

Firearm Use Increases Risk of Multiple Victims in Domestic Homicides

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Domestic homicides account for more than one in four homicides in the United States and frequently involve multiple victims. This study examined the prevalence of firearm use in domestic homicides in the United States and the associated risk of a multiple homicide event. We used weighted negative binomial regression to model the effects of firearm use on the number of additional victims in domestic and nondomestic homicides using data from the Federal Bureau of Investigation's Supplementary Homicide Reports. Results showed that firearms were used in 54.1 percent of domestic homicides. Firearm use was associated with a 70.9 percent and 38.7 percent increased incidence of additional victimization in domestic and nondomestic homicides, respectively. Whereas male and female perpetrators differed minimally in the likelihood of additional victims in domestic homicides committed with a non-firearm (3.6% versus 2.5%), males were nearly three times more likely to have multiple victims in domestic homicides involving a firearm (6.9% versus 2.4%). Interaction tests showed that the risk of additional victims associated with firearm use was stronger in domestic situations than in nondomestic situations and among male perpetrators. These findings highlight the risk of multiple homicides in domestic homicide situations and the role of firearms in expanding the risk of victimization beyond a single victim.

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Intimate partner homicides (IPH) account for nearly one in seven homicides worldwide, with the proportion of female homicide victims killed by intimate partners six times higher than male homicide victims (38.6% versus 6.3%).¹ In the United States, more than half of female homicide victims are killed by intimate partners.² Domestic homicide, which includes homicides perpetrated by either an intimate partner or other family member, account for more than a quarter of all homicides.^{3,4} Among the most robust risk factors for domestic homicide, the presence of a firearm in the home has been shown to increase the risk of death in domestic violence situations as much as

five-fold,⁵⁻⁸ and more than half of domestic homicide victims die by firearms.⁹⁻¹⁴

The burden of domestic homicide frequently extends to additional victims linked to the primary perpetrator or victim, either through a preexisting relationship or simply through physical proximity to the violence.^{5,12,15,16} Research shows that male-perpetrated IPH results in multiple fatalities in approximately 40 percent of cases, whether through perpetrator suicide or additional homicides.¹⁷ For example, Bourget and Gagne¹⁸ found that, in male-perpetrated IPH in Quebec, approximately 61 percent of such incidents resulted in a single death, 32 percent resulted in one additional death (often perpetrator suicide), 4 percent resulted in two additional deaths, and 3 percent resulted in three additional deaths. Focusing specifically on multiple homicides in 16 states, excluding suicides, Smith *et al.*¹² found that 20 percent of homicide victims linked to an act of partner homicide from 2003 through 2009 were not the perpetrator's current or former partner. In a study of 813 intimate partner homicides in North Carolina from 2004 through 2013, Smucker *et al.* found that 6.3 percent ($n = 51$) of all cases

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included one or more additional homicide victims beyond the intimate partner victim.⁵ Across the study period, 58.6 percent of all IPH involved a firearm. IPHs with at least one additional victim were significantly more likely to involve a firearm than cases with a single victim (74.5% versus 59.4%, $p < .05$). Research demonstrates that common additional victims include biological children, other family members, and victims' new romantic partners.^{5,12,18-20}

The available research thus suggests that firearms are a risk factor for domestic homicide, and that cases of domestic homicide commonly include multiple victims. Data from a sample of 622 male IPH perpetrators from North Carolina has shown a nonsignificant ($p < .10$) trend between firearm use and increased odds of additional victims. To date, however, the role of firearm use in domestic homicide situations on the risk of multiple victimization has not been examined in a nationally representative sample of male and female perpetrators. There is little data regarding whether the risk of multiple homicide is relatively unique to domestic homicides versus other victim-offender relationships.

This study sought to examine the role of firearms in domestic homicide and the associated risk of multiple homicide. The study used a nationally representative sample from the United States to address four questions. First, the study examined whether the incidence of additional homicide victims was higher in cases of domestic versus nondomestic homicide. Second, the study examined whether firearm use was associated with an increased incidence of additional victims, both across and within distinct victim-offender relationships. Third, the study examined whether gun use was more strongly associated with the incidence of multiple victims in cases of domestic versus nondomestic homicide. Fourth, the study sought to understand whether the association between firearm use and additional victims differed between male and female perpetrators. Given the lack of research to guide directional hypotheses, these objectives were addressed in an exploratory manner.

