



Short Communication

Firearm legislation and firearm use in female intimate partner homicide using National Violent Death Reporting System data[☆]



Erica L. Gollub*, Morgan Gardner

Pace University, Pleasantville and New York City, NY, United States of America

A B S T R A C T

Firearms account for over half of female intimate partner homicides (IPH) in the National Violent Death Reporting System (NVDRS). Although firearm-related IPH is directly associated with state-level firearm prevalence and inversely associated with specific firearm legislation targeting intimate partner violence perpetrators, these associations may be due to the underlying nature of the perpetrator population rather than the legislation or policy. We explored the impact of firearm legislation on weapon use in IPH in a cross-sectional analysis using NVDRS data via the WISQARS online interactional system, through examination of firearm (F) and non-firearm (NF) age-adjusted mortality rates and firearm: non-firearm (F:NF) rate ratios across victim gender and in states with varying levels of firearm restrictions. Overall, for 2015 (27 states aggregated), the impact of gender was substantial: the F:NF ratio for male victims was 0.92, indicating a small lead for NF mechanisms, but for female victims, it was 1.5, with greater firearm use apparent. When looking only at female IPH, jurisdictions with high firearm restrictions show a pronounced trend for a F:NF ratio < 1.0 whereas states with few of these restrictions demonstrate ratios > 1.0. Numerous limitations apply, including: the cross sectional nature of the data, varying years for available state data; and lack of control for multiple demographic variables. Despite its limitations, this analysis extends prior research by comparing rates of NF use across jurisdictions, and suggests that availability of firearms by itself plays an important role in driving IPH rates higher in areas with fewer firearm restrictions.

1. Introduction

Women are victims in the vast majority (85%) of the nearly 1800 intimate partner homicides (IPH) committed annually in the US, and approximately one-half of all IPH are firearm-related (Fowler et al., 2018; Díez et al., 2017; Violence Policy Center 2015). In the most recent National Violent Death Reporting System (NVDRS) report of 18 states, intimate partner violence (IPV) was a precipitating factor in 48% of homicides among females but only 9% of males (Fowler et al., 2018). Firearms play a pronounced role in IPH, used in over half of all instances—by far the most frequently used weapon in this type of violent death, as with overall violent deaths (Fowler et al., 2018).

A substantial literature supports the conclusion that stronger laws regulating firearms are associated with lower firearm homicides overall. Among the specific provisions, background checks for gun purchasers and laws requiring a permit to purchase a firearm have shown a consistent association with lower firearm homicide rates (Lee et al., 2017). Further, a large state-level analysis found universal background checks (UBC) to be associated with a 60% reduction in firearm mortality, one of 3 types of legislation demonstrating the strongest associations with overall firearm mortality (Kalesan et al., 2016). In contrast to the literature on overall mortality, available

studies on the association between firearm legislation and IPH are fewer in number, and have been hampered by limited power (Díez et al., 2017) and non-longitudinal designs (Zeoli et al., 2016). Rates of firearm-related IPH have been shown to be greatest in states where firearm prevalence is highest (Díez et al., 2017; Kalesan et al., 2016; Bangalore and Messerli, 2013). Recent work on the impact of legislation has focused on those provisions specific to the situation of IPH. A systematic review conducted by Zeoli et al. (2016) suggested that legislation that limited access to firearms among IPV perpetrators reduced the lethal risk in IPV; and recent work by Díez et al. (2017) estimated a lower risk of IPH in jurisdictions where certain IPV specific firearm legislation had been adopted. Nevertheless, due to the observational and often cross-sectional nature of many analyses, the uncovered associations may be due to the underlying nature of the perpetrator population—i.e., the violent nature of the intimate partner—rather than a result of either firearm prevalence or firearm legislation or policy (Zeoli et al., 2016). One way of investigating this problem of population “selection” is to compare homicides associated with other, non-firearm weapons in IPH across different states or jurisdictions that vary in their restrictions on firearm access. It is logical that with an increased tendency toward lethal violent behavior, one would observe higher rates of both non-firearm-related as well as firearm-related IPH across

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* Corresponding author at: Health Science Program, College of Health Professions, Pace University, 861 Bedford Rd, Rm L317, Pleasantville, NY 10570, United States of America.

E-mail address: egollub@pace.edu (E.L. Gollub).

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jurisdictions, independent of firearm restriction status.

