

# Criminal Use of Assault Weapons and High-Capacity Semiautomatic Firearms: an Updated Examination of Local and National Sources

Christopher S. Koper  · William D. Johnson ·  
Jordan L. Nichols · Ambrozie Ayers · Natalie Mullins

Published online: 2 October 2017  
© The New York Academy of Medicine 2017

**Abstract** Policies restricting semiautomatic assault weapons and large-capacity ammunition magazines are intended to reduce gunshot victimizations by limiting the stock of semiautomatic firearms with large ammunition capacities and other military-style features conducive to criminal use. The federal government banned such weaponry from 1994 to 2004, and a few states currently impose similar restrictions. Recent debates concerning these weapons have highlighted their use in mass shootings, but there has been little examination of their use in gun crime more generally since the expiration of the federal ban. This study investigates current levels of criminal activity with assault weapons and other high-capacity semiautomatics in the USA using several local and national data sources including the following: (1) guns recovered by police in ten large cities, (2) guns reported by police to federal authorities for investigative tracing, (3) guns used in murders of police, and (4) guns used in mass murders. Results suggest assault weapons (primarily assault-type rifles) account for 2–12% of guns used in crime in general (most estimates suggest less than 7%) and 13–16% of guns used in murders of police. Assault weapons and other high-capacity semiautomatics together generally account for 22 to 36% of crime guns, with some estimates upwards of 40% for cases involving serious

violence including murders of police. Assault weapons and other high-capacity semiautomatics appear to be used in a higher share of firearm mass murders (up to 57% in total), though data on this issue are very limited. Trend analyses also indicate that high-capacity semiautomatics have grown from 33 to 112% as a share of crime guns since the expiration of the federal ban—a trend that has coincided with recent growth in shootings nationwide. Further research seems warranted on how these weapons affect injuries and deaths from gun violence and how their regulation may impact public health.

**Keywords** Firearms · Assault weapons · Violence

## Introduction

Firearm violence imposes a significant burden on public health in the USA. From 2010 through 2012, the nation experienced an annual average of 11,256 firearm homicides and 48,534 non-fatal assault-related gunshot victimizations that cost society nearly \$22 billion a year in lifetime medical and work-related costs [1]. One type of policy response to reduce gun violence involves restricting or mandating design changes in particular types of firearms that are considered to be especially dangerous and/or attractive for criminal use.

Restrictions on assault weapons (AWs) represent one particularly controversial and highly contested form of such legislation that has featured prominently in gun policy debates in recent decades. In general, AW laws

---

C. S. Koper (✉) · W. D. Johnson · J. L. Nichols ·  
A. Ayers · N. Mullins  
Center for Evidence-Based Crime Policy, Department of  
Criminology, Law and Society, George Mason University, Fairfax,  
VA, USA  
e-mail: ckoper2@gmu.edu

restrict manufacturing, sales, and ownership of semiautomatic firearms with large ammunition capacities and other military-style features that appear useful in military and criminal applications but unnecessary in shooting sports or self-defense [2]. Examples of such features include pistol grips on rifles, flash hiders, folding rifle stocks, threaded barrels for attaching silencers, and barrel shrouds on pistols. AW laws also commonly include restrictions on large-capacity magazines (LCMs), which are typically defined as ammunition feeding devices holding more than ten rounds of ammunition (some laws have higher limits). LCM restrictions are arguably the most important components of AW laws in that they also apply to the larger class of high-capacity semiautomatic firearms without military-style features. In the broadest sense, AW-LCM laws are thus intended to reduce gunshot victimizations by limiting the stock of semiautomatic firearms with large ammunition capacities and other features conducive to criminal use. The federal government enacted a national ban on AWs and LCMs in 1994 but allowed it to expire in 2004. Currently, eight states and the District of Columbia have AW and/or LCM restrictions, as do some additional localities [3].

Recent discussion and debates concerning these weapons have largely focused on their use in mass shootings. However, there has been little examination of the use of AWs and LCMs in gun crime more generally since the expiration of the federal ban. Studies conducted around the time of the federal ban found that AWs accounted for up to 8% of guns used in crime (generally between 1 and 6% and averaging around 2%) and that the broader class of firearms equipped with LCMs (including AWs and other semiautomatic firearms equipped with LCMs) accounted for up to a quarter [2, 4–12]. Criminal use of such weaponry declined during the years of the federal ban [2, 13, 14], but trends since then have only been examined in the state of Virginia, where LCM use rose following the ban's expiration [14]. Semiautomatic weapons with LCMs and/or other military-style features are common among models produced in the contemporary gun market [15, 16], but precise estimates of their production and ownership are unavailable. Growth in the use of such weapons could have important implications for public health as these weapons tend to produce more lethal and injurious outcomes when used in gun violence [2, 17]. This study provides an updated examination of the AW issue by investigating current levels of criminal activity

with AWs and other LCM firearms as measured in a variety of national and local data sources.

