stored loaded, and, if yes, whether any gun was currently stored loaded and unlocked.

*Results.* Twenty-one percent of gun owners compared with 7% of nonowners reported that a household gun was stored loaded, while 9% and 2%, respectively, reported that a household gun was stored loaded and unlocked. Nongun owners were significantly more likely than were gun owners to be female (87% vs 22%) and to report that they lived in a house with only 1 gun (70% vs 57%) and no handguns (51% vs 31%). Based on the reports of actual gun owners ( $n = 252$ ), households with children <13 years old were significantly less likely to store a gun loaded and unlocked (multivariate odds ratio: .1; 95% confidence interval: .0,.4) than were households with teenagers only.

*Conclusions.* We find that among gun-owning households with children, nongun owners report significantly lower rates of guns stored loaded and unlocked than do gun owners. These findings are consistent with recent studies that have found that married men are far more likely to report household gun ownership than are married women, and that gun users are far more likely to report that a gun is stored loaded or loaded and unlocked than are never users. Our findings suggest that nongun owners, the vast majority of whom are women (87%), may be unaware that guns in their homes are stored in a manner that experts agree is unsafe.

Our findings reinforce the importance of many pediatricians' current efforts to offer anticipatory guidance about firearms to gun-owning families, and, in addition, suggest that this guidance can be adapted depending on whether the physician is speaking with a gun-owning or nongun-owning parent. In particular, because gun owners (mostly fathers) are less likely to bring children to the pediatrician's office than are nonowners (mostly mothers), physicians should take advantage of any opportunities that they have to address gun-related issues with parents who personally own guns. More commonly, physicians can encourage nongun owners to participate more fully in household decision-making about gun storage

by letting them know not only about recommended storage practices, but also that many nonowners may not know how guns are actually stored in their own homes. *Pediatrics* 2000;106(3). URL: <http://www.pediatrics.org/cgi/content/full/106/3/e31>; *firearm, storage, children, survey*.

ABBREVIATIONS. E, eligible; C, completed the survey; I, ineligible; U, eligibility not known; OR, odds ratio; CI, confidence interval.

Each year from 1991 to 1996, an average of 175 children <15 years old committed suicide with a firearm and at least another 190 died from an accidental gun shot wound. In each of those same years, >1250 adolescents 15 to 19 years old killed themselves with guns and another 290 died accidentally. Including deaths from homicide, firearms were the second leading cause of death (behind motor vehicles) for both children 10 to 14 and youth 15 to 19 years old<sup>1</sup> over these years.

Recent evidence suggests that >75% of the firearms used in childhood and adolescent suicide attempts and accidental shootings are stored in the home of the victim or in the home of a relative or friend.<sup>2</sup> In the one study to address the issue directly, the most common scenario for the fatal accidental shooting of a child was the child playing with a loaded and unlocked firearm.<sup>3</sup> Even among adolescents with no apparent psychiatric disorder, loaded household firearms seem to be associated with a higher risk for suicide.<sup>4</sup> Implementation of laws designed to encourage safe storage by holding gun owners responsible for how their guns are stored in the event a child is injured with a gun are associated with decreases in rates of accidental firearm deaths.<sup>5</sup> Experts from the National Rifle Association to the American Academy of Pediatrics agree that guns should be stored in a way that limits access by children.<sup>6,7</sup>

To understand and respond to the problem of childhood firearm injury—especially suicides and accidents—it is important to have good estimates of children's exposure to firearms. This requires information on, among other things, the number of gun-owning households with children and how those guns are stored. Unfortunately, traditional means of ascertaining household exposure to firearms through telephone surveys may be inadequate if some household adults have incomplete or inaccurate information regarding household guns. Recent studies have found that when a single member of a multiadult household is interviewed: 1) married men are far

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more likely to report household gun ownership than are married women,<sup>8-10</sup> and 2) gun users are far more likely to report that a gun is stored loaded or loaded and unlocked than are never users.<sup>11</sup>

We used data from a nationally representative random digit-dial telephone survey conducted in early 1999 to explore the accuracy of gun storage information provided by adults living with children who report that there is currently a firearm in their house.

## METHODS

The random digit-dial telephone survey was conducted by Fact Finders, Inc, a social science research firm in Albany, New York between March 19, 1999 and July 13, 1999. The sample, which is representative of US households with telephones, comprised 2521 adults 18 years of age and older living in the United States. Sampling was suspended after the school shooting in Littleton, Colorado on April 20, 1999 and resumed after a cool-down period. Comparisons of responses to the questions important to this study before and after the shooting revealed no significant differences.