Methods

Data Sources

The present study utilized the Supplementary Homicide Reports (SHR) of the Federal Bureau of In-

vestigation's Uniform Crime Reports,²¹ which is the only national data source with incident-level information on the relationship between homicide victims and perpetrators. The SHR also includes information on victim and perpetrator sex, weapon use, and the number of victims associated with each homicide event. Data from 1976 through 2016 were utilized. The SHR categorizes victim-offender relationships as intimate partner, other family, friend/acquaintance, and stranger. Intimate partners are defined as spouses, common-law spouses, former spouses, and dating partners. Former dating partners are not included, thus underestimating the true number of IPH. Other family relationships are defined as parents, children, stepparents, stepchildren, in-laws, and other family members. Friends/acquaintances are defined as neighbors, acquaintances, employees, employers, and friends, and strangers are defined for cases in which victims did not know offenders or knew them only by sight. For the present study, we defined domestic homicides as those categorized as either intimate partner or other family relationships, and we defined nondomestic homicides as those categorized as friend/acquaintance or stranger relationships. The study was determined by the Institutional Review Board of the University of Indianapolis to be non-human participant research.

Homicide events with multiple victims were defined as those in which there were two or more victims. Binary indicator variables were generated for the present study to indicate whether a homicide event involved a single victim (0) or at least one additional victim (1); was committed with a non-firearm (0) or with a firearm (1); and whether the perpetrator was female (0) or male (1). The primary outcome variable was a count of the number of additional homicide victims beyond one for each homicide event.

Missing Data

Research has shown that approximately one third of homicides reported to the FBI by local law enforcement do not include data on the victim-offender relationship.²² Fox and Swatt^{23,24} developed the multiply imputed SHR to address this limitation by modeling annual homicide rates by matching to the Uniform Crime Reports estimated national totals and demographic characteristics reported to the National Center for Health Statistics

Table 1 Demographic Characteristics of Homicide Perpetrators by Domestic Status and Firearm Use

	Total Homicide			Domestic Homicide			Nondomestic Homicide		
	All-Cause	Gun	Non-Gun	All-Cause	Gun	Non-Gun	All-Cause	Gun	Non-Gun
Age, y									
< 18	7.8	8.5	6.4	4.4	4.6	4.2	9.0	9.7	7.5
18–24	32.1	34.0	28.7	19.3	17.2	21.8	36.8	39.0	32.2
25–34	30.0	28.7	32.4	29.5	27.4	32.1	30.2	29.0	32.6
35–49	20.6	19.1	23.4	29.5	30.2	28.6	17.4	15.9	20.7
50+	9.5	9.7	9.1	17.3	20.6	13.3	6.6	6.5	6.9
Sex									
Male	89.1	91.2	85.4	73.7	75.5	71.6	94.7	95.8	92.6
Female	10.9	8.8	14.6	26.3	24.5	28.4	5.3	4.2	7.4
Race									
White	45.8	42.5	51.9	56.1	57.7	54.2	42.1	38.1	50.7
Black	51.5	55.3	44.7	40.8	39.9	42.0	55.4	59.8	46.0
Other	2.6	2.2	3.4	3.1	2.4	3.8	2.5	2.1	3.2

All values are percentages.

using log-linear models to impute missing case data and a weighting scheme for unit missingness.²⁵

Statistical Analysis

Weighted negative binomial regression was utilized to model the incidence of additional victimization as a function of firearm use and domestic status to account for overdispersion in the outcome data and the multiply imputed structure of the dataset. To test whether the risk of additional victimization associated with firearm use differed across domestic and nondomestic victim–offender relationships, weighted negative binomial regression was utilized to examine the full factorial interaction between firearm use and domestic status. Similarly, to test whether the risk of additional victimization associated with firearm use differed across male and female perpetrators, weighted negative binomial regression was utilized to test the interaction between firearm use and perpetrator sex, stratified by victim–offender relationship. Following prior research, we entered year as a fixed effect in all models to account for secular trends in homicide over time,²⁶ and we included region (Northeast, Midwest, South, West) and urban classification (large city, small city, suburban, rural) as covariates. Clustered robust error estimators were used to relax the assumption of independence within states. All analyses were conducted using Stata version 15 (StataCorp, College Station, Texas).