## Data and Methods

There is no national data source that can be used to count the numbers of homicides, non-fatal shootings, or other crimes committed with AWs and other LCM firearms. Therefore, criminal use of these weapons was approximated by examining and triangulating across several local and national data sources on guns used in different types of crimes.

### Local Data Sources

The local-level analyses are based on guns recovered by police over multiple years (defined below) in a convenience sample of ten cities including Hartford (CT), Rochester (NY), Syracuse (NY), Baltimore (MD), Richmond (VA), Minneapolis (MN), Milwaukee (WI), Kansas City (MO), Seattle (WA), and Sacramento (CA). Large cities were selected for the analysis (these cities range in size from roughly 124,000 to 684,500) due to the concentration of gun violence in urban areas [18, 19]. Patterns and trends in these particular cities may not be indicative of those elsewhere; further, some (Baltimore, Hartford, Rochester, Syracuse, and Sacramento) are covered by state AW and LCM restrictions that were in effect during all or portions of the study period (this study does not attempt to evaluate the implementation and effects of these laws or variations therein). Nonetheless, these cities constitute a geographically diverse set of ban and non-ban locations, thus strengthening generalizations. The data were obtained from law enforcement authorities in these jurisdictions except where otherwise noted. Information available in most of the police databases included the type, make, model, and caliber of each confiscated firearm; the date when it was recovered; and the type of crime with which it was associated.

Guns recovered by police (often referred to as “crime guns”) are the only readily available data with which to study patterns and trends in the types of guns used in crime across jurisdictions, and they are commonly used in research on gun markets, gun violence, and gun policy [2, 9, 20–37]. Guns confiscated by police include guns recovered in violent crime investigations as well as those recovered in connection with weapon offenses

(illegal possession, carrying, and discharges), drug violations, property crimes, and other incidents. These samples thus represent guns known to have been used in violence as well as guns possessed and/or carried by criminal and otherwise high-risk persons. As others have noted, they represent a sample from the population of guns that are at greatest risk of misuse [24] and thereby provide a probable sample of guns used to commit crimes [21]. As caveats, nonetheless, it should be noted that police do not recover all guns used and possessed illegally, and it is possible that the types of guns they confiscate differ from those of unrecovered guns linked to illegal possessors and users. The analyses highlighted below are based on all confiscated firearms in the study jurisdictions. Additional analyses conducted with just those guns clearly connected to a violent offense, which represented at least 13 to 19% of guns across the cities, produced very similar results except where noted (separate offense-type analyses could not be conducted with the Syracuse and Rochester gun data or the Richmond LCM data).

#### National Data Sources

National-level analyses were conducted using three data sources and compilations. The first consists of information on firearms recovered by law enforcement agencies throughout the nation and reported to the federal Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) for investigative tracing of their sale histories. Guns reported to ATF provide a national sample of crime guns numbering in the hundreds of thousands annually (predominantly from urban jurisdictions), but they do not constitute a statistically representative sample for the nation given that gun tracing is voluntary (agencies trace guns as needed for specific investigations and/or analysis of illegal gun markets) and varies between agencies and over time [24, 27, 38–40]. Further, publicly available data on traced guns are limited to aggregate figures on basic types and calibers of the weapons, thus limiting the analyses that could be conducted as described below. The other national data sources included information on guns used in murders of police officers and mass murder incidents. Prior research has shown that AWs and LCM firearms are used in a higher share of these crimes, due presumably to their lethality and attractiveness to the types of offenders who commit these offenses [2, 4], and this has been a prominent issue in the AW debate. Information on firearms used in murders of police,

including the type, make, model, and caliber of each weapon, was obtained from the Federal Bureau of Investigation (FBI), which compiles these data from reports by police agencies throughout the country. Information on firearms used in mass murder shooting incidents was collected from lists and reports compiled by several organizations since there is no single official data source that regularly provides detailed and comprehensive information on mass murders and the guns used in these incidents [41–50]. Consistent with many prior studies of this issue, firearm mass murders were defined as incidents in which four or more people were murdered with a firearm, not including the death of the shooter if applicable and irrespective of the number of additional victims shot but not killed. This increased the number of sources that could be used to gather information. As described below, however, detailed weapon information could not be found in public sources for many of the cases.

