

# Firearm ownership and storage practices in Pennsylvania homes

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## Abstract

**Objective**—To determine the household prevalence of firearms in Pennsylvania, and describe the storage practices for these weapons.

**Design**—A statewide telephone survey of 3620 Pennsylvania adults selected from households by random digit dialing in 1994.

**Main outcome measures**—Firearm ownership and storage practices were computed by household characteristics using logistic regression.

**Results**—The prevalence of firearm ownership was 37% (95% confidence interval = 35.4 to 38.6). Ownership of firearms was significantly higher for white residents, households with annual income of \$20 000 or more, those in rural counties, and those with children and adolescents. Of the households with firearms, 23% contained a single firearm, the majority of which were handguns (40%) or rifles (40%); 76% had two or more firearms, with 57% reporting one handgun or more and 83% reporting one rifle or more. Storage of firearms in 72% of households involved two or more of these barriers: (1) taken apart; (2) trigger lock applied; (3) kept in a locked place; (4) unloaded; (5) no other ammunition; (6) locked ammunition; 6% stored at least one of their firearms with none of these barriers. The strongest predictor of storing a firearm with fewer than two protective barriers was households with no children or adolescents.

**Conclusions**—Firearms are present in a large number of Pennsylvania homes. Many of these homes also contain children. To reduce the potential risks of firearms, optimal methods of storage of firearms in the home need to be determined.

(*Injury Prevention* 1996; 2: 278-282)

Keywords: firearm ownership, firearm storage, household characteristics, Pennsylvania.

Firearms are a leading cause of mortality in the US, accounting for more than 39 000 deaths or 26% of all injury deaths in 1994 alone.<sup>1</sup> Injury fatalities from firearms in the US are surpassed only by those from motor vehicles. Approximately 10 children aged 18 years and younger are killed each day from suicides and homicides committed with firearms, or from the uninten-

tional discharge of firearms.<sup>2</sup> Of the teens who die from suicides, about 60% involve the use of a firearm.<sup>3</sup> The number of non-fatal firearm injuries is estimated at two and a half to five times the number of fatalities.<sup>4-6</sup> In many other industrialized countries, firearm fatalities do not reach the proportions seen in the US. In Australia, for example, firearm fatalities account for only 7% of all injury deaths,<sup>7</sup> while in Finland<sup>8</sup> and New Zealand<sup>9</sup> they account for 8% and 5%, respectively.

It is estimated that there are more than 200 million guns in US homes.<sup>10</sup> Several previous studies have reported that the presence of a firearm in the home is associated with an increased risk of firearm related death from unintentional injuries,<sup>11</sup> suicides,<sup>12,13</sup> and homicides.<sup>14</sup> A potentially important contribution to the risk of firearm ownership is the method of storage in the home. In addition to the firearm owner, other members of the home, particularly children and adolescents, may be placed at increased risk if firearms are stored in an unsafe manner.<sup>15,16</sup> The US General Accounting Office recommends that firearms be stored unloaded and separated from ammunition,<sup>17</sup> but the optimal method of firearm storage has not been defined. To help define optimal methods of firearm storage, there is a need for population-wide estimates of firearm ownership and storage practices.<sup>18</sup>

In 1993, firearms were responsible for 1452 deaths and at least 2049 hospitalizations in Pennsylvania.<sup>19,20</sup> More than half of all suicides and homicides in Allegheny County, Pennsylvania, for example, were committed with firearms.<sup>21</sup> Despite their importance in the injury toll in Pennsylvania, there is no information about the household prevalence of firearms or storage practices. The aims of this study were to use Behavioral Risk Factor Surveillance System (BRFSS) data to (1) determine the prevalence of firearms in Pennsylvania homes and (2) describe the storage practices for these weapons.

