JUSTICE QUARTERLY
2021, VOL. 38, NO. 5, 892–915
https://doi.org/10.1080/07418825.2020.1789693

ACJS Routledge Taylor & Francis Group

Comparing the Impact of Household Gun Ownership and Concealed Carry Legislation on the Frequency of Mass Shootings and Firearms Homicide

Emma E. Fridel

College of Criminology & Criminal Justice, Florida State University, Tallahassee, FL, USA

ABSTRACT

Although mass shootings have fueled calls for large-scale changes in gun ownership and concealed carry legislation over the past thirty years, few studies have evaluated whether permissive gun policies actually deter mass shootings, and none have determined if their effects are the same on firearms homicide in general. This study examines the impact of household gun ownership and concealed carry legislation on annual counts of mass shootings and firearms homicides in the United States from 1991 to 2016. Negative binomial regressions with fixed effects and generalized estimating equations (GEE) indicate that mass shootings disproportionately occur in states with higher levels of gun ownership, while firearms homicide rates are higher in permissive concealed carry states. As the two crimes do not respond to changes in gun ownership and concealed carry legislation in the same way, lawmakers must contextualize mass shootings as a small, unique part of overall gun violence when considering policy interventions.

ARTICLE HISTORY
Received 5 May 2020
Accepted 25 June 2020

KEYWORDS
Mass shootings; firearms homicide; gun ownership; concealed carry

Introduction

Gun violence is a major public health crisis in the United States: nearly 40,000 residents die from suicide, homicide, and accidents involving firearms annually, making a single year of gun-related deaths equivalent to casualties from the Korean War (Cook, Moore, & Braga, 2011). In particular, firearms homicide accounted for 14,542 deaths in 2017 (Centers for Disease Control & Prevention, 2019), representing over 75% of all homicides, and the United States' firearms homicide rate is 25.2 times greater than that of similar high-income nations (Grinshteyn & Hemenway, 2016).

Mass shootings represent the epitome of the firearms violence epidemic. Defined as the killing of four or more individuals (excluding the offender) with a firearm within 24 hours, mass shootings occur 23 times a year on average and account for less than 1% of all homicides in the United States (Fridel, 2017; Krouse & Richardson, 2015). Despite their rarity, mass shootings have fueled moral panics, inspired social movements like March for Our Lives, and sparked calls for policy change on both sides of

CONTACT Emma E. Fridel efridel@fsu.edu

the political aisle. Nearly 80% of American adults experience stress related to mass shootings, and approximately one third avoid certain places and events due to their fear of victimization (American Psychological Association, 2019).

Despite the ubiquity of gun violence in the United States, widespread fear of mass shootings in particular has disproportionately influenced the public discourse on firearms ownership and legislation. Although household gun ownership has been declining since the early 1990s (Smith & Son, 2015), gun purchases and permit applications spike dramatically in the wake of infamous mass shootings (Liu & Wiebe, 2019; Wallace, 2015), especially among individuals with no history of firearms ownership (Studdert, Zhang, Rodden, Hyndman, & Wintemute, 2017). In 2019 alone, 13% of Americans surveyed purchased a weapon to protect themselves against mass shootings, with an additional 16% seriously considering the option (Brenan, 2019).

Aside from influencing individual gun-purchasing behavior, mass shootings are often used to garner support for more restrictive or permissive firearms laws. For example, one study found each incident increased the number of firearm bills introduced in any given state's legislature by 15% (Luca, Malhotra, & Poliquin, 2019). One of the most widely discussed—and most widely implemented—policies to prevent mass shootings is permissive concealed carry legislation. Suzanna Gratia Hupp famously called for fewer restrictions on concealed carry, arguing that she could have stopped the 1991 massacre at Luby's cafeteria in Killeen, Texas if she were not legally obligated to leave her firearm locked in her car (Hupp, 2009). Over twenty years later, Wayne LaPierre of the National Rifle Association (NRA) pithily reiterated Hupp's argument following the 2012 Sandy Hook Elementary School shooting, stating "The only thing that stops a bad guy with a gun is a good guy with a gun" (National Public Radio, 2012). Indeed, 56% of Americans believe that increased gun-carrying in public makes the nation safer (Newport, 2015). State laws have changed along with public opinion: while only 15 states maintained permissive concealed carry policies in the early 1990s, that number increased to 41 states as of 2018 (Siegel, Pahn et al. 2017).

Despite these large-scale changes in gun purchasing and carrying behavior, it remains unclear if these measures are an effective deterrent, as few studies have empirically examined the impact of gun ownership and/or concealed carry legislation on the frequency of mass shootings (Duwe, Kovandzic, & Moody, 2002; Lin, Fei, Barzman, & Hossain, 2018; Lott & Landes, 2000; Reeping et al., 2019; Webster, McCourt, Crifasi, Booty, & Stuart, 2020). Even further, research has yet to determine whether the effects of gun ownership and concealed carry legislation vary for mass shootings and firearms homicide. Doing so is critical, given that these extreme incidents disproportionately shape the gun control policies that influence the thousands of firearms homicides committed in the United States each year. Ultimately, broadening our understanding of the relationship between guns and homicide is crucial for combating moral panics, developing effective crime control policies, and dispelling public fear and old stereotypes. To address this gap in the literature, the present study utilizes cross-sectional panel models and generalized estimating equations (GEE) to compare the impact of household gun ownership and concealed carry legislation on the incidence rate of mass shootings and firearms homicide in the 50 U.S. states from 1991 to 2016. The study begins with a discussion of previous empirical work on gun

ownership, firearms homicide, and mass shootings before turning to the literature on concealed carry legislation.

Literature review

Household gun ownership

Scholars have long debated the link between the homicide rate and prevalence of gun ownership (Hepburn & Hemenway, 2004; Kleck, 1997; Kleck & Hogan, 1999). Some argue that guns have a positive relationship with homicide as they are more lethal in comparison to other weapons, increasing the likelihood of an assault becoming a murder (Zimring, 1968, 1991, 1972). Due to their psychological association with power, firearms may also subconsciously prime the individuals who wield them to act more aggressively (Anderson, Benjamin, & Bartholow, 1998; Berkowitz & Lepage, 1967; Bartholow, Sestir, & Davis, 2005; Killias & Haas, 2002; Bettencourt & Kernahan, 1997). Guns can also serve as the great equalizer, emboldening smaller, weaker aggressors to attack stronger victims whom they may not have been able to overpower otherwise (Kleck & Hogan, 1999). Assailants may be more likely to use lethal force with a firearm as they can be used at a distance, allowing offenders to be physically and psychologically removed from their actions (Wolfgang, 1958).