The number of interviews designated for each of the states was determined by that state's population relative to the total population of the United States based on 1990 Census figures. Of the 10 774 telephone numbers that were randomly selected, calls to 2588 yielded contact with households that were determined to be eligible (E) for the survey. Sixty-seven of these households (3%) declined to participate, yielding 2521 households that completed the survey (C). Two thousand seven hundred eighty-nine numbers were ineligible (I), because they were not working or were not residential, and the eligibility of 5397 was not known (U, eg, because there was no answer). Using a Council of the American Survey Research Organization formula [ $C/(E + (E/E + I)*U)$ ], we calculated a response rate for our survey of 49%.<sup>12</sup> This response rate is comparable to that of other national surveys on firearm ownership<sup>9</sup> and falls within the response rates for most Behavioral Risk Factor Survey firearm modules.<sup>13</sup>

Using techniques developed by Waksberg,<sup>14</sup> telephone numbers were randomly generated to include households with listed and unlisted numbers. The random digit-dial technique is designed to ensure an equal, unbiased probability of inclusion in the sample of all households with a single telephone line. Once a telephone number had been randomly selected for inclusion in the survey sample, as many as 10 repeat phone calls were made to screen the selected household. Respondents were told that all their answers were completely confidential, and neither names nor addresses were recorded.

No >1 adult from each household was interviewed. As a result, an adult in a single adult household was more likely to be interviewed than was an adult in a household with >1 adult. Thus, the sample is a representative sample of households, not of individuals. Instead of interviewing the adult who answered the phone or who happened to be home at the time of the call, the study was designed to select a household adult chosen at random. In practice, this meant alternately asking to speak with a man or woman living in the household. If there was no person of the requested gender living in the household, the initial respondent was interviewed.

The demographic composition of the sample is fairly similar to that of the adult population described by the 1990 US Census, although our survey contains fewer poor people (11% vs 20%) attributable in part to the requirement that respondents have telephones, more women (58% vs 51%), and not surprisingly given our oversampling of women, more households with children <18 years old (40% vs 33%). Because the noninstitutionalized population of women is greater than that of men (and single adult households headed by women outnumber those headed by men), sampling of women is increased when randomization takes place at the household level. Given our sampling technique, men and women in typical 2-adult households were equally likely to be asked to participate; among the excess of single adult households headed by women, however, only women were eligible.

This study concerns gun storage among people living with children <18 years old, so the sample was limited to individuals with children who reported that they or someone else in their household currently owned a gun ( $n = 434$ ). The gun ownership

question ("Do you or does anyone else in your household currently own any type of gun?") was the 11th question of the survey, after questions about the respondent's feelings of personal safety and whether they had ever been shot. This household gun ownership question was followed by a question about how many guns were owned by household members, and then by "Do you personally own a gun?" The dependent variable in our analyses is the respondent's answer to 2 questions about household gun storage practices: 1) whether any gun in the household was currently stored loaded, and, if the respondent answered in the affirmative, 2) whether any gun was stored both loaded and unlocked.

Independent variables include respondent demographics as well as variables reflecting respondents' firearm-related experience and behavior. Demographic variables include: respondent age ( $\geq 50$  and  $< 50$ ), gender, race (white or other), community (urban, suburban, or rural), region (South or other), education (completed college or not), family income ( $< \$35\,000$  or  $\geq \$35\,000$ ), and in these households with children <18 years old, an indicator for whether there was any child <13 years old in the household. Firearm-related variables include: whether any household gun was a handgun; the total number of guns in the house; whether the respondent had ever received formal firearm training; and for respondents who reported that they personally owned a gun, whether one reason for owning a gun was protection. Additional independent variables are whether the respondent felt safe alone in his or her neighborhood at night (very or somewhat safe; somewhat or very unsafe), thought gun injury was a problem in their community (major problem; minor or no problem), and had been the victim of a hostile gun display in the past 5 years (answered yes to the question: "In the past 5 years has anyone used, displayed or brought out a gun against you in a hostile manner, even if this event did not take place during commission of a crime?" and was not a police officer). The South is defined as Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. Forty people (9%) did not reveal their income and 31 (7%) declined to report how many guns were in the household. Dummy variables for missing income and missing number of guns were created for individuals with missing responses.

Bivariate analysis is used initially to explore the relationship between dependent and independent variables, using the  $\chi^2$  test for significant differences in discrete independent variables. In multivariate analyses, logistic regression is used to determine potential correlates of gun storage practices, while taking into account potential confounders.

We calculate national estimates of household gun storage practices by applying survey estimates to the ~33 million US households with children <18 years old reported in the 1990 Census.