Our analyses were conducted to investigate two main hypotheses regarding F:NF IPH rate ratios. First, we hypothesized that these rate ratios overall would be higher among female victims as compared with male victim homicides, because firearm use demonstrates a strong association with gender (Hemenway and Solnick, 2015; Geier et al., 2017). We further hypothesized that the ratios would be higher in jurisdictions with lower levels of firearm restrictions, which would enable intimate partner access to firearms. We based this latter hypothesis on available data demonstrating the predominance of firearm involvement in IPH (Violence Policy Center, 2015) and the inference that firearms are the weapon of choice to commit IPH where they are accessible.

2. Methods

We explored the impact of firearm legislation on weapon use in intimate partner homicide (IPH) using NVDRS data via the Web-based Injury Statistics Query and Reporting System (WISQARS), an online interactional system providing NVDRS data on injury and violent death (<https://wisqars.cdc.gov:8443/nvdrs/nvdrsDisplay.jsp>), through examination of firearm (F) and non-firearm (NF) age-adjusted mortality rates and F:NF rate ratios across victim gender and in states with varying levels of firearm restrictions. Violent death data are provided for participating states and are not nationally representative.¹ Victim-suspect relationship and mechanism of death data were compiled from multiple data sources, including death certificates and a series of coroner, medical examiner, law enforcement, and toxicology reports. Some participating states also collect information from secondary sources (e.g., child fatality review team data, supplemental homicide reports, and crime laboratory data). Intimate partner relationship is defined by NVDRS as a current or ex-spouse or other intimate partner (Fowler et al., 2018). Firearm IPH involved homicide cases where firearms were used as the homicide weapon; non-firearm IPH included homicides perpetrated with any other weapon (a comprehensive listing is found in the database; for cumulative percentages across all NVDRS states for female IPH, see Fig. 1).

We first compared the F:NF rate ratio by IPH victim gender in all NVDRS states for the most recent year available, 2015. We then restricted our attention to female IPH, including rates that were running averages over available years for each state, for the remaining analyses. We compared NVDRS participating states with “high” firearm restrictions defined as five of six provisions recently investigated by Diez et al. (2017) because of their specificity in targeting intimate partners with a history of abuse; as well as UBC, which has been consistently found to reduce overall mortality (Kalesan et al., 2016; Fleegler et al., 2013)—with states having none of the six IPV specific provisions, regardless of whether they required UBC. The six IPV-specific firearm provisions investigated in prior research include: (1) Prohibition of firearm possession by persons convicted of IPV-related misdemeanor; (2) Persons convicted of IPV-related misdemeanor prohibited from possessing firearms and required to surrender firearms they already have; (3) Prohibition of firearm possession by persons subject to IPV-related restraining order; (4) Persons subject to IPV-related restraining order prohibited from possessing firearms and required to surrender firearms they already have; (5) Removal of firearms from the scene of an IPV incident required; and (6) Prohibition of firearm possession by persons convicted of stalking (Diez et al., 2017). Although Diez et al. did not find most of these provisions to be associated with lower IPV,

¹ NVDRS states included in Fowler et al. (2018) and analyzed here are: Alaska, Arizona, Colorado, Connecticut, Georgia, Hawaii, Kansas, Kentucky, Massachusetts, Maryland, Maine, Michigan, Minnesota, North Carolina, New Hampshire, New Jersey, New Mexico, New York, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, Utah, Virginia, Vermont, and Wisconsin

we nonetheless hypothesized that there may be an effect since prior research has implicated abusers' access to firearms as a significant factor in IPV risk (e.g., Campbell et al., 2006; Zeoli et al., 2016); and Diez et al. were limited by an inability to adequately control for variation in enforcement (per their Discussion), which may have introduced substantial random error. “High” restriction states are New York and Massachusetts; “low” restriction states included Kentucky, Oregon, Georgia, South Carolina, Michigan, New Mexico, and Alaska. Of the states included with “low” firearm restriction, only one (Oregon) had UBC. Finally, we looked for comparable New York City (NYC) data; NYC surpasses NYS in legislation reducing access to firearms. Frequency data for IPV (2010–2016) were available for examination (Mayors Office, 2018) for combined male and female victims, which demonstrated a F:NF ratio of approximately 0.30. We applied this ratio to the estimated overall NYC annual rate for all IPH—0.5 per 100,000 (Mayors Office, 2018)—to plot estimated crude rates for F and NF IPH. All inferences are derived from a straightforward visual inspection of calculated ratios.