Results

Firearms were used in 64.3 percent of all criminal homicides during the study period (Table 1). Perpe-

tration of nondomestic homicide peaked between the ages of 18–34 years and decreased substantially after age 35. Domestic homicide perpetration, by contrast, peaked between the ages of 25–49 years. Whereas only 6.6 percent of nondomestic homicides were perpetrated by individuals 50 years or older, more than one in six (17.3%) domestic homicides were committed by individuals at least 50 years of age. Males committed a large majority of the total criminal homicides during the study period, although the gender difference was narrower for domestic (73.7% male) than nondomestic (94.7% male) homicides. Whereas black offenders committed more all-cause nondomestic homicides (55.4% versus 42.1% black and white offenders, respectively), white offenders were responsible for a greater proportion of domestic all-cause homicides (56.1% versus 40.8% white and black offenders, respectively). The odds of firearm use were 42.1 percent lower in domestic (54.1%) versus nondomestic (67.9%) homicides (odds ratio = 0.58, 95% CI 0.53–0.63, $P < .001$). Whereas male perpetrators used firearms in a higher proportion of nondomestic versus domestic homicides (66.6% versus 57.1%, respectively), female perpetrators used firearms at similar rates across nondomestic (46.0%) and domestic (48.2%) homicides.

There was at least one additional victim in 3.6 percent of all homicides during the study period; 4.6 percent of domestic homicides involved at least one additional victim compared with 3.3 percent of nondomestic homicides (Table 2). This corresponds to a 31.4 percent increased incidence of multiple

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Table 2 Incidence of Multiple Homicide Victims by Firearm Use and Victim–Offender Relationship, United States, 1976–2016

	Total Sample					
	% Gun Use	% Multiple Victim Homicides			IRR (95% CI)	P
		All Means	Gun	Non-Gun		
Total homicides	64.3	3.6	4.2	2.7	1.427 (1.246–1.636)	< .001
Domestic homicides	54.1	4.6	5.8	3.3	1.709 (1.553–1.879)	< .001
Intimate partner homicides	58.4	2.8	1.7	3.7	2.110 (1.913–2.328)	< .001
Family homicides	47.8	7.3	9.6	5.2	1.748 (1.540–1.985)	< .001
Nondomestic homicides	67.9	3.3	3.7	2.3	1.387 (1.165–1.652)	< .001
Friend/acquaintance homicides	66.8	3.2	3.7	2.3	1.453 (1.251–1.687)	< .001
Stranger homicides	70.1	3.3	3.7	2.5	1.270 (0.991–1.628)	.06
Male Perpetrators						
	% Gun Use	% Multiple Victim Homicides			IRR (95% CI)	P
		All Means	Gun	Non-Gun		
Total homicides	64.0	3.8	4.4	2.8	1.460 (1.268–1.681)	< .001
Domestic homicides	57.1	5.4	6.9	3.6	1.885 (1.706–2.084)	< .001
Intimate partner homicides	61.2	3.7	4.9	2.1	2.228 (1.975–2.513)	< .001
Family homicides	51.7	7.6	9.7	5.3	1.995 (1.741–2.285)	< .001
Nondomestic homicides	66.6	3.4	3.8	2.4	1.470 (1.252–1.726)	< .001
Friend/acquaintance homicides	65.4	3.3	3.8	2.4	1.571 (1.371–1.801)	< .001
Stranger homicides	69.3	3.4	3.7	2.5	1.273 (1.003–1.616)	.05
Female Perpetrators						
	% Gun Use	% Multiple Victim Homicides			IRR (95% CI)	P
		All Means	Gun	Non-Gun		
Total homicides	47.5	2.2	2.2	2.2	0.913 (0.769–1.085)	.30
Domestic homicides	48.2	2.4	2.4	2.5	0.884 (0.712–1.097)	.26
Intimate partner homicides	59.4	0.9	1.0	0.6	2.470 (1.400–4.356)	.002
Family homicides	23.2	6.0	9.0	4.9	1.968 (1.559–2.485)	< .001
Nondomestic homicides	46.0	1.8	2.0	1.6	0.757 (0.540–1.062)	.11
Friend/acquaintance homicides	45.6	1.7	1.8	1.5	0.757 (0.529–1.082)	.13
Stranger homicides	50.4	2.7	2.8	2.4	0.822 (0.493–1.370)	.45

