

# Firearm Availability and Female Homicide Victimization Rates Among 25 Populous High-Income Countries

**DAVID HEMENWAY, PHD**  
**TOMOKO SHINODA-TAGAWA,**  
**MD, MPH**  
**MATTHEW MILLER, MD,**  
**MPH, SCD**

**Objective:** to determine the association between firearm availability and female homicide victimization among high-income countries.

**Methods:** Data were assembled for the most recent available year (1994-1999) from the official reports of the ministries of health for those countries that had more than 2 million inhabitants and were classified as high income by the World Bank. Twenty-five nations provided sufficient information for the analysis. Rates of female victimization from homicide, firearm homicide, and nonfirearm homicide were compared with a validated proxy for household firearm ownership (the percentage of total national suicides that are committed with firearms). Possible confounding variables included in the analysis were the percentage of the population living in urban areas and income inequality.

**Results:** The United States is an outlier. It had the highest level of household firearm ownership and the highest female homicide rate. The United States accounted for 32% of the female population in these high-income countries, but for 70% of all female homicides and 84% of all female firearm homicides. Female homicide victimization rates were significantly associated with firearm availability largely because of the United States.

**Conclusion:** Among high-income countries, where firearms are more available, more women are homicide victims. Women in the United States are at higher risk of homicide victimization than are women in any other high-income country. (*JAMWA*. 2002;57:100-104)

Crossnational studies usually<sup>1-3</sup> (but not always<sup>4</sup>) find that countries with higher levels of household firearm ownership have significantly higher homicide rates. Women have much lower rates of homicide victimization than men do, so the data in these analyses are dominated by male deaths. To our knowledge, no study has examined female homicide rates crossnationally.

A few studies have investigated the association between household firearm ownership and homicide among US women. One study found that household firearm ownership was significantly correlated with female firearm homicide rates, but not with nonfirearm homicide rates.<sup>5</sup> Another study found that higher levels of firearm ownership were significantly associated with both firearm and overall homicide rates of women.<sup>6</sup>

In this article we examine whether women in countries with higher levels of household firearm ownership are also at higher risk of homicide victimization. Our study analyzed late 1990s data from countries that had more than 2 million inhabitants and were defined by the World Bank as high-income nations. We analyzed only high-income nations because, compared with lower-income nations, their surveillance data are more reliable and their socioeconomic conditions are more comparable. We were particularly interested in the victimization rates of women in the United States.

## Methods

The World Bank classifies countries by income level based on their gross national product per capita.<sup>7</sup> The World Health Organization assembled data on homicide victimization and suicide, broken down into firearm and nonfirearm categories, from official reports by the ministries of health of those countries classified as high income by the World Bank. We used data from only those high-income countries that had populations over 2 million. Many of the less populous high-income countries did not provide complete data, and results of rare events such as homicides among women might be unstable if we used data from countries with relatively few people (eg, Iceland, Kuwait, Luxembourg, Macau, Slovenia, Northern Ireland). We counted the United Kingdom as 2 populous countries (England/Wales and Scotland), for a total of 25 nations with more than 2 million inhabitants that met the World Bank definition of high income.

We used data from the most recent single year (1994-1999) for which they were available. The names of the countries, size of female population, absolute numbers and rates of overall female homicide, firearm homicide, and nonfirearm homicide are given in Table 1. Data were not available on handgun fatalities.

Perhaps the most preferred proxy for firearm availability is survey information on the percentage of households with firearms, but many high-income countries do not record such data. Various other proxies have been used, and a recent study tried to determine which of these was the most valid and reliable. The authors concluded that the percentage of suicides committed with guns was consistently better than the other proxies and that it had a high degree of validity when tested against survey-based estimates.<sup>8</sup> The percentage of suicides with

Dr. Hemenway is director, Dr. Shinoda-Tagawa is a researcher, and Dr. Miller is associate director, all at the Harvard Injury Control Research Center. Dr. Hemenway is also a professor in the Harvard School of Public Health.