#### Methods

There is no universal definition of an AW that applies across current and past AW laws. For example, the expired federal ban and some current state laws define AWs as having two military-style features, whereas other state bans and a recent (2013) proposal for a new federal ban use a one feature criterion [2, 51]. For this study, AWs were defined based on the weapons that have most commonly been identified as such based on the old federal ban, current state laws, and the recently proposed federal ban. This list included more than 200 make-model combinations covered by either of the federal lists (2004 and 2013) or at least two of the state laws. Based on preliminary analyses showing that most recovered AWs are assault rifles (as opposed to assault pistols or assault shotguns), an additional ceiling estimate of AW use was calculated based on the prevalence of semiautomatic rifles. This was also done to compensate for imprecision in the AW estimates (due, for example, to missing or partial gun model data, lack of information about the specific features or configurations of the weapons that could affect their AW status, and possible omissions from the operational AW list).

Use of guns with LCMs could only be measured precisely for the Syracuse, Baltimore, and Richmond analyses, which are based on data sources having an indicator for magazine capacity (which is typically

missing from police gun databases), and some of the mass murder incidents. For most analyses, use of LCM firearms was approximated based on recoveries of semi-automatics that are commonly manufactured and sold with LCMs, referred to below as LCM-compatible firearms. Identification of these models was based on gun catalogs (such as the *Blue Book of Gun Values* and *Gun Digest*) and examination of gun manufacturers' websites. This method likely overstates LCM use to some degree since many LCM compatible firearms can also be equipped with smaller magazines. As a rough guide, inspection of all recoveries of a small number of LCM-compatible handgun models in the Baltimore data revealed that approximately four of five were equipped with LCMs. Conversely, LCM use can also be undercounted for guns that were missing complete model information or equipped with aftermarket LCMs, which are available for some guns not sold with LCMs at retail. LCM use was not estimated for Rochester and Sacramento since New York and California have had longstanding restrictions on magazines with more than ten rounds (hence, it seems less likely that LCM-compatible guns recovered in those jurisdictions were actually equipped with LCMs).

Data were collected from 2014 through 2016. Current estimates of AW and LCM use were developed using the most recent 2–3 years of data from the local police databases and ATF data. Data spanning the most recent 5–6 years were used to generate contemporary estimates of AW and LCM use in murders of police and mass murders due to the rarity of these events. As described below, some data sources were also used to estimate trends in the use of semiautomatic rifles and LCM firearms since the expiration of the federal ban. Reported figures highlight AWs and LCM firearms as a share of crime guns in order to control for differences in the volume of gun crime and overall gun recoveries between places and over time. Other noteworthy aspects of the data and analyses are discussed below.

## Results

### Local Analyses

Results of the local analyses are presented in Table 1. For each site, estimates are based on data spanning different portions of the 2011–2014 period. The number of guns

analyzed ranged from 281 in Syracuse to 4994 in Kansas City and totaled 21,551 across all data sources.

Estimates of the prevalence of AWs among crime guns ranged from a low of 2.4% in Baltimore to a high of 8.5% in Syracuse. Assault rifles (e.g., variations of the AR-15 or AK-47) accounted for the majority of AWs in all sites and more than three-quarters in all but one (Richmond). The remaining AWs consisted entirely (or nearly so) of assault pistols (e.g., the TEC-9 or TEC-22). The share of crime guns consisting of semiautomatic rifles of any sort is also displayed in Table 1 for localities that had gun databases with gun-type designations (i.e., handgun/rifle/shotgun, semiautomatic/non-semiautomatic). These estimates ranged from a low of 4.1% in Hartford to 12.4% in Rochester but were less than 9% for most cities. (The Milwaukee estimate is based on the percentage of crime guns that were rifles of any sort as semiautomatic/non-semiautomatic designations were unavailable.) As noted, the semiautomatic rifle estimates, which include both AW-type and non-AW-type rifles, provide a likely ceiling for estimates of AW prevalence.

The percentage of crime guns clearly equipped with an LCM (including AWs and other high-capacity semiautomatics, most of which are pistols) was 16.5% in Baltimore during the 2012–2014 period, but this figure rose to 21.5% for guns that were connected to a violent crime. These findings are similar to those from a recent news report (involving a separate and independent analysis of Baltimore data) indicating that 18.4% of guns recovered in Baltimore had LCMs for the period of 2010 through 2016 [52]. In Richmond, 22% of crime guns were equipped with LCMs during 2008 and 2009 based on data collected by the Virginia State Police and initially reported by *The Washington Post* [14] (the *Post's* reported figures have been reanalyzed here to focus on the most recent available years and to assess trends). Crime guns were least likely to be equipped with LCMs in Syracuse (14.6%), where New York State LCM restrictions have been in effect since the early 2000s.