## RESULTS

Approximately 42% of our random sample of 2521 households ( $n = 1053$ ) reported currently owning a gun. Of these, 41% ( $n = 434$ ) reported that there were one or more children <18 years old living in the household. Results come from this subsample of 434 households (Table 1). Approximately 60% of these respondents reported that a gun in the household belonged to them personally ( $n = 252$ ), while 40% reported that they did not personally own a gun ( $n = 182$ ). Individuals who personally owned a gun were significantly more likely than were nonowners to be male (78% vs 13%;  $P < .001$ ) and older ( $\chi^2$  test for trend,  $P < .05$ ), but otherwise possessed similar demographic characteristics.

Compared with gun owners, nonowners were more likely to report that there was only 1 gun in the house (70% vs 57%;  $P < .001$ ) and that there were no handguns (69% vs 49%;  $P < .001$ ; Table 2). Although 21% of gun owners said that there was currently a household gun stored loaded and 9% said that a gun was stored both loaded and unlocked, only 7% of nongun owners reported that there was a loaded gun

**TABLE 1.** Respondent Demographics: Percent of Gun Owners and Nongun Owners Living in Gun-Own-ing Households With Children (*n* = 434)

	Gun Owners (%) ( <i>n</i> = 252)	Nongun Owners (%) ( <i>n</i> = 182)
Gender		
Male	78***	13
Respondent age (y)		
18–29	16*	26
30–39	39	31
40–49	33	36
50–64	11	6
65+	2	2
Any household child <13 y old		
Yes	70	73
Race		
White	80	83
South		
Yes	33	31
Community type		
Rural	44	46
Suburban	29	29
Urban	26	25
Feel safe in community		
Very or somewhat safe	92	91
Education		
College or more	29	26
Income		
<\$35 000	73	75

\* *P* < .05; \*\* *P* < .01; \*\*\* *P* < .001.

**TABLE 2.** Gun-Related Characteristics: Percentage of Gun Owners and Nongun Owners Living in Gun-Own-ing Households With Children (*n* = 434)

	Gun Owners (%)	Nongun Owners (%)
Handgun in house		
Yes	69***	49
Gun training		
Yes	71***	18
Gun loaded		
Yes	21***	7
Gun loaded and unlocked		
Yes	9**	2†
Number of guns in house		
One gun only	57***	70
Victim of hostile gun display		
Yes	4	5
Gun injury major problem		
Yes	11	9

\*\* *P* < .01; \*\*\* *P* < .001.

† Cell size ≤5.

in the home and 2% reported that there was a loaded and unlocked one (*P* < .001 and *P* < .01, respectively; Table 2).

Because we expect that gun owners will have better information about their firearms and how they are stored than will nongun-owning adults in the same household, we analyze gun storage practices among actual gun owners only (*n* = 252; Table 3). Among these owners, women (30% vs 18%; *P* < .05) and those who lived in the South (31% vs 15%; *P* < .01) were significantly more likely to store a gun loaded, as were those who reported owning a gun for protection (34% vs 9%; *P* < .001), and those whose households contained >1 gun (24% vs 8%; *P* < .001) or a handgun (28% vs 5%; *P* < .001). Correlates of keeping a gun loaded and unlocked

included living in a rural community (14% vs 5%; *P* < .05), owning a gun for protection (17% vs 2%; *P* < .001), and reporting that there was a handgun in the household (12% vs 4%; *P* < .05). Gun owners with children <13 years old were less likely than those with teen-aged children to store a gun loaded and unlocked (6% vs 17%; *P* < .01).

In the multivariate analyses, among gun owners, whites (odds ratio [OR]: 3.5; 95% confidence interval [CI]: 1.1,11.3), and those who lived in the South (OR: 2.6; 95% CI: 1.2,5.8) were more likely to report storing a gun loaded, as were those who reported a household handgun (OR: 6.0; 95% CI: 1.5,24.0) and those who reported owning a gun for protection (OR: 3.6; 95% CI: 1.5,8.8). Despite small cell sizes in this analysis, those who reported owning a gun for protection were significantly more likely to store a gun loaded and unlocked (OR: 10.4; 95% CI: 2.2,48.6), while those with children <13 years old were significantly less likely to store a gun in this fashion (OR: .1; 95% CI: .0,.4).

## DISCUSSION

This survey provides current, nationally representative data suggesting that in gun-owning households with children there is a significant reporting gap between those who actually own a gun and those who do not regarding the type, number, and storage status of guns in the home.

Together with previous work that found that married women underreport household gun ownership,<sup>9,10</sup> and that those who do not use guns are more likely than gun users to report that firearms are stored securely,<sup>11</sup> our findings suggest that surveys that rely on the reporting of a household member chosen at random may generate underestimates of both firearm ownership and the prevalence of firearms stored loaded or loaded and unlocked.