In contrast, the relative lethality of firearms may serve as an effective deterrent to homicide in certain situations. Perpetrators with a specific goal such as robbery may employ guns to threaten their victims into compliance, thus decreasing the likelihood of conflict. The threat of lethal force may also give pugnacious opponents a socially acceptable means of retreat, deescalating the conflict. Merely wielding a gun may also satisfy assailants who seek to establish dominance or control over their victims, precluding the need to use the weapon; armed attackers are automatically in a superior position to their opponents, a goal that might be impossible in the absence of a gun (Kleck & Hogan, 1999). Similarly, some studies have shown that the dire consequences of gun usage serve to reduce aggression for both parties involved in a dispute (Hindelang, 1976; Kleck, 1997). In this way, the presence of a gun reduces the situation into an all-or-nothing scenario, with two extreme choices: kill or do not attack at all. As most individuals involved in potentially lethal conflicts do not necessarily intend to commit murder, firearms in the majority of such incidents would decrease the likelihood of an attack (Kleck & Hogan, 1999). Particularly relevant to mass murder, potential offenders may also be less likely to attempt a crime when there is a possibility their victim is armed with a firearm (Lott, 2000).

Despite these competing theoretical rationales, prior research has consistently shown that gun ownership rates are positively associated with the firearms homicide rate. Time series analysis of firearm availability at the city (Fisher, 1976; McDowall, 1991; Newton & Zimring, 1969), county (Duggan, 2001), state (Siegel, Ross, & King, 2013; Sorenson & Berk, 2001), and regional/national (Kleck, 1979; Miller, Azrael, & Hemenway, 2002; Phillips, Votey, & Howell, 1976) levels in the United States show a significant, positive relationship between gun ownership and homicide rates, a finding replicated in most cross-sectional ecological studies across levels (Lester, 1988; Miller, Hemenway, & Azrael, 2007; Seitz, 1972). Similarly, international comparisons utilizing

multiple measures of firearms availability have repeatedly found significant positive correlations between household gun ownership and both the gun and overall homicide rate (Hemenway & Miller, 2000; Hemenway, Shinoda-Tagawa, & Miller, 2002; Killias, 1993a, 1993b). Even at the individual level, studies have linked household gun ownership to an increased risk of homicide victimization (Bailey et al., 1997; Cummings, Koepsell, Grossman, Savarino, & Thompson, 1997) and offending (Kleck & Hogan, 1999).

Although the majority of studies find support for this relationship (Hepburn & Hemenway, 2004), some scholars question their methods, specifically related to the measurement of firearms availability and the potential for reciprocal causation. As detailed survey data are frequently unavailable for the desired time period and/or levels of analysis, many researchers employ gun ownership proxies, including the proportion of suicides committed with a firearm, subscriptions to gun magazines, guns per capita, number of permits or licenses, accident rate, and registration rate (Kleck & Hogan, 1999). Even more problematic is the inability of many studies to establish causal direction, leading Kleck (1979, pp. 908) to argue "crime is a cause of gun ownership just as gun ownership is a cause of crime." In most studies, it remains unclear if there are more homicides in areas with more guns, or people obtain guns for self-protection because they live in dangerous areas. As a result, several studies have either found no significant relationship between gun ownership and homicide (Magaddino & Medoff, 1984), a positive relationship where homicide rates impact gun ownership but not the reverse (Kleck, 1984; Kleck & Patterson, 1993), or even a negative association where more guns decrease crime rates (Bordua, 1986; Lott, 2000). In response to these criticisms, more recent studies have employed various measures of firearm availability and examined the effect of gun ownership on non-firearm homicides, with the findings remaining robust to these changes (Miller et al., 2007; Siegel et al., 2013). In sum, most violence scholars agree with Cook's (2013, pp. 49) summary of the literature: "More guns, more homicides."

While guns are often assumed to have a causal impact on the rate of mass shootings in the United States, thus far only a few studies have directly tested this assumption, with mixed results. Using a time series analysis on 344 mass shootings from 1998 to 2015, Reeping and colleagues (2019) found that a 10% increase in household gun ownership was associated with a 35% increase in the incidence rate of mass shootings at the state level. The study has been criticized, however, for relying on the FBI's Supplementary Homicide Reports (SHR) to measure annual state mass shooting counts. Prior research has consistently shown that the SHR: suffers from a high degree of missing data (e.g., the state of Florida); utilizes multiple records for incidents with more than 11 victims and/or offenders (thus artificially inflating counts); and creates false positives via reporting errors (e.g., four single-victim homicides reported as one quadruple homicide) (Loftin, McDowall, Curtis, & Fetzer, 2015; Rokaw, Mercy, & Smith, 1990; Wiersema, Loftin, & McDowall, 2000). To address some of these concerns, Webster et al. (2020) removed duplicate records and supplemented the SHR data with cases from the Gun Violence Archive and the Stanford Geospatial Center and Stanford Libraries, finding that gun ownership did not significantly influence the mass shooting incidence rate. Another analysis using data on mass shootings from Mother Jones

similarly failed to find a relationship between gun ownership and mass shooting rates (Lin et al., 2018).

Concealed carry legislation

The research regarding concealed carry legislation, firearms homicide, and mass shootings is even murkier than the literature on household gun ownership. The United States has three types of concealed carry laws. The most permissive type of legislation is permitless carry, where firearms owners do not need to apply for an additional permit to carry a concealed weapon. In contrast, "shall-issue" states require individuals to apply for a concealed carry permit, but law enforcement has minimal discretion in whether to deny an applicant, as long as they meet certain requirements. The more restrictive "may-issue" policy also requires an additional permit, but grants law enforcement broad discretion in approving or denying an application, even if all prerequisites are fulfilled; individuals may be required to provide a heightened showing or establish good cause as to why they need the permit, and may be denied without being given a reason why. Although historically, most states maintained restrictive no-issue or may-issue policies, the United States has experienced a dramatic shift towards more permissive concealed carry legislation over the past thirty years. In the early 1990s, for example, 35 states were may-issue, 14 were shall-issue, and only Vermont allowed permitless carry; in 2016, by contrast, only 9 states were may-issue, 29 were shall-issue, and 12 were permitless carry. On average, 7% of the population has a concealed carry permit, although this figure varies substantially by state (Lott, 2018).

Proponents of less restrictive right-to-carry laws argue that increased gun-carrying by the public serves as general deterrent to violent crime (Lott, 2000). Potential offenders may decide, for example, that the costs of crime outweigh the benefits if they fear being mortally wounded. Wright and Rossi (1991) found that 39% of convicted felons refrained from committing a crime because they knew or believed that their victim was armed. Even when an offender is not deterred from committing the crime entirely, armed bystanders may be able to disrupt the attack and mitigate its damage. The benefits of more permissive concealed carry legislation are hypothesized to be even greater for mass public shootings in comparison to other homicides, as the probability that at least one victim has a weapon increases dramatically with crowd size (Lott & Landes, 2000).