Incidence rate ratio (IRR) models show incidence of multiple victims with guns (1) versus without (0) guns and include fixed effects for year. Errors are adjusted for clustering within states, and are controlled for region and level of urban classification.

victims in cases of domestic compared with nondomestic homicide (incidence rate ratio [IRR] = 1.314, 95% CI 1.254–1.378, $p < .001$). Stratified by perpetrator sex, male-perpetrated domestic homicides were associated with a 54.7 percent increased incidence of multiple victims relative to nondomestic homicides (IRR = 1.547, 95% CI 1.471–1.626, $p < .001$). For female perpetrators, the incidence of multiple victims increased a nonsignificant 23.9 percent in domestic situations (IRR = 1.239, 95% CI 0.932–1.646, $p = .14$).

The use of firearms was associated with a significantly increased incidence of additional victims when domestic and nondomestic homicides were aggregated in the combined sample (Table 2). In the aggregated sample, the incidence of additional vic-

tims was 42.7 percent higher in homicides involving a firearm than homicides without a firearm. Domestic homicides involving a firearm were associated with a 70.9 percent increased incidence of additional victims and firearm use was associated with a 38.7 percent increased incidence of multiple victims for nondomestic homicides.

Stratified by offender sex, the association between firearm use and an increased incidence of multiple victims in domestic and nondomestic situations was evident only for male perpetrators. Firearm use in male-perpetrated domestic and nondomestic homicides was associated with an 88.5 percent and 47.0 percent increased incidence of additional victims, respectively. By contrast, no significant differences in the incidence of additional victimization