## Methods

The BRFSS is a health survey conducted by the Centers for Disease Control and Prevention (CDC) to collect population based data on key behavioral health risks that contribute to the leading causes of death. The Pennsylvania Department of Health began participating in the BRFSS in 1989, and by 1994, all 50 states and the District of Columbia were included. All of the states use the standardized CDC generated core questionnaire, along with supplemental questions they add. The state added

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questions for Pennsylvania in 1994 included several on behavioral risks for firearms, obtained from the National Center for Health Statistics. Adequate reliability has been shown in the measurement of health risk behaviors generally,<sup>22</sup> and in the validity of self reports of firearm ownership among registered gun owners.<sup>23,24</sup>

The BRFSS is ongoing, consisting of monthly telephone interviews. Randomly generated telephone numbers were used to select households for the survey. Interviews were conducted in the evenings and on weekends in order to reach people when they were more likely to be at home, as well as during the day. A total of 10 041 telephone numbers were called in the first stage of sampling to identify residential telephone numbers. Non-working telephone numbers (25.1%) and business telephone numbers (16.2%) were discarded. In the second stage, drop-outs included refusals (14.6%), 'no answer' (4%), no eligible respondent or unavailability of respondent (2%), and all others (1.7%). At least six calls were placed at different times of the day and night and different days of the week before any sample number was classified as a 'no answer'. Within each contacted household, one respondent was selected randomly from all persons 18 years or older who reside in the household. A 10% probability sample of all completed interviews were verified by recontacting the respondent. According to the 1990 census of the population and housing, only 2.6% of occupied housing units in Pennsylvania do not have telephones.

Questions relating to firearm ownership, storage practices, and household characteristics were analyzed using households as the unit of analysis. Using SAS on a main frame computer,<sup>26</sup> prevalence rates and 95% confidence intervals (95% CI) were calculated by several household characteristics. We also analyzed the type of firearm owned by the household characteristics for those with single and multiple firearms.

Several questions were asked on the BRFSS that address six different barriers towards firearm usage. These were: (1) whether the firearm was kept in a locked place; (2) whether it was taken apart; and if not, (3) whether a trigger lock was applied to it; (4) whether it was unloaded; and if unloaded, (5) whether any ammunition was available, and if available, (6) whether the ammunition was kept in a locked place. To determine storage practices, we developed a hierarchy of practices based on the absolute number of barriers asked about. Twenty two different storage practices of varying risk were identified from combinations of the six barriers, for example, firearm(s): *taken apart + locked place + no ammunition* (three barriers; n = 10); *taken apart + unlocked place + locked ammunition* (two barriers; n = 30); *not taken apart + no trigger lock + loaded + locked place* (one barrier; n = 17). In cases of multiple firearms, the questions pertained to all or to the least secure of respondent's firearms. Therefore, a barrier was checked if all firearms were restricted by it (except for 'taken apart' which did not neces-

sarily apply to all) and not checked if at least one firearm was not restricted by it.

The 22 methods of storage were regrouped into five categories according to the number of barriers imposed. Although some of the barriers may appear to provide greater protection than others, our analyses were restricted to the absolute number of barriers and avoided the subjectivity of weighting some as more protective than others. In addition, we were not aware of any injury risk data associated with specific methods of storage. Finally, storage practice methods were dichotomized according to the total number of barriers present. Households using two or more barriers to every firearm were compared with those where at least one firearm was stored with fewer than two barriers. Adjusted odds ratios of ownership prevalence and firearm storage using fewer than two barriers in the home were computed through logistic regression modeling with statistical significance set at  $\alpha = 0.05$ .

## Results

### PREVALENCE OF FIREARM OWNERSHIP

Respondents from 37% (95% CI = 35.4 to 38.6) of households in Pennsylvania reported keeping one or more firearms in or around their homes. Ownership rates varied significantly by race, annual household income, presence of children and adolescents in the home, and residence. White, non-Hispanic households were three times more likely to contain firearms than black, non-Hispanic households. There was a significantly higher prevalence of firearms in households with increasing annual income above \$20 000. Households with children and adolescents were more likely to contain firearms than those with no children and adolescents, and those in rural counties were twice as likely to have firearms than those in urban counties. Victimization of a household member from interpersonal violence within 12 months before the survey was not related to firearm ownership (table 1).