In contrast, some scholars posit that more permissive concealed carry legislation is an unlikely deterrent, and may actually increase homicide rates. Instead of refraining from crime entirely, offenders may simply choose a more vulnerable victim, thus resulting in a displacement rather than deterrent effect (Green, 1987; McDowall, Lizotte, & Wiersema, 1991). In the same vein, perpetrators often have very limited information about whether or not a potential victim is armed, and thus may not include this factor in his or her decision-making process. Similarly, criminals may dismiss armed resistance as a minimal risk, given the element of surprise and relatively low rate of gun-carrying among the general public (Duwe et al., 2002). Aside from failing to decrease the homicide rate, right-to-carry laws may inadvertently encourage lethal violence. For example, more permissive concealed carry laws may inadvertently

lead to an arms race between the public and criminals, as potential offenders increasingly carry weapons to protect themselves. Most incarcerated felons cite protection as the main reason they carried firearms, and 63% state that they fired their weapon during the commission of the crime in self-defense (Cook, Ludwig, & Samaha, 2009; McDowall, 1995; Wright & Rossi, 1991). Increased gun-carrying in public may also indirectly contribute to violent crime by facilitating gun trafficking and straining police resources. Carrying a concealed weapon outside the home increases the likelihood of loss or theft, firearms which may subsequently be funneled to criminals via the illegal gun market. Donohue and colleagues (2019) suggest that as many as 100,000 firearms in the United States are accidently furnished to criminals by legal concealed carry permit holders each year. In the same vein, permissive concealed carry laws may hamper crime control efforts by the police, who waste valuable time differentiating legal and illegal carriers and responding to gun-related accidents (Donohue, Aneja, & Weber, 2019).

Like the its theoretical underpinnings, the empirical literature examining the relationship between more permissive concealed carry legislation and crime has been decidedly mixed. In their widely-debated study, Lott and Mustard (1997) compared crime rates for U.S. counties from 1977 to 1992 using a fixed effects model and found a deterrent effect of shall-issue policies, arguing that up to 1,500 homicides could be prevented annually by adopting the less stringent law in may-issue states. This study sparked a flurry of replication studies, with some finding a decrease in homicides associated with more permissive concealed carry (Bronars & Lott, 1998; Gius, 2014; Lott, 2000; Lott & Whitley, 2001), an increase in homicides (Ludwig, 1998; McDowall, Loftin, & Wiersema, 1995; Rosengart et al., 2005), or no effect at all (Aneja, Donohue, & Zhang, 2011; Hepburn, Miller, Azrael, & Hemenway, 2004; Kovandzic & Marvell, 2003; Zimmerman, 2014). In response, the National Research Council reviewed the literature and determined that "estimated effects are highly sensitive to seemingly minor changes in the model specification and control variables ... Thus, the committee concludes that with the current evidence it is not possible to determine that there is a causal link between the passage of right-to-carry laws and crime rates" (Wellford, Pepper, & Petrie, 2005, p. 150). More recent research utilizing a longer time period, more control variables, and more advanced statistical methods, however, suggests that permissive concealed carry laws significantly increase the homicide rate (Crifasi et al., 2018; Donohue et al., 2017; Doucette, Crifasi, & Frattaroli, 2019; Siegel et al., 2017).

Despite the widespread belief that arming the public prevents mass shootings or helps to save lives, only three studies have considered the impact of permissive concealed carry legislation on these rare crimes. Lott and Landes (2000) used data from 23 states from 1977 to 1997 to evaluate the impact of right-to-carry laws on public shootings in which two or more victims were killed or wounded. Employing a series of Poisson regressions, the authors found that right-to-carry legislation significantly decreased the combined number of killed/wounded victims by 78% and the overall number of shooting incidents by 67%. Defining mass murder as the killing of four or more victims, Duwe et al. (2002) and Webster et al. (2020) replicated these analyses using different methodologies, yet found no evidence of a deterrent effect of right-to-carry legislation on either the number of incidents or victims. While all three studies represent important contributions to the literature, they suffer from several

methodological limitations. Although pioneering at the time, the work of Lott and Landes (2000) and Duwe et al. (2002) is over two decades old, uses small samples, and only considers public mass shootings (which represent approximately 20% of all incidents) (Fridel, 2017). Webster et al. (2020)'s work is similarly laudable for addressing these concerns, yet remains limited by its utilization of a notoriously unreliable dataset (the SHR) to measure the dependent variable.[1]

Current study

Despite the public's widespread interest in gun ownership and concealed carry legislation in the wake of each massacre, little research has focused on the relationship between these factors and the frequency of mass shootings in the United States. The few pioneering studies that do directly examine this issue, however, reach opposite conclusions and are limited by the lack of reliable data on these rare crimes. Most importantly, prior work has failed to ask a crucial question: Do levels of household gun ownership and concealed carry legislation impact mass shootings in the same way as they do firearms homicide more generally? Implementing policy to address rare events is myopic: arguably, the effects of gun policies on two dozen mass shootings are only relevant for lawmakers if they are representative of the other 12,000 firearms homicides committed in the United States each year.

Addressing these gaps in the literature, the present study builds upon previous work by: (1) addressing data quality concerns with a robust mass shooting dataset validated by both official and media records; and (2) contextualizing the gun control debate by comparing the impact of policies on both mass shootings and firearms homicide. Using data from the Centers for Disease Control and Prevention (CDC) Web-based Injury Statistics Query and Reporting System (WISQARS) and the expanded USA TODAY mass murder database, the current study employs two cross-sectional negative binomial regression models to examine the impact of household gun ownership and concealed carry legislation on the incidence of mass shootings and firearms homicide in the United States from 1991 to 2016.

Methods

Data and sample

This study utilized two separate cross-sectional panel models to predict counts of firearm homicides and mass shootings in the 50 U.S. states from 1991 to 2016 ($N = 1250$ state-years). Data on firearm homicides were derived from the Centers for Disease Control and Prevention (CDC) Web-based Injury Statistics Query and Reporting System (WISQARS). WISQARS represents an ideal homicide data source as it extracts

[1]Notably, Webster and colleagues did try to address the gaps in the SHR by appending cases in the Gun Violence Archive (GVA) and the Stanford Geospatial Center and Stanford Libraries. However, these data are equally problematic, as both sources use different definitions than the one employed in the study (four or more shot yet not necessarily killed for GVA, and three or more shot yet not necessarily killed for Stanford). Even further, GVA data was only available for a fraction of the time period (2014-2017), and the Stanford data only included public mass shootings.

information from standardized death certificates directly and has a 99% reporting rate across the U.S. (Centers for Disease Control & Prevention, 2019).