For the other sites, the prevalence of LCM-compatible guns ranged from 22.2% in Hartford to 36.2% in both Kansas City and Seattle, with the majority of the estimates (3 of 5) higher than one-third. In most of these cities, the prevalence of LCM guns was similar whether focusing on all guns or those connected to a violent crime. In Hartford, however, 30% of violent crime guns were LCM compatible in contrast to 22.2% for all guns. Further, a supplemental analysis of guns linked to assault-

**Table 1** Prevalence of assault weapons, semiautomatic rifles, and semiautomatics with large-capacity magazines among guns recovered by police: estimates for selected cities and years

Location and sample	Assault weapons as % of guns	Semiautomatic rifles as % of guns	Semiautomatics with large-capacity magazines as % of guns
Hartford, CT (2011–2012, $N = 854$ )	2.6%	4.1%	22.2% overall, 30% for guns linked to violent crime
Rochester, NY (2012–July 2014, $N = 1687$ )	4.9%	12.4%	Not estimated
Syracuse, NY (2012–May 2014, $N = 281$ )	8.5%	12.1%	14.6%
Baltimore, MD (2012–Sep. 2014, $N = 4680$ )	2.4%	5.4%	16.5% overall, 21.5% for guns linked to violent crime
Richmond, VA (AW analysis: 2012–2013, $N = 1180$ ) (LCM analysis: 2008–2009, $N = 1960$ )	2.7%	Not estimated	22.0%
Minneapolis, MN (2012–Aug. 2014, $N = 2178$ )	3.4%	6.4%	25.1% overall, 46.3% for guns linked to shootings
Milwaukee, WI (Jul. 2013–Jun. 2014, $N = 1868$ )	4.6%	< 9.4%	35.5%
Kansas City, MO (2012–Aug. 2014, $N = 4994$ )	6.1%	6.3%	36.2%
Seattle, WA (2012–July 2014, $N = 596$ guns linked to violent crimes or weapons violations)	6.4%	7.9%	36.2%
Sacramento, CA (Aug. 2013–Jul. 2014, $N = 1273$ )	6.0%	Not estimated	Not estimated

Estimates are based on general gun recovery samples except where noted. Estimates were similar for guns known to have been connected to violent crimes except where noted. Large-capacity magazine (LCM) estimates for Syracuse, Baltimore, and Richmond are based on known LCM recoveries (the Richmond estimates are based on Virginia State Police data initially reported by *The Washington Post*). Other LCM estimates are based on recoveries of LCM compatible firearm models. The Milwaukee semiautomatic rifle estimate is based on the prevalence of all rifles

related shootings in Minneapolis (using gunshot victimization data provided by Minneapolis police) revealed that 46.3% were LCM compatible, though this was based on a small sample ( $n = 80$  guns).

### National Analyses

Results of the national analyses are presented in Table 2. AW prevalence was approximated in the national ATF tracing data for 2012 and 2013 ( $n = 481,632$ ) based on traces of guns in calibers .223, 5.56, and 7.62 mm. These are common calibers for AW-type semiautomatic rifles, though not all firearms in these calibers are AWs, and not all AWs fall into these calibers. This method nonetheless yielded an estimate of 5%, which is within the range of estimates provided by the local analyses. Further estimates of semiautomatic rifles and LCM firearms were not possible given the limitations of published tracing data.

Guns used in murders of police were analyzed for the years 2009 through 2013 ( $n = 219$ , excluding cases involving the officers' own weapons, which are often LCM firearms). AWs accounted for an estimated 13.2% of the firearms used in these crimes overall and varied

between 8 and 18% from year to year. Virtually all of the AWs (97%) were assault rifles. Semiautomatic rifles overall accounted for 15.5% of the firearms used in these cases and ranged from 5 to 23% annually. LCM-compatible firearms more generally constituted 40.6% of the murder weapons, ranging from 35 to 48% annually.

AW and LCM use in firearm mass murders was examined for a sample of 145 incidents that occurred from 2009 through 2015 but could only be estimated within broad ranges due to high levels of missing weapons data in public accounts. AWs were used in at least 10.3% of these incidents. However, only 42 incidents had sufficiently detailed weapon information to make a definitive determination regarding AW use; among these cases, 35.7% involved AW use. All but one AW case involved an assault rifle. (A separate estimate for semiautomatic rifle use is not presented because only two additional cases clearly involved a semiautomatic rifle with an unclear or non-AW designation.) LCM firearms overall were involved in at least 18.6% of the incidents based on cases that involved clear possession of LCMs, AWs, or other LCM-compatible models. Although many additional cases involved semiautomatic firearms, an LCM coding could

**Table 2** Prevalence of assault weapons, semiautomatic rifles, and semiautomatics with large-capacity magazines among national samples of guns recovered by police, guns used in murders of police, and guns used in mass murders