**Table 1. Female Homicide Rates for 25 Populous High-Income Countries, 1994-1999**

Country	Year	Female Population (in millions)	Total Homicides, n (rate)	Gun Homicides, n (rate)	Nongun Homicides, n (rate)	Gun Suicides as Percentage of All Suicides (men and women)
Australia	1997	9.3	106 (1.14)	25 (0.27)	81 (0.87)	11.3
Austria	1999	4.2	36 (0.86)	8 (0.19)	28 (0.67)	17.5
Belgium	1995	5.2	69 (1.33)	22 (0.42)	47 (0.91)	13.4
Canada	1997	15.1	146 (0.96)	44 (0.29)	102 (0.67)	22.2
Denmark	1996	2.7	23 (0.86)	4 (0.15)	19 (0.71)	9.0
England and Wales	1997	26.5	106 (0.40)	6 (0.02)	100 (0.38)	2.9
Finland	1996	2.6	51 (1.94)	10 (0.38)	41 (1.56)	22.3
France	1997	30.0	216 (0.72)	84 (0.28)	132 (0.44)	22.9
Germany	1998	42.0	278 (0.66)	47 (0.11)	231 (0.55)	7.8
Greece	1997	5.3	32 (0.60)	12 (0.23)	20 (0.38)	20.1
Hong Kong	1996	3.2	24 (0.76)	1 (0.03)	23 (0.73)	0.5
Ireland	1996	1.8	14 (0.77)	2 (0.11)	12 (0.66)	9.1
Israel	1997	3.0	6 (0.20)	1 (0.03)	5 (0.17)	19.3
Italy	1997	29.6	159 (0.54)	52 (0.18)	107 (0.36)	13.3
Japan	1997	63.7	284 (0.45)	4 (0.01)	280 (0.44)	0.2
Netherlands	1997	7.9	63 (0.80)	11 (0.14)	52 (0.66)	3.2
New Zealand	1998	1.9	25 (1.30)	1 (0.05)	24 (1.25)	12.5
Norway	1997	2.2	13 (0.58)	5 (0.22)	8 (0.36)	23.8
Portugal	1998	5.2	33 (0.64)	17 (0.33)	16 (0.31)	9.0
Scotland	1999	2.6	20 (0.76)	1 (0.04)	19 (0.72)	2.2
Singapore	1997	1.5	16 (1.04)	(0.00)	16 (1.04)	1.3
Spain	1997	20.1	99 (0.49)	22 (0.11)	77 (0.38)	6.6
Sweden	1996	4.5	36 (0.80)	2 (0.04)	34 (0.76)	13.0
Switzerland	1994	3.6	48 (1.34)	22 (0.61)	26 (0.72)	26.4
United States	1997	136.6	4384 (3.21)	2106 (1.54)	2278 (1.67)	57.6
Total		430.5	6287 (1.46)	2509 (0.58)	3778 (0.88)	
Total excluding United States		293.9	1903 (0.65)	403 (0.14)	1500 (0.51)	

firearms has been shown to be very highly correlated with the percentage of households reporting firearm ownership among US Census regions ( $r=.93$ ),<sup>9</sup> 21 US states ( $r=.90$ ),<sup>9</sup> 170 US cities ( $r=.86$ ),<sup>10</sup> and 14 areas within a single US state ( $r=.76$ ).<sup>8</sup>

The proxy is also highly correlated with surveys of gun ownership among high-income nations; the correlation was over 90% ( $r=.91$ ) in 16 developed nations in the early 1990s.<sup>2</sup> For this article, we analyzed data from 18 high-income nations for the late 1990s<sup>4</sup> and found a similar high degree of correlation ( $r=.92$ ). Given the high degree of correlation for those 18 countries, the association between firearm availability and female homicide rates was virtually identical whether we used firearm ownership or the percentage of suicides with firearms as our proxy for firearm availability (not shown).

Thus, we used the percentage of total (male and female) suicides with firearms as a measure of firearm availability. The percentage of male suicides with firearms was virtually the same as the percentage of total suicides with firearms ( $r=.99$ ) for these 25 countries. We did not use the percentage of female suicides with firearms as a proxy for firearm availability in this analysis because most firearms are owned and used by men, and most female homicide victims are killed by men.

Analyses were conducted using both the homicide victimization rate and the natural log of the homicide victimization rate, the latter better approximating a normal distribution. Analyses were also conducted using both unweighted data and data weighted by each country's female population.