In comparison to homicide, there are no official data sources designed to count mass shootings. WISQARS, for example, does not link multiple victims killed in the same incident, while the FBI's SHR suffers from a high degree of missing data, multiple records for incidents with large victim counts, and reporting errors. Crowd-sourced databases are equally problematic as they often focus exclusively on public mass shootings, lack a consistent definition, and are of questionable validity (Fridel, 2017). In order to address these challenges, a unique dataset of all mass murders in the United States from 1991 to 2016 was created. First, a master list compiled all cases included by the SHR, the Congressional Research Service (Krouse & Richardson, 2015), USA TODAY (Overberg et al., 2016), Gun Violence Archive (GVA), Stanford Geospatial Center and Stanford Libraries, Mother Jones, Everytown for Gun Safety, and the New York City Police Department report on active shooters (Kelly, 2010). Media accounts, court documents, academic journal articles, and available law enforcement records (provided by USA TODAY's Freedom of Information Act requests) were then utilized to validate each incident. Additional media searches were also conducted using Newspapers.com and LexisNexis to identify missing cases not included in any of the other datasets. To date, this represents the most comprehensive and accurate database available on mass shooting incidents in the United States, with a total sample size of 592 mass shootings during the study period. The SHR, for example, missed 157 validated incidents (after excluding the state of Florida and removing duplicate records) and included an additional 135 erroneous cases that could not be corroborated by other sources.

Annual state-level data on key independent and control variables were appended from multiple sources (detailed in Table 1), including the: U.S. Census Bureau Current Population Survey; U.S. Bureau of Labor Statistics; National Vital Statistics System; CDC's WISQARS and Wide-ranging Online Data for Epidemiological Research (WONDER); National Institute of Alcoholism and Alcohol Abuse; U.S. Fish and Wildlife Service; FBI's Uniform Crime Reports (UCR); U.S. Bureau of Justice Statistics, National Prisoner Statistics Data; and Henry J. Kaiser Family Foundation State Mental Health Agency (SMHA). Information on firearms legislation over time was provided by the State Firearms Laws Database, which used *Thomson Reuters Westlaw* to track the presence or absence of more than 100 firearms provisions by state since 1991 (Siegel et al., 2017).

Measures

Study variables are described briefly in this section, while a more description of all measures is provided in Table 1, including the definition, data source, and extent of missing information for each variable. Table 2 shows descriptive statistics for all variables for may-issue states, shall-issue/permitless carry states, and the sample in totality.

Outcome and key independent variables

The current study examined two dependent variables, including annual state counts of firearms homicide victims and mass shooting incidents. The CDC defines firearms homicide as injuries inflicted by another person with intent to injure or kill with a

Table 1. Data source for all study variables.

Variable	*Definition*	*Data Source*	*Notes*
Firearm homicides	Count of victims	CDC WISQARS	Complete panel series
Mass shootings	Count of incidents with four or more persons shot to death within 24 hours, not including the perpetrator(s) and unborn children	Expanded USA TODAY Mass Murder Database	Complete panel series
Gun ownership	Proportion of suicides committed with a gun (ICD codes X72, X73, and X74)	CDC WISQARS and CDC WONDER	Complete panel series; data from 1991-1998 is derived from WISQARS while data from 1999-2016 is derived from WONDER
Concealed carry legislation	1 = Shall issue or permitless carry; 0 = May issue (lagged by one year)	State Firearms Laws Database	Complete panel series
Mental health expenditures	Expenditures per capita reported in actual dollars	The Henry J. Kaiser Family Foundation State Mental Health Agency (SMHA)	Data imputed for 1991-1992, 1994-1996, 1998-2000, and 2016 for all states; Arkansas (2011); Florida (2013); Hawaii (2007); and New Mexico (2013)
Divorce rate	Number of divorces and annulments by state of occurrence per 1,000 population	CDC/NCHS, National Vital Statistics System	Data imputed for California, Colorado (1995-1998); Connecticut (1991); Georgia (2004-2016); Hawaii (2003-2016); Illinois (1991); Indiana; Louisiana (1991-2001, 2004-2012); Maine (1996); Minnesota (2005-2016); Nevada (1991-1993); New Jersey (1991); New Mexico (2016); Oklahoma (1999-2003); and Texas (1996-1997)
Unemployment	Percentage of persons aged 16 and older in the civilian labor force who do not have a job, are currently available for work, and have actively looked for work in the prior four weeks, or if they are waiting to be recalled to a job from which they have been laid off	U.S. Bureau of Labor Statistics, Local Area Unemployment Statistics and Current Population Survey	Complete panel series
Advantage index	Weighted principal components factor regression score of median household income, education, and poverty. Factor loadings were all above ± 0.70 with a first eigenvalue score of 2.144.	U.S. Census Bureau, Current Population Survey, Annual Social and Economic Supplements (Median household income); U.S. Census Bureau, Educational attainment reports and tables from previous years (Education); and U.S Census Bureau, Historical Poverty Tables (Poverty)	Education data interpolated for 1992
Percent male	Percentage of the population that is male	CDC WONDER Bridged Race Population Estimates	Complete panel series

(*continued*)

Table 1. (*Continued*)

Variable	*Definition*	*Data Source*	*Notes*
Percent aged 18-24	Percentage of the population aged 18 to 24	CDC WONDER Bridged Race Population Estimates	Complete panel series
Alcohol consumption	Per capita alcohol consumption among persons aged 14 years and older	National Institute of Alcoholism and Alcohol Abuse	Data imputed for Georgia (2000)
Hunting	Number of paid hunting licenses per 100 persons aged 15 or older	US Fish and Wildlife Service. Historical hunting license data.	Complete panel series
Property crime rate	Number of burglaries, larcenies, and motor vehicle thefts per 100,000 population	FBI, Uniform Crime Reports (UCR)	Complete panel series
Violent crime rate	Number of rapes, assaults, and robberies per 100,000 population	FBI, Uniform Crime Reports (UCR)	Complete panel series
Incarceration rate	Number of sentenced prisoners with a sentence of at least one year per 10,000 population	BJS, National Prisoner Statistics data series	Complete panel series
Non-firearm homicide rate	Number of homicide victims killed with a weapon other than a firearm per 100,000 population	CDC WISQARS	Complete panel series
Ethnic heterogeneity	Blau's (1977) index by summing the squared proportion of the population in each racial/ethnic group and then subtracting this summation from 1. The equation for this measure is as follows: $1 - \Sigma pi^2$, where pi is the proportion of the population in each racial/ethnic group (White, Black, Hispanic, Asian, and American Indian).	CDC WONDER Bridged Race Population Estimates	Complete panel series
Region	South, West, Northeast, or Midwest, as defined by the U.S. Census	U.S. Census Bureau	Complete panel series

firearm, excluding injuries due to legal intervention, operations of war, and justifiable homicides. As WISQARS does not provide linkage information, firearms homicide was measured as a count of victims rather than incidents. However, given that nearly 90% of homicides are single-victim incidents (Federal Bureau of Investigation, 2017), this limitation is not too serious. Consistent with prior work (Fridel, 2017; Ressler, Burgess, & Douglas, 1988), mass shootings are defined as the intentional killing of four or more persons (excluding the offender and unborn children) with a firearm within a 24-hour period. Less than 10% (N = 62) of incidents involved other weapons in addition to a firearm.