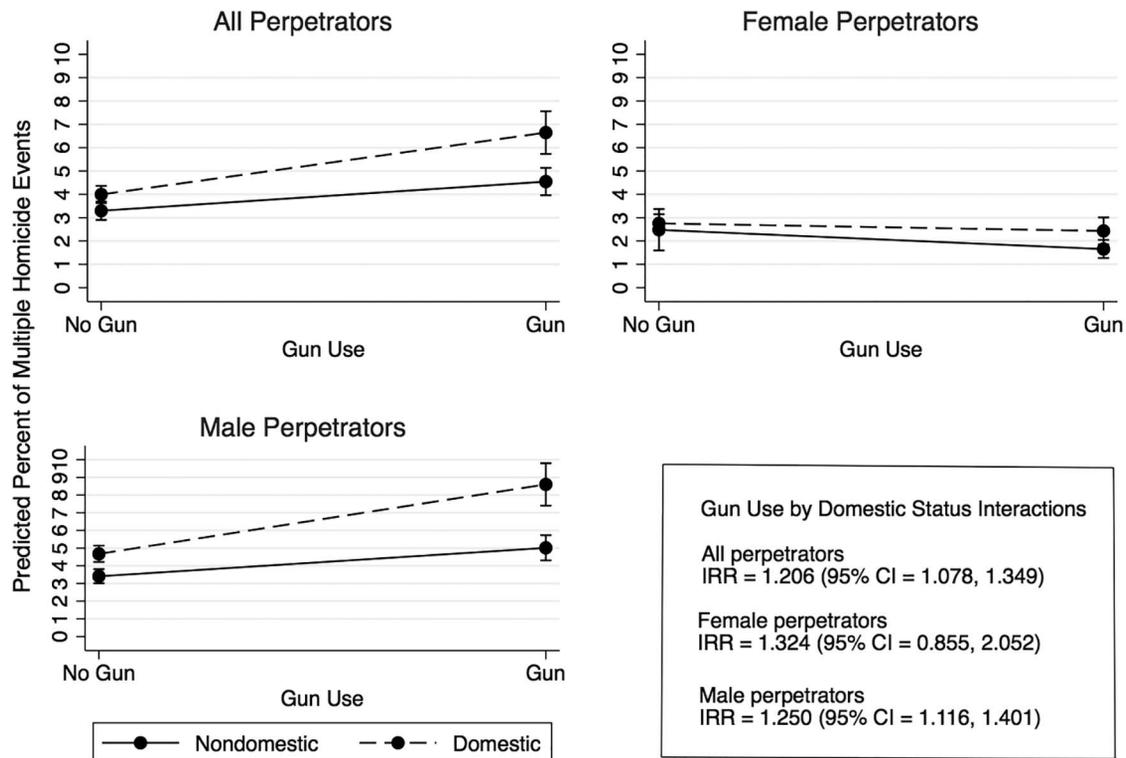


Figure 1. Interaction between gun use and victim–offender relationship on incidence of multiple victim homicides, United States, 1976–2016. IRR, incidence rate ratio.

were observed among female perpetrators of domestic or nondomestic homicides as a function of firearm use. Whereas males and females differed minimally in the likelihood of additional victims in domestic homicides committed with a non-firearm (3.6% versus 2.5%), males were nearly three times more likely than females to have multiple victims in domestic homicides involving a firearm (6.9% versus 2.4%). Male domestic homicide perpetrators were nearly twice as likely to have at least one additional victim when they used a firearm compared with a non-firearm.

Interaction tests were utilized to assess whether the increased risk of multiple victims associated with firearm use differed across domestic and nondomestic victim–offender relationships. As shown in Figure 1, the firearm use by domestic status interaction term was significant in the combined sample (IRR = 1.206, 95% = 1.078, 1.349, $p = .001$), such that firearm use was more strongly associated with multiple victims in domestic versus nondomestic situations. Stratified by perpetrator sex, the interaction between firearm use and domestic status was significant for male perpetrators (IRR = 1.250, 95% CI 1.116–1.401, $p < .001$) but not for female perpetra-

tors (IRR = 1.324, 95% CI 0.855–2.052, $p = .21$). Thus, firearm use was associated with an increased incidence of multiple victims for both domestic and nondomestic homicides in the combined and male perpetrator samples, although the increased incidence associated with gun use was stronger in domestic situations.

Figure 2 shows the interaction between gun use and perpetrator sex, stratified by victim–offender relationship. The interaction between gun use and perpetrator sex on the incidence of multiple victims was significant for domestic (IRR = 2.132, 95% CI 1.825–2.490, $p < .001$) and nondomestic (IRR = 2.391, 95% CI 1.550–3.688, $p < .001$) homicides, showing that gun use is more strongly associated with an increased incidence of multiple victims in domestic and nondomestic homicides for male compared with female perpetrators. The interaction term was nonsignificant for intimate partner homicides (IRR = 1.058, 95% CI 0.584–1.919, $p = .85$) and family homicides (IRR = .962, 95% CI 0.812–1.140, $p = .82$), marginally significant for stranger homicides (IRR = 1.741, 95% CI 0.965–3.140, $p = .07$), and significant for friend/acquaintance homicides (IRR = 2.667, 95% CI 1.672–