Assuming that respondents are answering honestly, our findings suggest that a troubling information gap lies behind the reporting gap. Nongun owners (87% of whom are women) may be unaware that there is a gun in the house at all; even if they know a gun is present, they may be unaware that it is stored in a manner that experts agree is unsafe. Without good information regarding household firearms, the ability of these non-owners to participate in decision-making regarding household guns, to take reasonable precautions regarding those guns, or to safeguard their children from them may be compromised.

Given the reporting gap, our analysis of the correlates of various gun storage practices relies on the reports of actual gun owners only (*n* = 252). In our sample of gun-owning households with children, 21% of gun owners reported that a firearm in the house was stored loaded and 9% that it was stored loaded and unlocked. These estimates are comparable to those from other surveys that interviewed gun owners only.<sup>15</sup> The estimates are generally higher than those from surveys in which a household member who may not have personally owned a gun was also interviewed<sup>16,17</sup> although not always.<sup>18</sup>

Our study is consistent with others that have found that among gun owners those who own hand-

**TABLE 3.** Univariate and Multivariate Correlates of Gun Storage Practices Among Gun Owners With Children (*n* = 252)

	<i>n</i>	Loaded (%)	Loaded and Unlocked (%)	Multivariate OR Loaded (95% CI)	Multivariate OR Loaded and Unlocked (95% CI)
Overall	252	21	9		
Gender					
Male	197	18	8	.4 (.2, 1.0)	.9 (.2, 3.6)
Female	55	30*	11		
Race					
White	201	22	10	3.5 (1.1, 11.3)*	2.9 (.4, 18.7)
Other	49	12	4†		
Age					
>50	31	19	10‡	1.4 (.4, 4.8)	.8 (.1, 6.1)
<50	220	21	9		
Any child <13 y old in household					
Yes	177	20	6‡	.4 (.2, 1.1)	.1 (.0, .4)**
No	75	23	17*		
Education					
≥College	71	19	7	1.2 (.5, 3.2)	1.7 (.4, 6.6)
<College	177	21	9		
Income					
≥\$35 000	184	24	10†	1.6 (.5, 4.8)	.6 (.1, 2.7)
<\$35 000	50	14	10†		
Missing	18	16‡	5‡	1.1 (.2, 7.4)	—
Live in the south					
Yes	83	31**	13	2.6 (1.2, 5.8)*	2.2 (.6, 7.3)
No	169	15	7		
Community type					
Urban	66	21	8*†	1.3 (.5, 3.4)	1.1 (.3, 4.4)
Suburban	73	11	2‡	.5 (.2, 1.5)	.2 (.0, 1.7)
Rural	112	26	14†		
Own for protection					
Yes	116	34***	17***	3.6 (1.5, 8.8)**	10.4 (2.2, 48.6)**
No	136	9	2‡		
Handgun in HH					
Yes	169	28***	12*	6.0 (1.5, 24.0)*	4.7 (.6, 37.2)
No	76	5	4‡		
Number guns in household					
>1	178	24*†	11†	2.0 (.5, 7.5)	6.6 (.5, 78.6)
1	49	8	2‡		
Missing	25	23	15‡	1.2 (.2, 6.3)	4.8 (.3, 72.0)
Firearm training					
Yes	178	22	9	1.5 (.6, 4.2)	.5 (.1, 1.9)
No	73	18	10		
Victim of hostile gun display					
Yes	14	29‡	21	4.0 (.7, 24.0)	3.9 (.6, 27.8)
No	238	20	8‡		
Feel safe in neighborhood					
Yes	232	21	8	4.2 (.6, 28.0)	2.2 (.1, 47.5)
No	19	21	16‡		
Feel gun injury problem					
Yes	21	19‡	5	.5 (.1, 2.3)	.3 (.0, 3.3)
No	221	20	10‡		

\* *P* < .05; \*\* *P* < .01; \*\*\* *P* < .001.

† Versus all.

‡ Cell size <5.

guns and those, often the same people, who own guns for protection are more likely to store these guns loaded or loaded and unlocked.<sup>15,18,19</sup> In our sample of gun owners, women were significantly more likely to own a gun for protection than were men (62% vs 42%; *P* < .01). However, when we controlled for whether the respondent owned a gun for protection, women were no more or less likely than were men to store a gun unsafely. We also found that individuals living in the South and whites were more likely to store a gun loaded.