Household gun ownership and concealed carry legislation represented the two primary independent variables of interest in this study. Household gun ownership was measured using a common proxy, the proportion of suicides committed with a firearm. This measure has been extensively validated in the prior literature, correlates highly with state-specific survey measures, and has been demonstrated as the best

Table 2. Descriptive statistics for may-issue states, shall-issue/permitless carry states, and all U.S. States, 1992-2016.

	May-Issue States			Shall-Issue/Permitless Carry States			All States		
	N = 445 State-Years			N = 805 State-Years			N = 1250 State-Years		
Predictors	*Mean*	*SD*	*[Range]*	*Mean*	*SD*	*[Range]*	*Mean*	*SD*	*[Range]*
Firearm homicides	334.50	470.22	[3.00–3183.00]	209.21	233.45	[0.00–1222.00]	257.45	353.24	[0.00–3183.00]
Mass shootings	0.49	0.94	[0.00–6.00]	0.40	0.74	[0.00–6.00]	0.44	0.84	[0.00–6.00]
Gun ownership	47.36	16.22	[14.29–78.52]	59.08	8.07	[35.81–81.04]	55.15	12.99	[14.29–84.00]
Advantage	0.19	1.07	[-2.64–2.90]	−0.05	0.93	[-2.82–3.12]	0.00	1.00	[-2.82–3.12]
Unemployment	5.60	1.80	[2.40–12.20]	5.61	1.90	[2.30–13.70]	5.64	1.86	[2.30–13.70]
Ethnic heterogeneity	0.41	0.14	[0.13–0.67]	0.34	0.16	[0.04–0.64]	0.36	0.16	[0.04–0.67]
Divorce rate	3.71	1.30	[1.21–9.17]	4.16	1.08	[1.21–10.40]	4.04	1.20	[1.21–10.40]
Property crime rate	3693.61	1064.95	[1544.60–7221.40]	3315.28	1003.29	[1406.60–7500.10]	3498.26	1069.05	[1406.60–7500.10]
Violent crime rate	496.75	211.54	[207.03–1108.86]	384.30	190.81	[65.33–1198.24]	429.19	210.69	[64.25–1198.24]
Incarceration rate	33.85	11.80	[8.50–67.39]	39.11	15.83	[6.71–88.56]	36.80	14.76	[6.71–88.56]
Non-firearm homicide rate	2.09	1.07	[0.64–11.71]	1.84	0.81	[0.00–5.95]	1.97	0.96	[0.00–11.71]
Mental health expenditures	90.72	57.51	[12.76–269.60]	92.55	68.50	[12.76–410.35]	90.79	64.62	[12.76–410.35]
Alcohol consumption	2.31	0.39	[1.21–4.25]	2.35	0.54	[1.20–4.76]	2.34	0.49	[1.20–4.76]
Hunting licenses	6.27	5.90	[0.63–46.09]	12.79	9.04	[1.04–43.25]	10.54	8.68	[0.63–46.09]
Percent male	48.93	0.74	[47.98–52.64]	49.41	0.77	[47.91–52.37]	49.23	0.80	[47.88–52.64]
Percent aged 18-24	9.76	0.72	[7.92–12.81]	9.98	0.86	[8.08–14.39]	9.92	0.82	[7.92–14.289]
Region									
South	24.72%			36.02%			32.00%		
Northeast	28.09%			12.42%			18.00%		
West	20.00%			29.32%			26.00%		
Midwest	27.19%			22.24%			24.00%		

available proxy (Azrael, Cook, & Miller, 2004; Cook & Ludwig, 2006; Kleck, 2004; Siegel et al., 2013). Consistent with prior research, concealed carry legislation was operationalized as a binary measure, with shall-issue and permitless carry states coded as 1 and may-issue states coded as 0 (Siegel et al., 2017). Laws were lagged by one year to ensure that they were in effect when the homicide incidents occurred (Lott & Mustard, 1997; Siegel et al., 2017).

Control variables

The analysis also controlled for a variety of predictors that previous work has shown to be significantly related to homicide rates, including: socioeconomic advantage, racial/ethnic heterogeneity, unemployment rate, divorce rate, property crime rate, violent crime rate (excluding homicide), incarceration rate, non-firearm homicide rate, mental health expenditures per capita, alcohol consumption per capita, number of hunting licenses per capita, percent male, percent aged 18 to 29, and census region. Missing data on mental health expenditures per capita, alcohol consumption per capita, and the divorce rate were imputed in *STATA 15* with chained equations (N = 10 imputations).

Analytical strategy

This analysis used a cross-sectional panel design to examine the impact of changing firearms legislation and ownership over time on both firearms homicide and mass shootings. Due to the rarity of mass shooting incidents, both outcomes were measured as counts, as often recommended for studying crimes with low base rates (Hepburn et al., 2004; Plassmann & Tideman, 2001; Siegel et al., 2017). Overdispersed data required the use of negative binomial regression models for both firearms homicide and mass shootings. The total population of the state was included as an exposure variable for both models.

The model also accounted for clustering by year and by state. Year fixed effects (in the form of a dummy variable for each cross section from 1991 to 2016 minus one) were included to purge the model of cross-sectional bias. Following prior work (Miller et al., 2002; Siegel et al., 2017), generalized estimating equations (GEE) was utilized to control for clustering within states over time. GEE is a semiparametric, population-averaged or marginal approach that treats dependence as a nuisance feature of the data (Liang & Zeger, 1986). As GEE requires no assumptions about the distribution, it is robust to misspecification of the working correlation matrix, reducing the potential for omitted variable bias. Considering that sensitivity to model misspecification was one of the National Research Council's major criticisms of the concealed carry literature, GEE is well-suited for this study. An exchangeable (compound symmetry) working correlation matrix and robust (Huber-White sandwich estimators) standard errors were used to produce consistent point estimates and standard errors even if the working correlation matrix is misspecified (Liang & Zeger, 1986).

Given the large number of related predictor variables, several tests for potential multicollinearity were conducted. First, all variance inflation factors (VIF) were under 4, well below the traditional threshold of 10, as well as the more rigorous cutoff of 5

(Menard, 1995; O'Brien, 2007). Second, a series of regression models for both homicide and mass murder counts were estimated without potentially collinear predictors. The results remained largely unchanged when: (1) the unemployment and divorce rates were included in the advantage index; (2) the hunting licenses per capita variable was eliminated from the model; (3) the property crime rate and the non-gun homicide rate were excluded; (4) the violent crime rate and the non-gun homicide rate were excluded; and (5) the unemployment and divorce rate variables were incorporated in the advantage index, and the hunting licenses per capita, property crime rate, and non-gun crime rate were excluded from the model. Taken together, the consistency in results across models as well as the relatively low VIF values suggest that multicollinearity is not too serious a concern.

Results

Table 3 presents the results of the population-averaged negative binomial regressions of gun ownership and concealed carry legislation on firearms homicide and mass shootings. Standardized regression coefficients in the form of incidence rate ratios (IRR) and 95% confidence intervals are presented to facilitate interpretation. IRRs indicate the percentage increase or decrease in the outcome incidence rate for every one standard deviation increase in the predictor [(IRR $-$ 1) $\times$ 100%].