Data source and sample	Assault weapons as % of guns	Semiautomatic rifles as % of guns	Semiautomatics with large-capacity magazines as % of guns
Federal Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF): guns recovered by police and reported to ATF for investigative tracing (2012–2013, $N = 481,632$ )	5%	Not estimated	Not estimated
Federal Bureau of Investigation: guns used in murders of police (2009–2013, $N = 219$ )	13.2%	15.5%	40.6%
Public reports of firearm mass murders (4+ killed) (2009–2015, $N = 145$ )	10.3–35.7%	Not estimated	18.6–57.4%

Assault weapon estimate for ATF data is based on reported firearms in calibers .223, 5.56, and 7.62 mm. LCM estimates are based on recoveries of LCM compatible firearm models in the FBI data and recoveries of both LCMs and LCM compatible firearms in the mass murder data

only be made for 47 cases, 57.4% of which involved an LCM firearm. The identified AW and LCM cases typically occurred in public locations (80%) and resulted in more than twice as many people shot on average as did other incidents (13.7 victims on average for AW-LCM cases versus 5.2 for other cases;  $t$  test  $p$  level < 0.01).

### Trend Analyses

Trends in the use of AWs and LCM firearms since the end of the federal AW ban or the early post-ban years were also estimated using selected data sources that had sufficiently detailed weapon information and spanned the period of interest. First, trends in recoveries of semiautomatic rifles were used to approximate trends in crime with AWs using the FBI national data on police murders (2003–2013) and data from the following cities and time periods: Baltimore (2004–2014), Rochester (2004–2014), Syracuse (2004–2014), Milwaukee (2006–2014, based on all rifles), Seattle (2008–2014), Minneapolis (2006–2014), and Kansas City (2008–2014). In summary, these analyses (not shown) revealed little evidence of upward trends in the use of semiautomatic rifles across sites.

Second, trends in crimes with LCM firearms were estimated based on guns used in murders of police (2003–2013) as well as guns recovered in Baltimore (2004–2014), Richmond (2003–2009), and Minneapolis (2006–2014). Table 3 shows changes over time in the percentage of guns that were LCM firearms using the earliest and latest years of each data source. In relative

terms, the prevalence of LCM firearms increased from 33 to 49% in the Baltimore, Minneapolis, and national (FBI) data (note that Maryland restricted LCMs with more than 20 rounds throughout this period and extended these restrictions to LCMs with more than 10 rounds in late 2013). The largest increase occurred in Richmond, where LCM firearms increased 111.5%, rising from 10.4% of recovered guns in 2003–2004 (the final years of the federal AW ban) to 22% in 2008–2009. Similar trends have also been reported for the state of Virginia overall [14]. All of these changes were statistically significant ( $p < 0.05$ ) based on chi-square tests of the equality of proportions.

### Discussion

Subject to caveats noted above, this examination of several national and local data sources suggests that AWs are used in between 2 and 9% of gun crimes in general with most estimates being less than 7%. Upper bound estimates of AW use based on semiautomatic rifles range from 4 to 12% in most data sources and are typically less than 9%. These estimates are broadly similar to those generated in the early 1990s prior to the federal AW ban [2], though they are perhaps somewhat higher on average. However, comparisons of these estimates with others should be made cautiously, as operational definitions of an AW have varied across studies and estimates presented here are based on the most contemporary definitions of AWs. One clearly notable

**Table 3** Changes in prevalence of semiautomatics with LCMs: estimates for selected local and national data sources and time frames, 2003–2014

Data source/location	LCM firearm prevalence: early time period	LCM firearm prevalence: late time period	Change in LCM firearm prevalence
Baltimore crime guns	11.1% (2004, 2006, <i>N</i> = 5369 total firearms)	16.5% (2012–Sep. 2014, <i>N</i> = 4381 total firearms)	+ 48.6%**
Richmond, VA crime guns	10.4% (2003–2004, <i>N</i> = 2413 total firearms)	22.0% (2008–2009, <i>N</i> = 1960 total firearms)	+ 111.5%**
Minneapolis crime guns	16.8% (2006–2007, <i>N</i> = 2564 total firearms)	25.1% (2012–Aug. 2014, <i>N</i> = 2178 total firearms)	+ 49.4%**
National (FBI): guns used in murders of police	30.4% (2003–2007, <i>N</i> = 224 total firearms)	40.6% (2009–2013, <i>N</i> = 219 total firearms)	+ 33.6%*

Change in proportions statistically significant at  $p < 0.05$  (\*) or  $p < 0.01$  (\*\*)

Estimates are based on general gun recovery samples except where noted. LCM estimates for Baltimore and Richmond are based on known LCM recoveries (the Richmond estimates are based on Virginia State Police data initially reported by *The Washington Post*). The early period estimate for Baltimore excludes the year 2005 due to an unusually large number of guns appearing that year within the buyback/turn-in/safekeeping category. Other LCM estimates are based on recoveries of LCM compatible firearm models

recent change is that assault rifles, rather than assault pistols, now account for a substantial majority of AWs used in crime in contrast to prior estimates [2]. This implies an increase over time in the average lethality of AWs used in violence.