Although the risk of firearm death is far greater among older children, having younger children at

home was associated with safer gun storage practices among gun owners no matter how we defined younger (from age 8 years and under to age 14 years and under; data not shown). Compared with households with teenagers only, for example, gun owners in households with younger children were significantly less likely to store a gun loaded and unlocked, perhaps because they believe that younger children are more susceptible to firearm accidents or do not believe that gun storage effectively limits access to firearms for older children.

Consistent with some studies,<sup>20,21</sup> but not with others,<sup>22–24</sup> in our larger sample of gun owners with

and without children at home ( $n = 635$ ), those with children were significantly less likely to store a gun either loaded (21% vs 32%) or loaded and unlocked (9% vs 21%) than were those without children (data not shown). In contrast, and consistent with an information gap rather than reporting bias, the gun storage practices reported by nongun owners in households with guns seem to be largely insensitive to the presence of children, despite the fact that the majority of nonowners are women (8% without children reported storing a gun loaded, while 7% with children did; 3% without children reported storing a gun loaded and unlocked, while 2% with children did; data not shown).

Surveys have various limitations. Telephone surveys are subject to both random and systematic error.<sup>25</sup> For example, there is random sampling error associated with all population estimates (eg,  $\pm 6\%$  for a population proportion of 50% in a sample of 252) and systematic error associated with the fact that individuals without telephones are underrepresented.<sup>26</sup> In addition, self-report data are subject to potential inaccuracies attributable to social desirability responses, recall bias, intentional distortions, or noncandid responses.<sup>27</sup>

It is possible that among adults in households with guns, nongun-owning men have more accurate information about guns than do nongun-owning women. Because of the small number of male nonowners in our sample ( $n = 23$ ), however, we lack the statistical power to disentangle the relationship between gender and ownership in the reports of nongun owners about gun storage.

In our sample, it is possible that some respondents may have intentionally misreported the storage status of guns in their households. If the propensity to misreport affects gun owners and nongun owners differently, some part of the large difference in reported gun storage may reflect this reporting bias.

In addition, the survey did not ask how many adults lived in each interviewed household. Therefore, it is possible that some of what we attribute to an information gap between nongun owners (who we assume live with at least 1 other adult) and gun owners (who may or may not live with another adult) is instead attributable to different storage patterns among adults in single versus multiple adult households. To assess the sensitivity of our results to this possibility, we used household composition data from the US Census that indicate that 95% of men and 80% of women in households with children live with a spouse. If, for example, we assume that all 5% and all 20% of single adult gun-owning households store their guns loaded (biasing our results strongly toward the null), and remove these households from our analyses of reporting differences, the reporting gap persists, with 13% of gun owners but only 7% of nonowners reporting that a household gun is stored loaded.

An ideal study might have interviewed all household members—when the others were not present—allowing for the comparison of reporting of gun-owning and nongun-owning adults in the same household. On all reported demographics except

gender and age, nongun owners and gun owners in our survey seem similar, however, suggesting that comparisons between them are reasonable.

Of the  $\sim 1000$  households with children in our larger survey, 43% contained guns. Applying this 43% figure to the  $\sim 33$  million households with children  $< 18$  years old in the United States,  $\sim 14$  million of these households contain guns. Based on the reports of respondents who personally own a gun, 21% (or 3 million) of these households contain a gun that is stored loaded and 9% (or 1.3 million) a gun that is stored loaded and unlocked.

Other studies have found a large reporting differential between men and women concerning whether there is a gun in the household. We find a large reporting differential between gun owners (generally men) and nongun owners (overwhelmingly women) concerning how the firearm is stored. Assuming that respondents are trying to answer honestly, the results indicate that nongun owners (87% women) in 2-adult households often do not know that there is a gun in their home, and when they do know, they believe—incorrectly—that it is stored safely. This can be a particular problem when, as for our respondents, there are children in the home. Gun storage practices in the United States may be one reason that, for 5- to 14-year-olds, our unintentional firearm death rate is 9 times and our firearm suicide rate 10 times higher than those of other developed countries.<sup>28</sup>

Our findings reinforce the importance of many pediatricians' current efforts to offer anticipatory guidance about firearms to gun-owning families, and, in addition, suggest that this guidance can be adapted depending on whether the physician is speaking with a gun-owning or nongun-owning parent. In particular, because gun owners (mostly fathers) are less likely to bring children to the pediatrician's office than are nonowners (mostly mothers), physicians should take advantage of any opportunities that they have to address gun-related issues with parents who personally own guns. More commonly, physicians can encourage nongun owners to participate more fully in household decision-making about gun storage by letting them know not only about recommended storage practices, but also that many nonowners may not know how guns are actually stored in their own homes.

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