3. Results

Overall, for 2015 (27 states aggregated), the impact of victim gender was substantial: the F:NF ratio for male victims was 0.92, indicating a small lead for NF mechanisms, but for female victims, it was 1.5, with greater firearm use apparent and providing an additional perspective on how firearm availability drives female IPH (data not shown).

Fig. 2 demonstrates the range and variability of firearm- and non-firearm-involved female IPH rates, and F:NF ratios across analyzed states. Nine states were available for analysis (see Fig. 2) — these states met our criteria of being either “High” or “Low” restriction states, and had sufficient data for stable estimates. The highest firearm-involved IPH rates (in red) were found in “low restriction” states. Rates of NF-related IPH (in blue) showed less variability than firearm-related IPH across “high” and “low” legal restriction categories. Notably, in some “low restriction” states (e.g., KY and OR), NF IPH rates were lower than in states with stronger firearm restrictions. Overall, jurisdictions with high firearm restrictions demonstrated a pronounced trend for a F:NF ratio < 1.0 whereas states with few of these restrictions demonstrated ratios > 1.0. The range of ratios was 0.30 to 0.64 for “high” restriction states (mean 0.47; s.d. 0.14). For “low” restriction states, the range of ratios was 1.1 to 4.4 (mean 1.9; s.d. 1.2). Firearms are used in the majority of female IPH in states with lax restrictions, but not in jurisdictions with tighter regulation. Though “high” restriction jurisdictions are few, a rough control for differences in magnitude of NF IPH (thus, extreme violent behavior) can be had by comparing states with similar NF IPH rates, but varying levels of firearm restrictions. Here we observe that even in states with lower NF rates (KY, OR, GA), the F:NF ratios are all > 1.0 (Fig. 2).

4. Discussion

Our analysis demonstrated an association of F:NF rate ratios with jurisdiction level of restrictive firearm provisions: these ratios exceeded 1.0 in jurisdictions with lower firearm provisions, and were all below 1.0 in jurisdictions with stronger provisions. The gender comparison of F:NF ratio over all NVDRS states demonstrates the special significance and targeted potential impact of firearm legislation on reduced female mortality from IPV. The disparate gender-specific ratios may be interpreted to engender (at a minimum) differences in lethal violent behavior, gender differences in firearm use, as well as the impact of firearm access interacting with these variables. In the second analysis stratified by degree of firearm restriction, the fact that utilization of other lethal means of homicide was low in many “low restriction” areas bolsters the inference that availability of firearms by itself plays an important role in driving IPH rates higher in these areas.

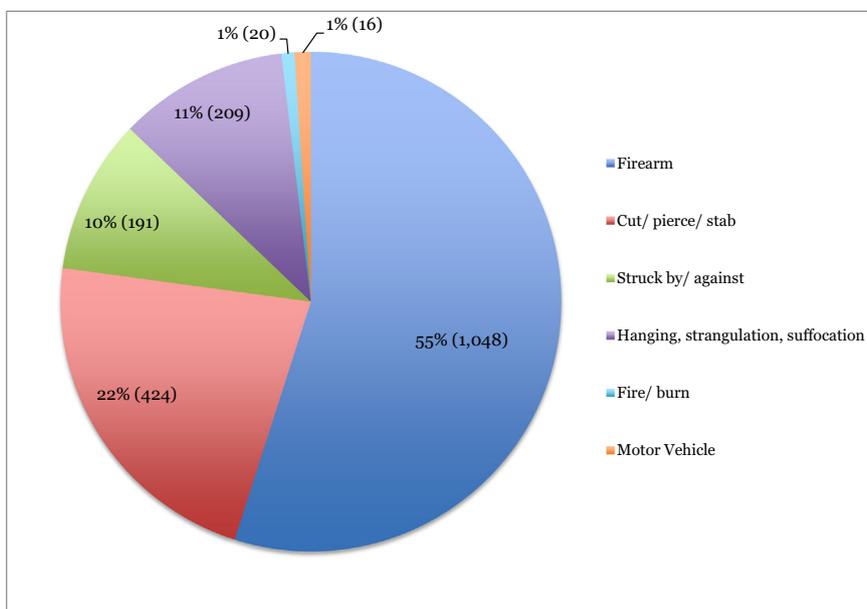


Fig. 1. Weapon use in US female intimate partner homicides (2003–2015)¹.

Notes:

¹Frequency and percentage data derived from NVDRS data currently available in WISQARS on 27 states for cumulative years contributed. Number of cumulative years varied over states.