Table 1 Prevalence of firearm ownership by selected household characteristics, Pennsylvania, 1994

Household characteristic	No*	Prevalence (%)	95% CI
Total sample	3620	37.0	35.4 to 38.6
Race			
White	3160	39.8	38.1 to 41.5**
Black	285	14.4	10.3 to 18.5
Annual household income			
<\$20 000	1108	25.9	23.3 to 28.5**
\$20 000+	2215	43.6	41.5 to 45.7
Presence of children <18 years			
Yes	1347	41.8	39.2 to 44.4**
No	2273	34.1	32.2 to 36.0
Victimized for IPV			
Yes	201	37.8	31.1 to 44.5
No	3419	36.9	35.3 to 38.5
Urban/rural residence			
Urban	2809	30.4	28.7 to 32.1**
Rural	811	59.9	56.5 to 63.3

\*Cells may not add to total number because of missing data.  
IPV = Interpersonal violence defined as having been hit, slapped, pushed, or kicked by another person or hit by them with an object or weapon.

\*\*Significant differences between two groups at 0.05.

## TYPE OF FIREARMS OWNED

Nineteen per cent of households with firearms had at least one handgun, 22% had at least one shotgun, and 26% had at least one rifle. The type of firearms owned was significantly related to race and residence (table 2).

Table 2 Firearm ownership by type and selected household characteristics, Pennsylvania, 1994

Household characteristics	No with firearms*	% with ≥1 handguns	% with ≥1 shotguns	% with ≥1 rifles
All households	1339	19.2	21.6	26.4
Race				
White	1259	20.0	23.8	29.2**
Black	41	11.6	2.8	2.8
Annual household income				
<\$20 000	287	12.0	14.5	18.3
\$20 000+	965	23.6	25.9	31.6
Presence of children <18 years				
Yes	563	22.1	25.2	31.4
No	776	17.4	19.4	23.5
Victimized for IPV				
Yes	76	21.4	20.4	26.9
No	1263	19.0	21.6	26.4
Urban/rural residence				
Urban	853	16.5	16.3	20.3**
Rural	486	28.6	39.7	47.7

\*Cells may not add to total number because of missing data.

IPV = Interpersonal violence defined as having been hit, slapped, pushed, or kicked by another person or hit by them with an object or weapon.

\*\*Significant differences between two groups at 0.05.

Table 3 Method of firearm storage by number of barriers and selected household characteristics, Pennsylvania, 1994

Household characteristic	No*	No of barriers				
		4 (n = 204)	3 (n = 289)	2 (n = 254)	1 (n = 231)	0 (n = 58)
All households	1036	19.7	27.9	24.5	22.3	5.6
Race						
White	971	19.1	27.7	24.8	22.9	5.6**
Black	35	37.1	28.6	14.3	11.4	8.6
Annual household income						
<\$20 000	218	23.4	28.4	22.9	20.6	4.6
\$20 000+	768	18.2	27.6	24.9	23.3	6.0
Presence of children <18 years						
Yes	452	24.6	30.5	23.7	17.7	3.5**
No	584	15.9	25.9	25.2	25.9	7.2
Victimized for IPV						
Yes	65	24.6	15.4	29.2	27.7	3.1
No	971	19.4	28.7	24.2	21.9	5.8
Urban/rural residence						
Urban	662	19.2	27.2	25.7	21.8	6.2
Rural	374	20.6	29.1	22.5	23.3	4.6

\*Cells may not add to total due to respondents' refusal to answer some questions or because they did not know or were not sure about answers to questions on storage.

IPV = Interpersonal violence defined as having been hit, slapped, pushed, or kicked by another person or hit by them with an object or weapon.

\*\*Significant differences between two groups at 0.05.

Table 4 Logistic regression adjusted odds ratios of firearm ownership storage practices, Pennsylvania, 1994

Household characteristic	Firearms ownership (n = 3161)		Firearm storage using <2 protective barriers (n = 958)	
	Adjusted odds ratio	95% CI	Adjusted odds ratio	95% CI
Race				
White	2.84	1.98-4.09	1.49	0.60-3.36
Black	1.00	—	1.00	—
Annual household income				
<\$20 000	0.40	0.34-0.48	0.74	0.52-1.07
\$20 000+	1.00	—	1.00	—
Presence of children <18 years				
Yes	1.31	1.12-1.54	0.54	0.40-0.72
No	1.00	—	1.00	—
Victimized for IPV				
Yes	1.15	0.82-1.57	1.25	0.71-2.22
No	1.00	—	1.00	—
Urban/rural residence				
Urban	0.28	0.23-0.33	0.96	0.71-1.30
Rural	1.00	—	1.00	—

\*IPV = Interpersonal violence defined as having been hit, slapped, pushed, or kicked by another person or hit by them with an object or weapon.