Consistent with prior research, firearms homicide was more likely to occur in areas with more permissive concealed carry laws, higher levels of racial/ethnic heterogeneity, higher property crime rates, and in Southern states (relative to states in the Northeast and West). Specifically, the firearms homicide incidence rate increased by

Table 3. Population-averaged negative binomial regression of concealed carry legislation on firearms homicide and mass shootings: United States, 1991-2016.

	Firearms Homicide		Mass Shootings	
(Standardized) Predictor	*IRR*	*95% CI*	*IRR*	*95% CI*
Gun ownership	1.046	[0.978, 1.119]	1.525***	[1.199, 1.940]
Shall-issue or permitless carry	1.108**	[1.026, 1.196]	0.881	[0.696, 1.115]
Advantage	0.988	[0.925, 1.055]	0.933	[0.769, 1.133]
Unemployment	1.010	[0.974, 1.048]	0.987	[0.820, 1.187]
Ethnic heterogeneity	1.290***	[1.133, 1.469]	1.021	[0.780, 1.336]
Divorce rate	0.976	[0.923, 1.032]	0.948	[0.854, 1.053]
Property crime rate	1.174***	[1.104, 1.248]	1.148	[0.937, 1.408]
Other violent crime rate	1.037	[0.954, 1.128]	0.987	[0.847, 1.150]
Incarceration rate	0.976	[0.895, 1.065]	1.053	[0.901, 1.230]
Non-firearm homicide rate	1.014	[0.993, 1.035]	1.017	[0.881, 1.173]
Mental health expenditures	1.003	[0.958, 1.051]	0.949	[0.811, 1.112]
Alcohol consumption	1.052	[0.928, 1.192]	0.977	[0.849, 1.123]
Hunting licenses	0.987	[0.906, 1.075]	0.842	[0.673, 1.054]
Percent male	1.043	[0.915, 1.189]	1.131	[0.858, 1.491]
Percent aged 18-24	1.012	[0.981, 1.044]	0.946	[0.797, 1.124]
Region (reference = South)				
Northeast	0.553*	[0.332, 0.922]	1.417	[0.808, 2.484]
West	0.448***	[0.315, 0.637]	1.183	[0.737, 1.898]
Midwest	0.731	[0.491, 1.088]	1.441	[0.922, 2.250]

ABBREVIATIONS: IRR = incidence rate ratio; CI = confidence interval. .
The results for year fixed effects (not shown) are available upon request.
* $p < 0.05$ ** $p < 0.01$ ***$p < 0.001$.

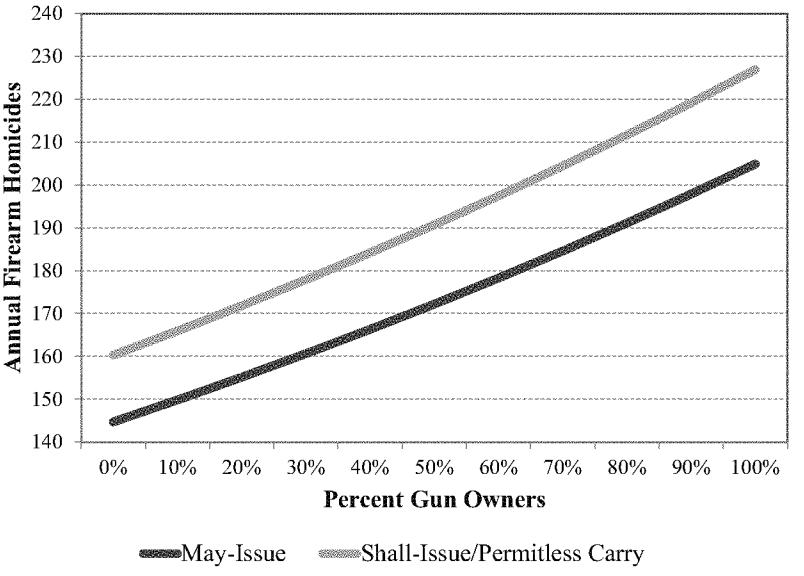

Figure 1. Predicted Annual Firearms Homicide Counts in May-Issue and Shall-Issue/Permitless Carry States by Household Gun Ownership: 50 U.S. States, 1991–2016.

10.8% (CI = 1.026–1.196) in shall-issue or permitless carry states in comparison to their may-issue counterparts; this point estimate is within the 95% confidence interval presented by Siegel et al. (2017), and thus confirmed their findings. In addition, for every one standard deviation increase in racial/ethnic heterogeneity and the property crime rate, the firearms homicide incidence rate respectively increased by 29.0% and 17.4%. Consistent with the Southern culture of violence hypothesis (Cohen & Nisbett, 1994; Nisbett & Cohen, 1996), firearms homicide rates were 44.7% lower in the Northeast and 55.2% lower in the West in comparison to the South.

Figure 1 contextualizes the impact of more permissive concealed carry legislation by presenting predicted annual firearm homicide counts for shall-issue/permitless carry and may-issue states across levels of household gun ownership. An average state in an average year experienced an additional 16 to 22 firearms homicides annually in states with more permissive concealed carry laws, an effect that is relatively consistent across all levels of gun ownership (tests for an interaction between gun ownership and concealed carry legislation were not significant; results available upon request). It is interesting to note that although gun ownership was not a significant predictor of firearms homicide in the full model (IRR = 1.046, CI = 0.978–1.119), it was positively associated with firearms homicide in models (not shown) excluding concealed carry legislation (IRR = 1.063, CI = 1.002–1.128). This suggests that the concealed carry legislation variable may suppress the effects of gun ownership frequently found in previous work (results available upon request) (Siegel et al., 2013).

In comparison to firearms homicide, only one state-level correlate significantly predicted mass shootings: gun ownership. Specifically, every one standard deviation increase in gun ownership increased the incidence rate of mass shootings by 53.5% (CI = 1.199–1.940). Contrary to the common "good guy with a gun" argument, mass