We also included 2 control variables, urbanization<sup>11</sup> and income inequality,<sup>12</sup> which have been associated with homi-

cide rates in previous studies. Data on the percentage of the country that is urbanized come from the Population Reference Bureau. As a proxy for income inequality, we use the Gini coefficient; data come from the World Bank's World Development Report. Unfortunately, Gini coefficient data were not available for New Zealand or Hong Kong, and data for England/Wales and Scotland were combined. As a result, multivariate analyses, which included both urbanization and income inequality as independent variables along with gun availability, had only 22 observations.

We did not use poverty as a predictor variable because data were available for only 17 of the populous high-income countries.

We provide the Pearson correlation coefficient between the gun availability proxy and female homicide, and in the regressions we used the t-test for significance.

**Results**

The female homicide rate per 100 000 for the 25 populous high-income countries varied from 0.20 (Israel) to 3.21 (United States). The weighted mean was 1.46 (6287 homicides divided by the total female population); the unweighted mean was 0.92, with a standard deviation of 0.60.

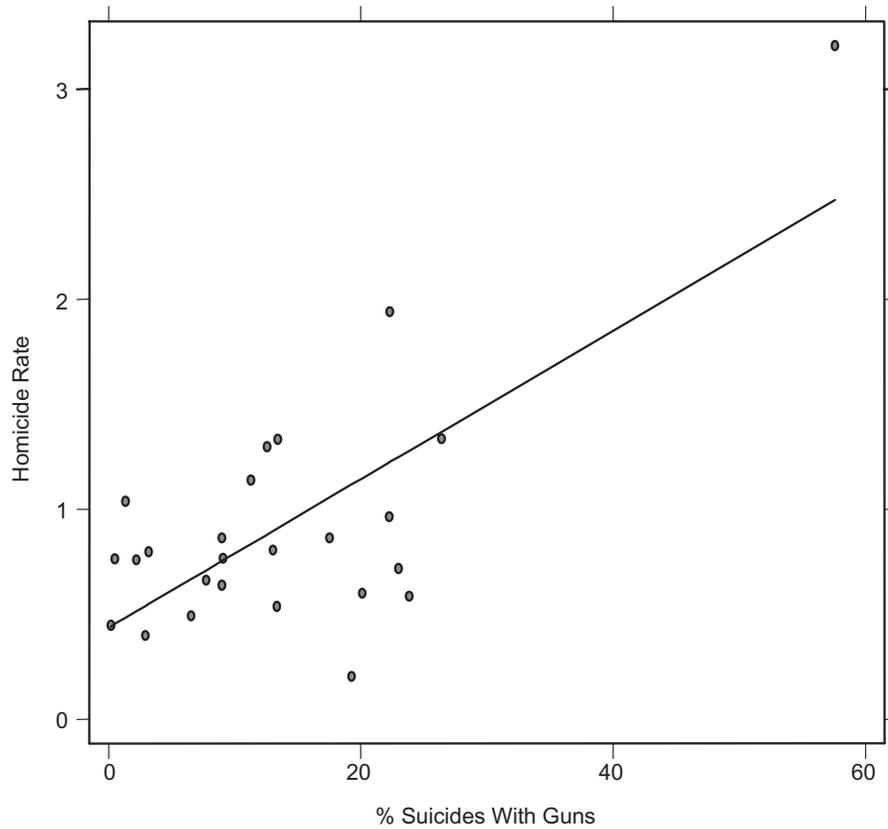
The United States was an extreme case in terms of both gun prevalence and female homicide (Figures 1 and 2). The United States accounted for 32% of the total female population among these high-income nations and for 70% of all female homicide victims (Table 1). The US female homicide rate was 5 times that of all the other high-income countries combined (3.21 per 100 000 v 0.65 per 100 000), and the female *firearm* homicide rate in the United States was 11 times higher than that of the other countries in our sample (1.54 per 100 000 v 0.14 per 100 000); the US nongun homicide rate was 3 times higher (1.67 per 100 000 v 0.51 per 100 000) (Table 1).

When the United States was excluded, Finland and Israel were the main outliers (Figures 1 and 2). Both have fairly many guns, but Finland had a high female homicide rate and Israel a very low rate.