LCM firearms, which include AWs as well as other high-capacity semiautomatics, appear to account for 22 to 36% of crime guns in most places, with some estimates upwards of 40% for cases involving serious violence. These estimates are comparable to or higher than earlier estimates of LCM use. However, the higher-end estimates may overstate LCM use somewhat as most are based on measurement of LCM-compatible guns that may not all have been equipped with LCMs.

Consistent with prior research, this study also finds that AWs and LCM firearms are more heavily represented among guns used in murders of police and mass murders. AWs account for 13–16% of guns used in murders of police, while LCM weapons overall account for about 41% of these weapons. Estimates for firearm mass murders are very imprecise due to lack of data on the guns and magazines used in these cases, but available information suggests that AWs and other high-capacity semiautomatics are involved in as many as 57% of such incidents. Further, they are particularly prominent in public mass shootings and those resulting in the highest casualty counts.

Importantly, trend analyses suggest that LCM firearms have grown substantially as a share of crime guns since the expiration of the federal ban on AWs and LCMs. This implies possible increases in the level of

gunfire and injury per gun attack during this time. Consistent with this inference, national statistics from the Centers for Disease Control and Prevention (CDC) and the FBI show that the ratio of gun homicides and assaultive non-fatal shootings to overall reported violent gun crimes (homicides, assaults, and robberies) rose from an average of 0.163 for 2003–2005 to an average of 0.21 for 2010–2012 (calculated from CDC [53] and FBI [54] data). This change was driven by non-fatal shootings, which have been trending upward since the early 2000s and recently reached their highest levels since 1995 [1]. The findings presented in this study suggest the possibility that greater use of high-capacity semiautomatics has contributed to this upward trend in shootings.

Further study would seem warranted on LCM use trends with additional jurisdictions and data sources. Research on this issue could be facilitated by more systematic efforts to collect detailed information on crime guns and magazines in local police databases as well as through national data collection systems like the Supplemental Homicide Reports and the National Violent Death Reporting System. Study of these weapons is also hampered by lack of public data on production of LCMs and LCM-compatible firearms. The need for better data on this issue may become more pressing if there continue to be significant changes in the lethality of commercially available firearms.

Additional research is also needed to quantify the effects that LCM use has on injuries and deaths from gun attacks—and by extension on the costs to society

from gun violence. Research suggests that gunfire attacks involving semiautomatics produce more lethal and injurious outcomes [2, 10, 17, 55] and that 4–5% of assault-related gunshot victims are wounded in attacks involving more than ten shots fired [2]. However, such evidence is extremely limited at present. Studies of this issue, combined with evaluation research on the effects of current state and local LCM laws, could provide additional insights into the efficacy of expanding LCM restrictions at the local, state, and/or national levels. Research illuminating the public health and safety benefits of AW-LCM restrictions could also inform the courts as they continue to adjudicate recent challenges to the constitutionality of these statutes. Although this study does not directly evaluate any AW-LCM law, it provides further evidence that the federal ban curbed the spread of high-capacity semiautomatic weapons when it was in place and, in so doing, may have had preventive effects on gunshot victimizations.

**Acknowledgments** The authors thank the police agencies that provided data for this study: the Hartford (CT) Police Department, the New York State Police, the Baltimore Police Department, the Richmond (VA) Police Department, the Minneapolis Police Department, the Milwaukee Police Department, the Kansas City (MO) Police Department, the Sacramento Police Department, the Seattle Police Department, and the Federal Bureau of Investigation. The authors also thank Grace Beya, Mark Ecleo, and Thomas Prifti for additional research assistance. The opinions expressed in this manuscript are those of the authors and should not be attributed to any of the aforementioned organizations or individuals.