The difference in firearm type became more marked when analyzed by number. Of all households with firearms, 23% had a single firearm while 76% had more than one. For those with single firearms, 40% were handguns, 20% were shotguns, while 40% were rifles. However, of households with two or more firearms, 57% included a handgun, 72% a shotgun, and 83% a rifle.

## STORAGE OF FIREARMS IN THE HOUSEHOLD

Storage practices based on the number of barriers are shown in table 3. Three hundred and three (23%) households with one or more firearms could not be categorized as to storage practices because respondents refused to answer some questions, did not know, or were uncertain how to respond.

More than 70% with one or more firearms had two or more barriers towards usage, 22% had only one barrier, and 6% had no barrier. Storage practices were significantly related to race and the presence of children and adolescents (table 3). Thirty five per cent of handguns in households with one or more firearms were stored with one barrier or none compared with 28% of shotguns and 27% of rifles (data not shown).

## ADJUSTED ODDS RATIOS FOR FIREARM OWNERSHIP AND STORAGE USING &lt;2 BARRIERS

After adjusting for all other factors, owning a firearm was found to be significantly related to race, annual household income, presence of children and adolescents in the home, and rural residence. White, non-Hispanic homes were nearly three times as likely to contain firearms than black, non-Hispanic homes, whereas those with annual income of less than \$20 000 were less likely to own a firearm than those whose annual income was \$20 000 or more (odds ratio = 0.40; 95% CI = 0.34 to 0.48). In contrast, homes with children and adolescents were more likely to store firearms using two or more barriers (table 4).

## Discussion

It has been estimated that half of all homes in the US own at least one firearm,<sup>27,28</sup> but our investigation estimated a household firearm prevalence of 37% in Pennsylvania. This rate of ownership is, however, similar to that recently reported for two other US states by other investigators<sup>29,30</sup> but much higher than many other countries. In Australia, 20% of households own firearms, while in Finland firearm ownership is 23%.<sup>28</sup> Only 10% of the total population of New Zealand are reported to possess firearms,<sup>9</sup> while lower ownership rates are reported for households in the Netherlands (2%) and Scotland (5%).<sup>28</sup>

Previous studies of predictors of firearm ownership showed higher rates in rural residents, those in single family dwellings, in families with one adult male, fewer preschool children, females with 12 years of education,

and white females.<sup>29</sup> A somewhat similar pattern was observed in this investigation. Homes with white residents, rural residence, and the presence of children and adolescents were associated with firearm ownership. The relationship of poverty and gun ownership found in our study seems reasonable and consistent with the medical literature. In many studies, the effects of poverty override those of race or population density.<sup>31</sup> For example, among low income families in Chicago, the prevalence of gun ownership was found to be only 6%.<sup>32</sup>

In addition to a household firearm prevalence of 37%, we found that 76% of these homes contained more than one firearm, and that at least one firearm was stored loaded and unlocked in 6% of homes surveyed. Another 22% of homes stored at least one firearm with only one barrier towards usage. Most prior studies have limited the definition of unsafe storage practices of firearms only to cases where they are stored loaded and kept in unlocked places,<sup>18 29 33 34</sup> without consideration of other storage methods, such as the presence of ammunition in unlocked places. Senturia *et al* reported that 13% of handguns and 1% of rifles kept in the homes of families attending pediatric practices in Chicago, New Jersey, Houston, Utah, Georgia, Iowa, and South Carolina were stored loaded and in unlocked places.<sup>29</sup> In Oregon, 10% of adults were reported to live in households with firearms always or sometimes stored loaded and unlocked. Another 30% of homes were reported to store their firearms in 'some other way'.<sup>18</sup> A national random telephone survey found 21% of gun owners keeping their firearms loaded and unlocked.<sup>33</sup>

Ownership of a handgun, having received training, and owning a gun for protection were predictors of firearms stored loaded and unlocked in a national random telephone survey.<sup>34</sup> We found that homes without children were more likely to store firearms using fewer than two barriers. We also found handguns, the most prevalent type of firearm kept in Pennsylvania homes, to be more commonly stored using fewer than two barriers. This is a concern as a recent study found that handguns were used in 89% of firearm homicides, 71% of firearm suicides, and all unintentional and undetermined firearm deaths between 1990 and 1994 in Milwaukee.<sup>33</sup>

A significant proportion of households with firearms also have children. Even though these households stored their firearms using more barriers, the mere combination of firearms and children is alarming. The availability of guns in the home has been identified as a contributory factor in adolescent suicide.<sup>13 36 37</sup> An accessible firearm with accessible ammunition may be all that is needed for a depressed adolescent to succeed in a suicide attempt.