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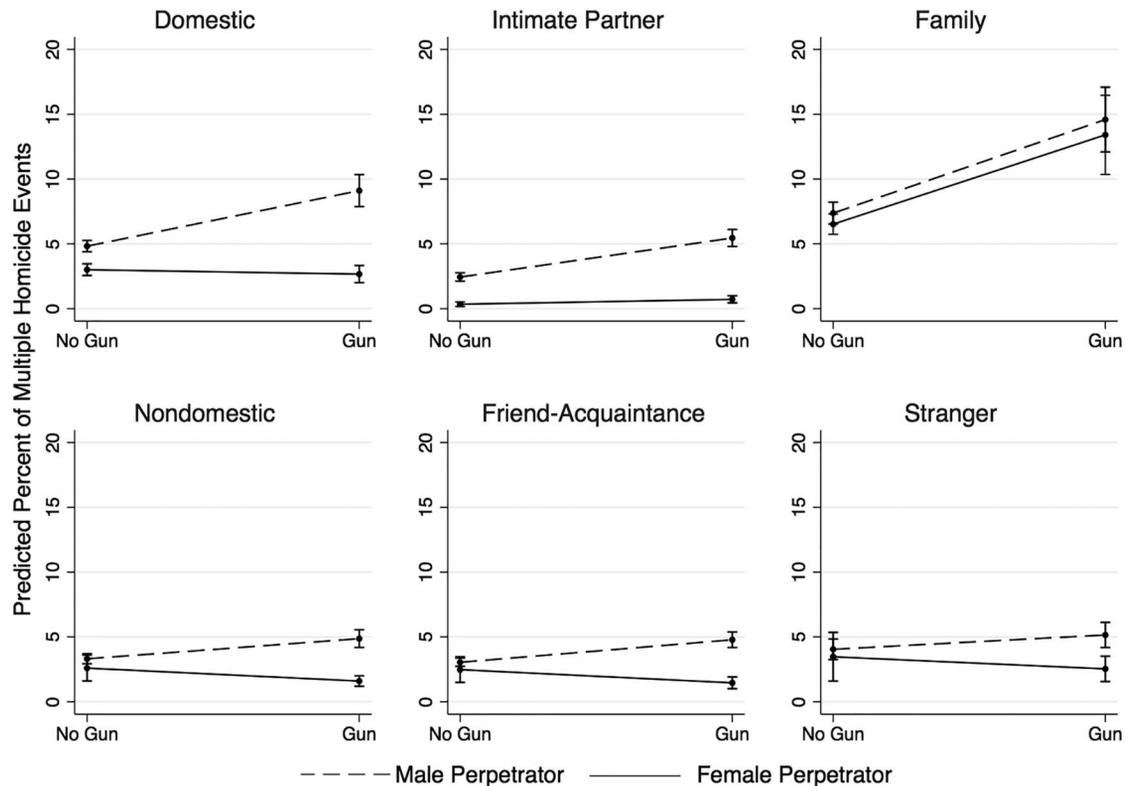


Figure 2. Interaction between gun use and perpetrator sex on incidence of multiple victim homicides, stratified by victim–offender relationship, United States, 1976–2016.

4.254, $p < .001$). As shown in Figure 2, the likelihood of additional victims is relatively unchanged for female perpetrators regardless of whether a firearm is used across victim–offender relationships. The exception is seen for family homicides, where both females and males showed a sharp increase in the likelihood of multiple victims for firearm versus non-firearm homicides. By contrast, male perpetrators demonstrated an increased likelihood of additional victims when firearms were used across victim–offender relationships, although the slope was stronger in domestic situations.

Discussion

More than one in four homicides in the United States occurs at the hands of an intimate partner or other family member,³ and firearm access increases the risk of domestic homicide.⁷ Prior research has shown that multiple victims are not uncommon in domestic homicide situations,^{5,12} but the factors contributing to the risk of multiple homicide have received little attention. The present study suggests that the use of firearms in a homicide event increases

the risk of additional victimization and that this risk is higher in the context of domestic homicides relative to nondomestic homicides. These data also indicate that the association between firearm use and multiple victimization in domestic homicides is stronger for male perpetrators. Male perpetrators who used a firearm in a domestic homicide were nearly three times more likely to have one or more additional victims than their female counterparts (6.9% versus 2.4%). Among males, the use of a firearm in domestic homicide situations was associated with a nearly two times higher likelihood of having at least one additional victim compared to domestic homicide situations not involving a firearm (6.9% versus 3.6%).

These findings have implications for forensic practice and public policy. Forensic psychiatrists are routinely engaged in cases involving family violence to evaluate the risk of ongoing or escalating violence and to develop appropriate risk-management strategies. In addition to addressing intrapersonal factors contributing to risk, a comprehensive risk assessment and management plan must also consider the exam-

inee's access to highly lethal means, most prominently firearms. Although state legislatures have occasionally enacted barriers to health care professionals' ability to carry out this task (e.g., Florida's 2011 law that placed restrictions on health care providers' ability to inquire about firearm ownership), it is the position of the American Psychiatric Association that physicians and other health care professionals should be "free to make clinically appropriate inquiries of patients and others about possession of and access to firearms and [to] take necessary steps to reduce the risk of loss of life by suicide, homicide, and accidental injury" (Ref. 27, p 196). This position aligns with evidence supporting the necessary role of psychiatrists in reducing firearm fatalities. For example, there exists a clear relationship between domestic homicide, particularly IPH, and suicide.^{18,28} Given the fluidity between acts of suicide and homicide, risk assessment for the former should necessarily entail considerations of the latter.