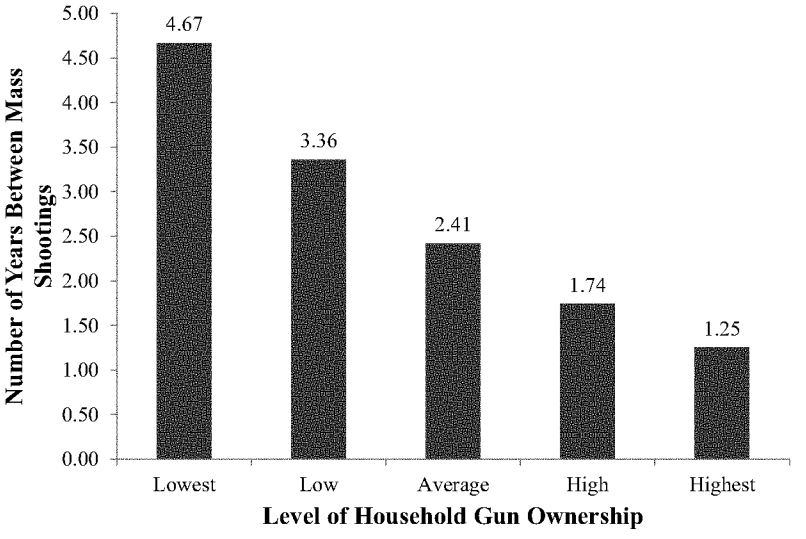

Figure 2. Predicted Number of Years Between Mass Shootings By Levels of Household Gun Ownership, 50 U.S. States, 1991–2016.
Note: An average level of household gun ownership is zero standard deviations from the mean; lowest and highest levels are 2 standard deviations below and above the mean, respectively; and low and high levels are 1 standard deviation below and above the mean, respectively.

shootings were no more or less likely to occur in areas with more permissive concealed carry laws (IRR = 0.881, CI = 0.696–1.115).

To illustrate this finding, Figure 2 presents the predicted number of years between mass shootings for states with different levels of household gun ownership (calculated as one divided by the predicted annual number of incidents). States with average levels of gun ownership experienced a mass shooting every 2.41 years; states with the highest levels of gun ownership experienced a mass shooting nearly twice as frequently—every 1.25 years; and states with the lowest levels of gun ownership experienced a mass shooting almost two times less often—every 4.66 years.[2]

Sensitivity analyses

Various sensitivity analyses were conducted to ensure the validity of the results. Findings remained substantively unchanged when: (1) fixed effects for state were employed instead of GEE; (2) outcome variables were modeled as rates per 100,000 population; (3) mass murders were measured as number of victims instead of incidents; (4) all independent variables were lagged by one year; (5) additional control variables were added, including the lagged firearm homicide rate, a binary measure of the assault weapons ban (1994-2004), and other "common sense" gun laws often proposed in the wake of mass shootings (i.e., universal background checks, universal permiting, mandatory waiting periods, prohibitions for violent misdemeanors and domestic violence restraining orders, high capacity magazine bans, and the total

[2]The predicted annual counts of mass shootings were 0.21, 0.30, 0.41, 0.58, and 0.80 for states with the lowest, low, average, high, and highest levels of gun ownership, respectively.

number of firearms laws). Models using non-firearm homicides and mass murders as the outcome found no significant findings in terms of firearm variables, lending credence to the results.

Discussion

Using a novel dataset, this study represents the first to compare the impact of household gun ownership and concealed carry legislation on both firearm homicides and mass shootings. More permissive concealed carry legislation was associated with a 10.8% increase in the firearms homicide incidence rate, yet had no significant effect on mass shootings. Similarly, household gun ownership was associated with a 53.5% increase in the mass shooting incidence rate, yet has a minimal impact on firearm homicides when accounting for concealed carry legislation.

These findings are not without certain empirical limitations. The low base rate of mass shootings: (1) required a count model approach instead of the typical modeling of homicide rates; (2) reduced variation in the outcome, as over 70% of state-years experienced no incidents; and (3) prevented the examination of specific types of incidents (e.g., public mass shootings) most likely to be impacted by concealed carry legislation. Additionally, using the semi-parametric approach of GEE lowers the model power which, in combination with the reduced variation in the number of mass shootings, indicates that these results are relatively conservative. Due to the small number of permitless carry states, particularly in earlier years, it was not possible to examine differences between shall-issue and permitless carry policies (Siegel et al., 2017).

Finally, although the percentage of suicides committed with a firearm has been vigorously validated as a proxy, this measure does not distinguish between legal and illegal gun ownership, which may have disparate effects on violent crime (Stolzenberg & D'Alessio, 2000; Dierenfeldt, Brown, & Roles, 2017). The empirical literature remains divided as to the relationship between homicide and gun ownership, with scholars finding a positive effect of both legal (Semenza, Stansfield, & Link, 2020; Steidley, Ramey, & Shrider, 2017) and illegal gun availability (Stolzenberg & D'Alessio, 2000; Dierenfeldt et al., 2017) on violent crime rates. As Kleck (1997, p. 215) summarizes, "it is possible that gun possession among prospective aggressors [illegal ownership] increases lethal violence, while gun possession among prospective victims [legal ownership] reduces it, with no net effect of overall gun ownership levels on violence rates." In this way, the inability to separate legal and illegal gun ownership may partially explain why gun ownership was not a significant predictor of firearms homicide, despite widespread support for this relationship in the literature. Future research should attempt to disentangle the effects of legal and illegal gun ownership on firearms homicide and mass shootings, though the lack of sufficient data on illegal gun ownership represents a challenge in this regard (Azrael, Hepburn, Hemenway, & Miller, 2017).

Despite these limitations, this study has important implications for both research and policy. First, consistent with some prior work (Reeping et al., 2019), household gun ownership is strongly associated with mass shootings at the state level. Equally important to note is that other factors often cited in the wake of mass shootings, such

as access to mental healthcare, do not significantly influence the rate of these crimes. The fact that gun ownership was the only significant macro-level predictor of mass shootings provides evidence that guns represent a fruitful target for intervention currently validated by research. There are several explanations for the strong relationship between levels of gun ownership and mass shooting rates. Guns are incontrovertibly quicker and more lethal than most other personal weapons, and therefore increase the likelihood of multiple deaths during an assault (Zimring, 1968, 1972, 1991). Firearms are also psychologically associated with power and aggression, and thus their presence in an argument can trigger aggressive behavior due to this learned association (Anderson et al., 1998; Bartholow et al., 2005; Berkowitz & Lepage, 1967; Bettencourt & Kernahan, 1997; Killias & Haas, 2002). Considering that two-thirds of mass shootings occur in private residences (Fridel, 2016), easy access to firearms during domestic disputes may facilitate impulsive or unplanned family massacres. Indeed, prior research has shown that the risk of dying from homicide or suicide in the home is dramatically increased in households with firearms, regardless of gun storage and safety practices (Cummings et al., 1997; Dahlberg, Ikeda, & Kresnow, 2004). High levels of community gun ownership may also facilitate mass shootings outside the home. Approximately three-quarters of school shootings, for example, involve guns stolen from the home or from another relative (National Threat Assessment Center, 2019). Easy access to weapons stored in cars may similarly provide opportunities for impulsive workplace massacres, like the 2003 shooting at the Lockheed Martin plant in Meridian, Mississippi. The greater prevalence of firearms may also indirectly facilitate felony-related mass shootings linked to robberies, gang warfare, and drug trafficking, which often involve illegally obtained weapons. Criminals otherwise prohibited from purchasing firearms are more easily able to steal or obtain guns in communities with many gun owners (Duggan, 2001). Areas in which guns are prevalent also tend to have a robust secondhand market and host gun shows, both of which are much less regulated than federally licensed dealers.