## References

1. Fowler KA, Dahlberg LL, Haileyesus T, Annett JL. Firearm injuries in the United States. *Prev Med.* 2015;79:5–14.
2. Koper CS. *An Updated Assessment of the Federal Assault Weapons Ban: Impacts on Gun Markets and Gun Violence, 1994–2003.* Report to the National Institute of Justice, U.S. Department of Justice. Philadelphia, PA: Jerry Lee Center of Criminology, University of Pennsylvania; 2004.
3. Law center to prevent gun violence. <http://smartgunlaws.org>. Accessed May 2016.
4. Adler WC, Bielke FM, Doi DJ, Kennedy JF. *Cops under fire: law enforcement officers killed with assault weapons or guns with high capacity magazines.* Washington, DC: Handgun Control, Inc.; 1995.
5. Beck A, Gilliard D, Greenfield L, et al. *Survey of state prison inmates, 1991.* Washington, DC: Bureau of Justice Statistics, U.S. Department of Justice. 1993.
6. Hargarten SW, Karlson TA, O'Brien M, Hancock J, Quebbeman E. Characteristics of firearms involved in fatalities. *JAMA.* 1996;275:42–5.
7. Hutson HR, Anglin D, Pratts MJ Jr. Adolescents and children injured or killed in drive-by shootings in Los Angeles. *N Engl J Med.* 1994;330:324–7.
8. Hutson HR, Anglin D, Kyriacou DN, Hart J, Spears K. The epidemic of gang-related homicides in Los Angeles county from 1979 through 1994. *JAMA.* 1995;274:1031–6.
9. Kleck G. *Targeting guns: firearms and their control.* New York: NY; Aldine de Gruyter; 1997.
10. McGonigal MD, Cole J, Schwab CW, Kauder DR, Rotondo MF, Angood PB. Urban firearm deaths: a five-year perspective. *J Trauma.* 1993;35:532–7.
11. New York State Division of Criminal Justice Services. *Assault weapons and homicide in New York City.* Albany, NY: Author; 1994.
12. Zawitz MW. *Guns used in crime.* Washington, DC: Bureau of Justice Statistics, U.S. Department of Justice; 1995.
13. Koper CS. America's experience with the federal assault weapons ban, 1994–2004: key findings and implications. In: Webster DW, Vernick JS, editors. *Reducing gun violence in America: informing policy with evidence and analysis,* vol. 2013. Baltimore MD: Johns Hopkins University Press; 2013. p. 157–71.
14. Fallis D VA. Data show drop in criminal firepower during assault gun ban. *The Washington Post,* 2011; January 23.
15. Lee J, editor. *Gun digest 2015.* Iola, WI: Krause Publications; 2014.
16. Violence Policy Center. *The militarization of the U.S. civilian firearms market.* Washington, DC: Author; 2011.
17. Reedy DC, Koper CS. Impact of handgun types on gun assault outcomes: a comparison of gun assaults involving semiautomatic pistols and revolvers. *Injury Prevention.* 2003;9:151–5.
18. Planty M, Truman JL. *Firearm violence, 1993–2011.* Washington, DC: Bureau of Justice Statistics, U.S. Department of Justice; 2013.
19. Smith EL, Cooper A. *Homicides in the U.S. known to law enforcement, 2011.* Washington, DC: Bureau of Justice Statistics, U.S. Department of Justice; 2013.
20. Bureau of Alcohol, Tobacco, and Firearms. Crime gun trace reports. In: *National report.* Washington, DC: United States Department of the Treasury; 2000. p. 2002.
21. Brill S. *Firearm abuse: a research and policy report.* Washington, DC: Police Foundation; 1977.
22. Braga AA, Wintemute GJ, Pierce GL, Cook PJ, Ridgeway G. Interpreting the empirical evidence on illegal gun market dynamics. *J Urban Health: Bull New York Acad Med.* 2012;89:779–93.
23. Braga AA, Pierce GL. Disrupting illegal firearms markets in Boston: the effects of operation ceasefire on the supply of new handguns to criminals. *Criminol Public Policy.* 2005;4(4):717–48.
24. Cook PJ, Braga AA. Comprehensive firearms tracing: strategic and investigative uses of new data on firearms markets. *Arizona Law Review.* 2001;43:277–309.
25. Koper CS. Federal legislation and gun markets: how much have recent reforms of the federal firearms licensing system reduced criminal gun suppliers? *Criminol Public Policy.* 2002;1:151–78.
26. Koper CS. Crime gun risk factors: buyer, seller, firearm, and transaction characteristics associated with gun trafficking and criminal gun use. *J Quant Criminol.* 2014;30:285–315.