There are several limitations with this study, as with any based on self reports. Self report of behaviors rather than direct observations means some information is under-reported perhaps because of social desirability, illegal behavior, or personal sensitivities. However, these inaccuracies may apply only to persons with stolen firearms who may not admit to

ownership. Several prior studies attest to the validity of self reported surveys of registered gun owners.<sup>23 24</sup>

The problem of recall bias may also affect our estimates, particularly if it has been a long while since the respondents used their firearm. There is also a possibility of selection bias towards persons from homes with telephones, those of high socioeconomic status, and English speaking homes. According to the 1990 census, however, only 2.6% of occupied housing units in Pennsylvania do not have telephones. Although this is a small proportion, non-coverage of these homes, as well as of non-English speaking homes, could lead to biased estimates.

Our analysis is also limited by the fact that the effectiveness of specific firearm storage methods is unknown. We avoided the subjective process of classifying one storage practice as more effective than another. Instead, we focused on the absolute number of barriers used. While the imposition of no barrier is clearly the highest risk, the small sample size (6%) prevented this subgroup from being analyzed separately. Therefore, we collapsed the imposition of a single barrier with no barrier. It is conceivable that some homes with a single barrier (for example a trigger lock) may be safer than others with two or more barriers (for example locked ammunition and a trigger lock *but gun loaded*). Conversely, it could be argued that homes that have taken the steps to apply two or more barriers are more conscious of the risk for injury that a firearm imposes. Finally, some of our estimates are based on small denominators and may, therefore, be unstable and unreliable.

This study raises a number of important questions and implications for prevention. It is clear from this study and others<sup>18 29 30 34</sup> that a large number of homes in the US contain firearms. As with any other potentially lethal household product, prevention dictates that the product be stored in a manner that promotes safe and responsible usage. Yet the optimal method of firearm storage remain undefined. It is unclear, for example, whether the use of a trigger lock is a more effective method of storage than use of a gun safe or case. Further research is needed to determine what methods of storage and what combinations of protective barriers are most effective in reducing the risk of firearm injuries and deaths.

In addition, once optimal methods of firearm storage are determined, there will still remain the challenge of implementing safe and effective storage in the estimated 200 million US homes that contain firearms. The study by Hemenway *et al* revealed that firearm training alone, as currently provided, may not be enough to ensure appropriate storage.<sup>33</sup> Other strategies need to be considered and researched. In the interim, we believe that all health care providers and particularly pediatricians, family physicians, and emergency physicians should have open and frank discussions with their patients regarding firearm ownership and storage. Health care providers should become familiar with various storage methods and

safety options. The use of at least one or preferably two or more protective barriers should be advocated, particularly in homes with children.

This project was funded, in part, under a contract administered by the Pennsylvania Department of Health. The department specifically disclaims responsibility for any analyses, interpretations, or conclusions.

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### Gun dangers, Australian style

Police arrested a blind man walking in Melbourne with a semiautomatic gun who was threatening people. Amazingly, perhaps, he was licensed to own this weapon.

### Safety symbols

The Department of Trade and Industry (DTI) in the UK has commissioned a long overdue study of safety related symbols or pictograms to answer the simple question, do they work? The study is to include a literature review, a survey of symbols in use, and a limited user trial (*Child Safety News*, Summer 1996).

### Firearm deaths: international comparisons

These annual death rates by firearms per million population speak for themselves: Japan 0.3, UK 2.3, Canada 5.9, Switzerland 13.8, US 62.5 (*Toronto Star*, 28 July 1996). Commenting on the Japanese figures, Yamanaka writes: '... about firearm statistics ... I have never thought about [this]. In Japan, firearms are strictly controlled, I believe ... I am 48 years old but have never touched a gun ... I only see firearms on the waist of a policeman'.