Highlighting the importance of evaluating risk for domestic homicide, Oram and colleagues²⁹ reported that 14 percent of IPH perpetrators and 23 percent of family homicide perpetrators had been in contact with mental health services in the year prior to the offense. Moreover, they found that the perpetrators of intimate partner and family homicides displayed symptoms of mental illness at the time of arrest in 23 percent and 34 percent of cases, respectively. Compared with the 10 percent of cases of general homicide in which perpetrators showed symptoms of mental illness at the time of arrest, domestic homicide perpetrators appear relatively more likely to exhibit and seek services for symptoms of mental illness.

At the public policy level, a variety of federal and state laws are aimed at reducing access to firearms for individuals with a history of domestic violence. At the federal level, the 1994 Violence Against Women Act and the Gun Control Act of 1968 prohibit firearm possession by individuals subjected to permanent domestic violence restraining orders and convicted of felony intimate partner violence, respectively. Yet because these laws do not require individuals to surrender firearms already in their possession, they are ill equipped to respond to individuals with a history of domestic violence who own firearms prior to their legal involvement.

In response, a growing number of states have enacted "red flag" laws that permit the temporary seizure of firearms from individuals determined to be at

risk of harm to themselves or others.³⁰ Further, many states have enacted laws specific to domestic violence perpetrators that require the surrender of firearms in their possession under certain circumstances. These laws have been shown to be associated with reductions in state-level rates of IPH.^{6,31}

Although such laws are intended to protect a specific, targeted victim, the current findings raise the possibility that such laws might be associated with reductions in additional homicides that occur in the context of domestic homicide situations. One key variation in the firearm-seizure laws enacted at the state level concerns who is eligible to petition the court to initiate the seizure. Some states, such as Indiana, allow only law enforcement to initiate temporary firearm seizures, whereas several other states permit family members or others to petition the court.³² Given the risk of multiple victimization in domestic homicide situations, along with research showing that other family members are common additional victims,^{12,18,20} the present findings highlight the heightened risk faced by family members in proximity to domestic violence situations. These findings are relevant to policy makers considering such procedural issues related to firearm removal laws.

Firearm removal laws are beginning to intersect more clearly with the practice of psychiatrists, as Maryland's recent "red flag" law expands those who can petition for firearm removal to include health care professionals. While it is too early to know what impact such laws will have on psychiatrists and other mental health providers, concerns have been raised about the possibility that psychiatrists who fail to address the topic of firearm ownership and removal with patient's families could be held liable.³³ As described in the American Psychiatric Association's Position Statement on Firearm Access, Acts of Violence, and the Relationship to Mental Illness and Mental Health Services, laws that remove flexibility in favor of mandated reporting to law enforcement could prove counterproductive and deter individuals in need of treatment from seeking services.²⁷

Several limitations warrant consideration. First, as a result of missing data regarding the victim-offender relationship as reported to the FBI by local law enforcement, the current estimates were derived from statistically modeled data developed by Fox and Swatt.²³ Prior research, however, has supported the

consistency between estimates derived from raw and multiply imputed SHR data.^{6,26} Related to the data available in the FBI's SHR, the exclusion of ex-dating partners from classification in the intimate partner category resulted in an underestimate of the true count of intimate partner and domestic homicides. Additional research is necessary to better understand the relationships between perpetrators and additional victims. Despite these limitations, the present study is novel in showing an association between firearm use and the distinctly increased risk of additional victimization in domestic homicide in a nationally representative sample from the United States.

Conclusions

Firearm use is associated with an increased incidence of multiple homicide victimization, particularly in domestic situations. Male perpetrators of domestic homicide are nearly twice as likely to have at least one additional victim when they use a firearm compared to homicide situations involving a non-firearm. Among all domestic homicides involving a firearm, male perpetrators are nearly three times more likely than females to have at least one additional victim. These findings highlight the risk of additional victimization in domestic homicide situations and the role of firearms in expanding the risk of victimization beyond a single victim. Policy efforts to reduce domestically violent individuals' access to firearms represent one means of reducing domestic homicide.

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