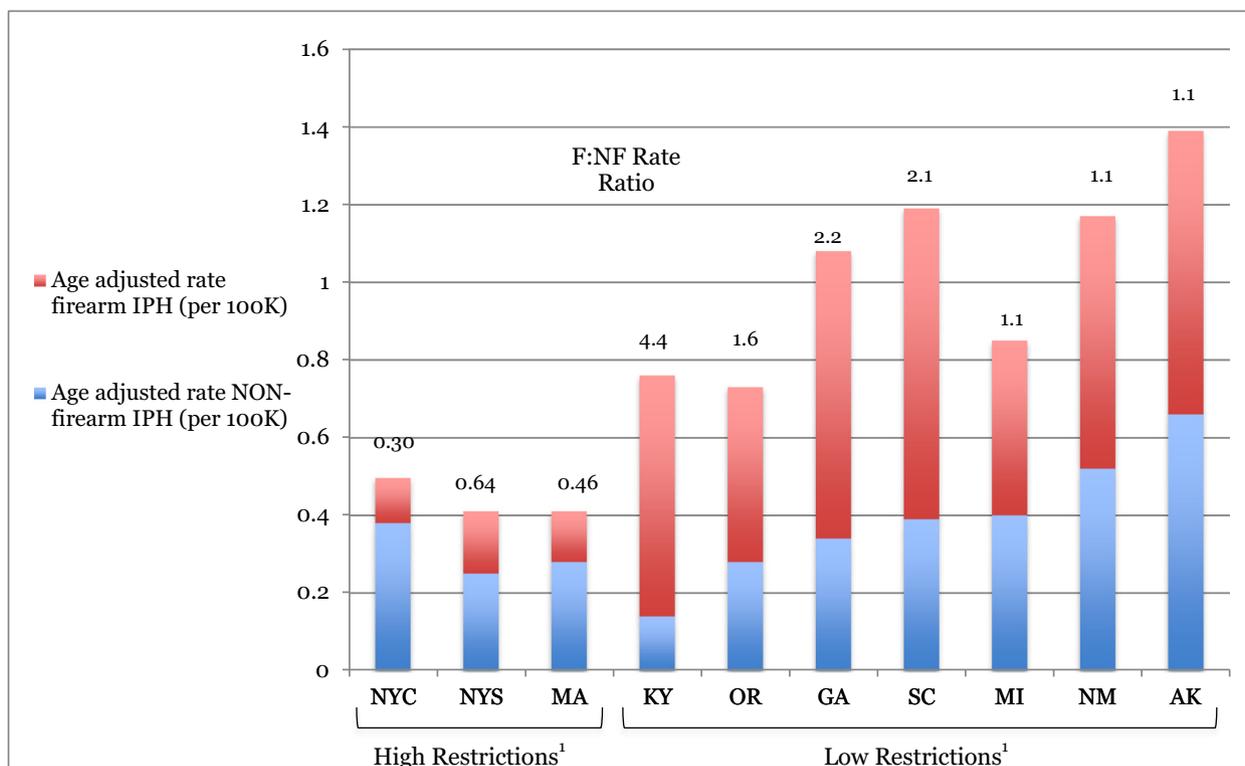


Fig. 2. Firearm (F) and non-firearm (NF) female intimate partner homicide (IPH) rates and ratios.

¹High restrictions are jurisdictions with 5 IPV-specific firearm provisions (Diez et al., 2017) and universal background checks; Low restrictions are jurisdictions with less than this standard. (For interpretation of the references to color in this figure, the reader is referred to the web version of this article.)

The strengths of our analysis include the use of NVDRS data; as well, we extended the types of analyses conducted to date by exploring a distinct set of legal restrictions. The NVDRS is unique in that it augments death certificate data with event and circumstance information from death investigation reports filed by coroners, medical examiners, and law enforcement, in one central database. In these analyses, sex

specific data were available as age-adjusted rates, enhancing the validity of comparisons across states over and above a comparison of proportionate mortality from firearms, to inform prevention and intervention research and action. As well, the interactive site, WISQARS, enables flexibility in manipulating the many key contextual variables. As data from additional states are loaded into the system, broader

geographic comparisons with more stable estimates will be available for study.