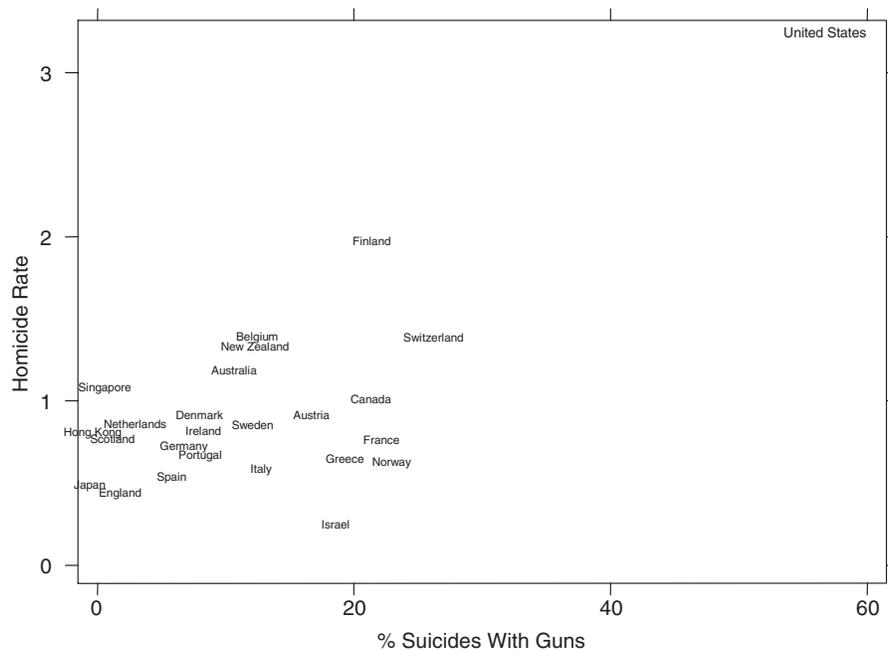
In the bivariate analysis, for unweighted data, the total female homicide rate was significantly associated with firearm availability ( $r=.71$ ) among these 25 countries. When the United States was excluded, however, the association was not significant (Table 2). Results using the natural log of the dependent variable were always very similar (but with correlation coefficients a bit lower) and are not shown.

For unweighted data, the female *firearm* homicide rate was very highly correlated with firearm availability ( $r=.87$ ). US women accounted for 84% (2106/2509) of women who were killed with firearms (Table 1). Even when the United States was excluded, there was still a strong correlation between firearm availability and firearm homicide rates ( $r=.66$ ) (Table 2).

For unweighted data, the nongun female homicide rate was significantly associated with gun availability ( $r=.42$ ). When the United States was excluded,



**Figure 1. Female homicide victimization rates versus a proxy for firearm availability for 25 populous high-income countries, 1994-1999. See Figure 2 for names of countries.**



**Figure 2. Female homicide victimization rates versus a proxy for firearm availability for 25 populous high-income countries, 1994-1999. See Figure 1 for placement of each country.**

**Table 2: Correlation Coefficients and Significance Levels from Regressions of Gun Availability and Female Homicide Rates for 25 Populous High-Income Countries, 1994-1999**

For Female Victims Dependent Variable	Gun Ownership Level			
	Gun Ownership Level, Correlation (p)		Gun Ownership Level Weighted by Population, Correlation (p)	
Total homicide rate	0.71	(<.001)	0.97	(<.001)
Excluding United States	0.30	(.15)	0.54	(.01)
Firearm homicide rate	0.87	(<.001)	0.98	(<.001)
Excluding United States	0.66	(<.001)	0.84	(<.001)
Nonfirearm homicide rate	0.42	(.04)	0.93	(<.001)
Excluding United States	0.02	(.91)	0.19	(.38)

there was no association between the nongun female homicide rate and gun availability (Table 2).

In bivariate analysis using weighted data, results show that, when the United States was excluded, overall female homicide rates and female firearm homicide rates were associated with gun availability, and nongun homicide rates were not (Table 2).

Neither urbanization nor income inequality was significantly associated with the overall female homicide rate, the female firearm homicide rate, or the female nonfirearm homicide rate in either the unweighted or weighted analyses. Including these 2 variables in multivariate regressions had virtually no effect on the association between firearm availability and female homicide victimization (not shown).