27. Pierce GL, Braga AA, Hyatt RR Jr, Koper CS. Characteristics and dynamics of illegal firearms markets: implications for a supply-side enforcement strategy. *Justice Q.* 2004;21:391–422.
28. Vernick JS, Webster DW, Hepburn LM. Effects of Maryland's law banning Saturday night special handguns on crime guns. *Injury Prev.* 1999;5:259–63.
29. Webster DW, Vernick JS, Hepburn LM. Effects of Maryland's law banning Saturday night special handguns on homicides. *Am J Epidemiol.* 2002;155:406–12.
30. Webster DW, Bulzacchelli MT, Zeoli AM, Vernick JS. Effects of undercover police stings of gun dealers on the supply of new guns to criminals. *Injury Prev.* 2006;12:255–30.
31. Webster DW, Vernick JS, Bulzacchelli MT. Effects of a gun dealer's change in sales practices on the supply of guns to criminals. *J Urban Health: Bull New York Acad Med.* 2006;83:778–87.
32. Webster DW, Vernick JS, Hepburn LM. Relationship between licensing, registration, and other gun sales laws and the source state of crime guns. *Injury Prev.* 2006;7:184–9.
33. Webster DW, Vernick JS, Bulzacchelli MT. Effects of state-level firearm seller accountability policies on firearm trafficking. *J Urban Health: Bull New York Acad Med.* 2009;86:525–37.
34. Wintemute GJ. *Ring of fire: the handgun makers of southern California.* Davis, CA: Violence Prevention Research Program, University of California, Davis; 1994.
35. Wintemute GJ, Romero MP, Wright MA, Grassel KM. The life cycle of crime guns: a description based on guns recovered from young people in California. *Ann Emerg Med.* 2004;43:733–42.
36. Wintemute GJ, Cook PJ, Wright MA. Risk factors among retail handgun dealers for frequent and disproportionate sales of guns used in violent and firearm related crimes. *Injury Prev.* 2005;11:357–63.
37. Wright MA, Wintemute GJ, Webster DW. Factors affecting a recently purchased handgun's risk for use in crime under circumstances that suggest gun trafficking. *J Urban Health: Bull New York Acad Med.* 2010;87:352–64.
38. Koper CS. Purchase of multiple firearms as a risk factor for criminal gun use: implications for gun policy and enforcement. *Criminal Public Policy.* 2005;4:749–78.
39. Kleck GBATF. Gun trace data and the role of organized gun trafficking in supplying guns to criminals. *Saint Louis Univ Public Law Rev.* 1999;18:23–45.
40. National Research Council. *Firearms and violence: a critical review.* Washington, DC: The national academies press; 2005.
41. Citizens Crime Commission of New York City. *Mass shooting incidents in America (1984–2012).* <http://www.nycrimecommission.org/mass-shooting-incidents-america.php>. Accessed March 2015.
42. Everytown for Gun Safety. *Analysis of recent mass shootings.* New York: NY; Author; 2014.
43. Everytown for Gun Safety. *Mass shootings in the United States: 2009-2016.* New York: Author; 2017.
44. Mass shooting tracker, gun violence archive. <http://www.shootingtracker.com/>. Accessed Aug. 2016.
45. Federal Bureau of Investigation. *A study of active shooter incidents in the United States between 2000 and 2013.* Washington, DC: U.S. Department of Justice.
46. Kaminski Leduc JL. *Weapons used in mass shootings.* Report 2013-R-0057. Hartford: Connecticut; Office of Legislative Research, Connecticut General Assembly; 2013.
47. Aronsen G, Follman M, Pan D. A guide to mass shootings in America. *Mother Jones.* <http://www.motherjones.com/politics/2012/07/mass-shootings-map>. Accessed Feb. 2015, Jul. 2016.
48. New York City Police Department. *Active shooter: recommendations and analysis for risk mitigation.* New York: counterterrorism bureau, New York City Police Department; New York, NY; 2012.
49. Violence Policy Center. *Mass shootings in the United States involving high-capacity ammunition magazines.* [http://www.vpc.org/fact\\_sht/VPCshootinglist.pdf](http://www.vpc.org/fact_sht/VPCshootinglist.pdf). Accessed June 18, 2017.
50. Berkowitz B, Gamio L, Lu D, Uhrmacher K, and Lindeman T. The math of mass shootings. *The Washington Post* <https://www.washingtonpost.com/graphics/national/mass-shootings-in-america/>. Accessed Aug. 2016.
51. Assault Weapons Act of 2013. OLL13047, 113<sup>th</sup> Cong. (2013).
52. Freskos B. Baltimore police are recovering more guns loaded with high-capacity magazines, despite ban on sales. *The Trace.* 2017; Apr. 1. <https://www.thetrace.org/2017/03/high-capacity-magazine-ban-baltimore-police/> Accessed Apr. 1, 2017.
53. Centers for Disease Control and Prevention. Injury Center. <https://www.cdc.gov/injury/wisqars/>. Accessed March 2015.
54. Federal Bureau of Investigation. Uniform crime reporting. <https://ucr.fbi.gov/ucr>. Accessed March 2015.
55. Richmond TS, Branas CC, Cheney RA, Schwab CW. The case for enhanced data collection of gun type. *J Trauma.* 2004;57:1356–60.