Clearly many limitations apply. Data are ecologic and cross-sectional and no control for other key variables aside from age (e.g. region, income, etc.) was possible. Varying degrees of enforcement of legal restrictions on firearm use have been demonstrated to play a key role in explaining the impact on observed firearm-related morbidity and mortality (Beckett, 2018; Zeoli et al., 2016); control for enforcement was not possible in this analysis, and would be a key variable to consider in analyses of states with finer degrees of difference in legislation (such as 3 or 4 of the specified laws). Only a limited number of states were able to be analyzed and rates are running averages over available years, since participating states joined the NVDRS system at different times; effects of recent restrictive legislation may thus be diluted. For NY State (NYS), estimates for a sole year, 2015, were available in NVDRS and firearm IPH rates were considered to be unstable. To assess whether that year's rates represented an outlier, we obtained and compared female IPH rates data by weapon type across 4 years (2014–2017) from NY State Office for Prevention of Domestic Violence (NYSOPDV, personal communication, 2018). The OPDV data (sourced from the state's Division of Criminal Justice Services) demonstrated extremely close values for the calculated rate ratio: 0.64 from NVDRS (shown in Fig. 2), and 0.62 from OPDV for the year 2015. The OPDV average across 4 years was 0.57, indicating an even stronger effect in recent years. NYC data represent crude rates with combined male and female IPH (gender-specific, age-adjusted data were not available); while 84% (NYC; Mayor's Office, 2018) of IPH victims were women, these data might underestimate (bias away from the null) the true F:N ratio since firearms are used less frequently in male IPH. Finally, these homicide data do not represent the true number of women who have died as a more distal result of ongoing IPV, who may commit suicide to escape their abuse or die while being homeless after escaping from their abuser (NIJ, 2018).

A key consideration in inferring an overall population survival benefit through reduced IPH owing to stronger firearm restrictions is the possibility of “substitution” by other lethal means when an abuser's firearm access is strongly legislated. There are several lines of argument suggesting that such substitution, if it occurred, would not completely cancel the protective impact of effective firearm legislation. First, prior research has demonstrated between a 5- and 6-fold increase in risk of IPH when firearms are in the house where partners cohabit, even where women in abusive relationships were threatened prior with other weapons (Campbell et al., 2006). Researchers concluded that abusers with access to firearms are more likely to use them in the worst instances of abuse. Thus, even if the abuser substitutes other weapons in homicide attempts, the clear inference is that women are more likely to survive such an attack. A second, related line of argument is based in logic: although male strength on average is superior to that of females, effective resistance and/or escape in instances of non-firearm weapon use is a great deal more likely than when firearms are used (note: we have assumed a majority of male perpetrators in female IPH, supported by considerable prior national data [e.g. Zeoli et al., 2016]). Yet a third line of argument weighing in favor of a net protective effect of firearm legislation even considering possible weapon substitution is found in the solid body of work on access to carried firearms (e.g. Branas et al., 2009) and firearms purchase and ownership (e.g. Wintemute et al., 1999; Kellerman et al., 1994) which has long supported the general notion that increased access to firearms results in greater firearm-related death and injury. Finally, limited prior research on suicide (Miller et al., 2002) suggests weapon substitution for firearms is incomplete

and possibly quite infrequent (Fowler et al., 2015); in the situation of homicide, where a victim's goal is survival, the lethal impact of any substitution would thus be expected to be less.

In conclusion, these data offer a supplemental measure of firearm-related excess mortality for females, and further support the notion that firearm involvement in female IPH is indeed reduced with effective firearm legislation. Additionally, several lines of argument support the notion that weapon substitution would not completely outweigh the female survival benefits of tighter firearm legislation even in areas where non-firearm IPH rates are high, especially important given the variation demonstrated across some of the states included in this analysis. A continued focus on the most efficient ways to reduce firearm access for violent intimate partners is an urgent priority due to the outsized role firearms play in female deaths.