### Discussion

Our simple regressions of 25 populous high-income countries showed a significant positive correlation between gun availability and rates of female homicide victimization. The correlation between gun availability and the rate of female *firearm* homicide victimization was even higher.

Our results are consistent with many ecological studies of the relationship between firearm availability and total (male and female) homicide rates. Crossnational studies of high-income countries<sup>1-3</sup> and cross-sectional studies of the United States<sup>13-17</sup> have found that areas with more firearms have higher homicide rates. Our results are also consistent with case-control studies that have found a gun in the home to be a risk factor for homicide victimization

and perpetration.<sup>18-21</sup>

The US female homicide victimization rate was 5 times higher than the rate for the other high-income countries combined. When the United States was excluded from the sample, a significant relationship existed between gun availability and female homicide in the model when we weighted observations by each country's population, but not for the unweighted analysis. Weighting the 25 observations by the population of the country increased the association between firearm availability and female homicide because some of the most populous countries (eg, the United States, Japan, England/Wales) were at the extremes. The United States had many guns and many female homicides, whereas Japan and England/Wales had few guns and few female homicides.

Because the United States has such a large population, weighted analyses emphasized how it differed from other high-income nations in homicide rates and firearm availability. The United States was also an outlier among high-income countries not only in the number of households with firearms, but even more so in the percentage with *handguns*.<sup>2</sup> In addition, the United States has fewer regulations governing the acquisition and use of firearms than other high-income countries,<sup>22</sup> giving residents much easier access to firearms.

Although we know of no other cross-national studies of firearms and female homicide, various studies have examined the relationship between firearms and female victimization within the United States. Stranger violence is not the major threat to women, as it is for men. An analysis of female homicides in the United

States from 1976 to 1987 found that when the perpetrator was known, almost half were spouses or intimate acquaintances; only 13% of female homicide victims were killed by strangers. Many more women were killed with guns used by their husbands or intimate acquaintances than were murdered by strangers using guns, knives, or any other means.<sup>23</sup>

A recent study of the United States showed that women in states with higher levels of firearm availability had higher rates of homicide victimization.<sup>6</sup> A case-control study<sup>24</sup> of 143 women from 3 metropolitan counties who were killed in their homes found that having a gun in the home was a large, independent, and significant risk factor for homicide victimization (odds ratio 3.4). Other factors controlled for in the analysis included age, race, neighborhood, a history of mental illness or depression, and living alone.

One reason a gun in the home can be a threat to women is that assaults with guns are far more likely to be lethal than are other assaults. A study of family and intimate assaults in Atlanta found that firearm assaults were 3 times more likely to result in death than were assaults with knives and 23 times more likely to result in death than were assaults with other weapons.<sup>25</sup> Guns are used against women to intimidate as well as to wound or kill. More than 6% of US women reported having ever been threatened with guns, and most assaults against women were perpetrated by their partners.<sup>26</sup> National random-digit-dial surveys conducted in 1996 and 1999 found that gun threats in the home against women by intimates were far more common than home self-defense gun uses by women.<sup>27,28</sup>

The analyses in this article have various limitations. First, the regressions contain only 3 independent variables: urbanization, income inequality, and a proxy for firearm availability. It is possible that the associations could be explained by other variables. Although we looked exclusively at high-income nations and thus controlled, in part, for some social and economic variables, these countries differ in many ways. Even among regions of the United States, for example, cultures may vary sufficiently to affect homicide rates.<sup>29</sup> The cultural differences among

nations are even greater.

Another limitation of our study is that measures of homicide may vary from country to country because of differences in the specificity and sensitivity of the surveillance systems. Such problems with data comparability and accuracy are particularly acute for nonindustrialized nations. Including only high-income countries in our analysis reduced this problem.

Cross-sectional studies like ours do not provide information about causality. It is possible that high rates of lethal violence cause some US households to acquire firearms. For women, this does not generally appear to be a beneficial strategy, because many women are murdered by intimates. Furthermore, because men typically own household firearms,<sup>30</sup> reverse causation is not likely to be a problem in this study.

Our analyses showed that in high-income countries, where there were more firearms, there were more female homicide victims, particularly female *firearm* homicide victims. These results were driven largely by the United States. US women are at far higher risk of homicide victimization than are women in any other high-income country. ■

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