References

- Bangalore, S., Messerli, F.H., 2013. Gun ownership and firearm-related deaths. *Am. J. Med.* 126 (10), 873–876. <https://doi.org/10.1016/j.amjmed.2013.04.012>.
- Beckett, L., 2018. Gun laws that cost millions had little effect because they weren't enforced. URL: <https://www.theguardian.com/us-news/2017/oct/13/gun-laws-that-cost-two-state-lawmakers-their-seats-had-little-effect-study-finds>.
- Branas, C.C., Richmond, T.S., Culhane, D.P., Have, T.R., Wiebe, D.J., 2009. Investigating the link between gun possession and gun assault. *Am. J. Public Health* 99 (11), 2034–2040. <https://doi.org/10.2105/ajph.2008.143099>.
- Campbell, J.C., Webster, D., Koziol-McLain, J., McFarlane, J., Block, C., Campbell, D., Curry, M.A., 2006. Risk factors for femicide-suicide in abusive relationships: results from a multisite case control study. *Violence Vict.* 21 (1), 3–21. <https://doi.org/10.1891/088667006780927358>.
- Díez, C., Kurland, R., Rothman, E., Bair-Merritt, M., Fleegler, E., Xuan, Z., Siegel, M., 2017. State intimate partner violence-related firearm laws and intimate partner homicide rates in the United States, 1991 to 2015. *Ann. Intern. Med.* 167 (8), 536. <https://doi.org/10.7326/m16-2849>.
- Fleegler, E.W., Lee, L.K., Monuteaux, M.C., Hemenway, D., Mannix, R., 2013. Firearm legislation and firearm-related fatalities in the United States. *JAMA Intern. Med.* 173, 732–740. <https://doi.org/10.1001/jamainternmed.2013.1286>.
- Fowler, K.A., Dahlberg, L.L., Hailey, T., Annett, J.L., 2015. Firearm injuries in the United States. *Prev. Med.* 79, 5–14 October.
- Fowler, K.A., Jack, S.P., Lyons, B.H., Betz, C.J., Petrosky, E., 2018. Surveillance for violent deaths — National Violent Death Reporting System, 18 states, 2014. *MMWR Surveill. Summ.* 67 (SS-2), 1–36. <https://doi.org/10.15585/mmwr.ss6702a1>.
- Geier, D.A., Kern, J.K., Geier, M.R., 2017. A longitudinal ecological study of household firearm ownership and firearm-related deaths in the United States from 1999 through 2014: a specific focus on gender, race, and geographic variables. *Prev. Med. Rep.* 6, 329–335.
- Hemenway, D., Solnick, S.J., 2015. Children and unintentional firearm death. *Int. J. Epidemiol.* 2 (1). <https://doi.org/10.1186/s40621-015-0057-0>.
- Kalesan, B., Mobily, M., Keiser, O., Fagan, A., Galea, S., 2016. Firearm legislation and firearm mortality in the USA: a cross-sectional, state-level study. *Lancet* 387 (10030), 1847–1855. [https://doi.org/10.1016/S0140-6736\(15\)01026-0](https://doi.org/10.1016/S0140-6736(15)01026-0). Apr 30.
- Kellerman, A., Rivera, F., Rushforth, N., 1994. Gun ownership as a risk factor for homicide in the home. *J. Clin. Forensic Med.* 1 (1), 52. [https://doi.org/10.1016/1353-1131\(94\)90070-1](https://doi.org/10.1016/1353-1131(94)90070-1).
- Lee, L., Fleegler, E.W., Farrell, C., Avakame, E., Srinivasan, S., Hemenway, D., Monuteaux, M.C., 2017. Firearm laws and firearm homicides: a systematic review. *JAMA Intern. Med.* 177 (1), 106–119.
- Mayor's Office to Combat Domestic Violence. New York City Domestic Violence Fatality Review Committee, 2018. 2017 Annual Report. URL: <http://www1.nyc.gov/assets/ocdv/downloads/pdf/FRC2017AnnualReport.pdf>.
- Miller, M., Azrael, D., Hemenway, D., 2002. Firearm availability and suicide, homicide, and unintentional firearm deaths. *J. Urban Health* 79 (1), 26–38. <https://doi.org/10.1093/jurban/79.1.26>.
- National Institute of Justice (NIJ), 2018. Intimate Partner Homicide, November 2003 Journal. URL: <https://www.ncjrs.gov/pdffiles1/jr000250.pdf>.
- New York State Office for the Prevention of Domestic Violence (NYSOPDV), 2018. New York State. Personal communication, Maire Cunningham, October. .
- Violence Policy Center, 2015. When men murder women: an analysis of 2013 homicide data. URL: <http://www.vpc.org>.
- Wintemute, J., Parham, A., Beaumont, J., Wright, M., Drake, C., 1999. Mortality among recent purchasers of handguns. *NEJM* 341 (21), 1583–1589. <https://doi.org/10.1056/nejm199911183412106>.
- Zeoli, A., Malinski, R., Turchan, B., 2016. Risks and targeted interventions: firearms in intimate partner violence. *Epidemiol. Rev.* <https://doi.org/10.1093/epirev/mxv007>.