Second, there is no evidence that permissive concealed carry laws prevent mass shootings or mitigate their damage. The lack of a deterrent effect is hardly surprising, considering that the vast majority of armed victims fail to defend themselves or threaten their attacker during other, more common crimes (Planty & Truman, 2013). One study examining homicides in Sweden over a twenty-year period found that only 0.2% were committed by legal gun owners in self-defense (Killias & Markwalder, 2012). In addition, over 60% of mass murders are family killings, and so the majority of victims in these cases trust and are not threatened by their attacker (Fridel, 2017). Even so, mass shooters who act in public spaces often extensively plan their attacks, precluding the impulsive use of a concealed weapon during an argument. Furthermore, over one-third commit suicide or suicide-by-cop during the assault, indicating that the "good guy with a gun" is unlikely an effective deterrent, and may even be appealing for those who want to engage in a firefight (Fridel, 2017). Anecdotal evidence similarly suggests that armed citizens rarely stop or prevent mass shootings, as only one active shooter incident in the United States from 2000 to 2013 was resolved by an armed private citizen (excluding security guards and off-duty law enforcement officers), who was notably an active-duty marine; in contrast, 21 incidents were stopped by unarmed

citizens without such training during the same time period (Blair & Schweit, 2014). Given that nearly half of incidents in which law enforcement officers confronted active shooters resulted in police casualties, the "good guy with a gun" is more likely to be wounded himself or accidentally kill an innocent bystander than successfully stop a mass shooting (Donohue et al., 2017).

Although permissive concealed carry laws do not impact mass shootings, they significantly increase the firearms homicide rate. Even assuming permit holders are generally law-abiding citizens (Lott, 2018), increased gun-carrying in public may indirectly contribute to violence through several distinct pathways. Some scholars have suggested that offenders may use guns more often in states with permissive concealed carry laws in order to protect themselves against potentially armed victims. For example, Cook and colleagues (2009) found that two-thirds of prisoners incarcerated for gun offenses considered the armed status of potential victims as very or somewhat important in their choice to use a gun themselves. Increased gun-carrying in public also elevates the likelihood of loss or theft, in turn contributing to trafficking and the illegal gun market. Approximately 1% of individuals who carry firearms outside the home have their weapons stolen (Hemenway et al., 2017), leading to an estimated 100,000 guns being funneled from concealed carry permit holders to criminals each year in the United States (Donohue et al., 2017). Finally, permissive concealed carry laws may increase crime by wasting valuable police time and resources as they differentiate illegal and legal carriers and respond to gun-related accidents; the size of police forces in permissive states has increased significantly in comparison to their more restrictive counterparts, potentially due to the increased demands on law enforcement (Donohue et al., 2017).

Regardless of the precise mechanism underlying its association with increased firearm homicide rates, the national trend towards more permissive concealed carry is deeply troubling. Since 2007, the number of concealed handgun permits has skyrocketed by 273%, a figure that does not even count those with concealed firearms in permitless carry states (Lott, 2018). The public health implications are clear: permissive concealed carry legislation is a significant contributor to the gun violence epidemic in the United States.

Perhaps the most important finding of this study, however, is that gun ownership and legislation do not impact mass shootings and firearms homicides in the same way. As a result, policymakers likely need to enact distinct prevention initiatives in order to address different types of gun violence. The results of the current study, for example, indicate that reducing gun ownership (potentially through universal background checks and permit requirements) benefits mass shooting prevention efforts, while reinstating more restrictive concealed carry legislation decreases the overall firearms homicide rate. The fact that neither intervention appears to have a deleterious effect on the other crime (e.g., higher levels of gun ownership do not reduce the firearms homicide rate, and more permissive concealed carry legislation is not associated with a reduction in mass shootings) suggests that a two-pronged approach would be most beneficial in combating both mass shootings and firearms homicide. Considering that other policies not considered here may prevent one type of gun violence while promoting another, it is imperative that legislators recognize the distinct correlates of

mass shootings and firearms homicide and consider potential collateral consequences before enacting an intervention.

Conclusion

In viewing mass shootings as the epitome of gun violence in the United States, policymakers on both sides of the gun control debate fundamentally assume that mass shootings are representative of firearms homicide more generally, and therefore that strategies to prevent mass shootings will also reduce gun violence overall. The present study examines two such interventions—levels of household gun ownership and permissive concealed carry legislation—and finds evidence that mass shootings are poor proxies of gun violence more generally. It is imperative that policymakers enact legislation that will help reduce the thousands of firearms homicides occurring in the United States each year, rather than focusing on the rare mass shooting, however tragic such incidents may be. It is essential that lawmakers and researchers alike properly contextualize mass shootings as a small part of the gun violence epidemic, or else risk missing the forest for the trees.

Acknowledgements

The author would like to thank James Alan Fox, Gregory M. Zimmerman, and Anthony A. Braga for their comments on earlier drafts of this manuscript.

Disclosure statement

No potential conflict of interest was reported by the author.

Notes on contributor

Emma E. Fridel is an assistant professor in the College of Criminology and Criminal Justice at Florida State University. She primarily studies violence and aggression with a focus on homicide, including homicide–suicide, serial and mass murder, and legal intervention homicides. Her work has recently been published in *Criminology*, *Social Forces*, the *Journal of Quantitative Criminology*, and *Justice Quarterly*.

ORCID

Emma E. Fridel https://orcid.org/0000-0001-9346-2156

References

American Psychological Association. (2019). One-third of US adults say fear of mass shootings prevents them from going to certain places or events. https://www.apa.org/news/press/releases/2019/08/fear-mass-shooting

Anderson, C. A., Benjamin, A. J., & Bartholow, B. D. (1998). Does the gun pull the trigger? Automatic priming effects of weapon pictures and weapon names. *Psychological Science*, *9*(4), 308–314. doi:10.1111/1467-9280.00061

Aneja, A., Donohue, J. J., & Zhang, A. (2011). The impact of right-to-carry laws and the NRC report: Lessons for the empirical evaluation of law and policy. *American Law and Economics Review*, *13*(2), 565–632. doi:10.1093/aler/ahr009

Azrael, D., Cook, P. J., & Miller, M. (2004). State and local prevalence of firearms ownership: Measurement, struture, and trends. *Journal of Quantitative Criminology*, *20*(1), 43–62. doi:10.1023/B:JOQC.0000016699.11995.c7

Azrael, D., Hepburn, L., Hemenway, D., & Miller, M. (2017). The stock and flow of U.S. firearms: Results from the 2015 National Firearms Survey. *The Russell Sage Foundation Journal of the Social Sciences*, *3*(5), 38–57.

Bailey, J. E., Kellerman, A. L., Somes, G., Banton, J. G., Rivara, F., & Rushforth, N. B. (1997). Risk factors for violent death of women in the home. *Archives of Internal Medicine*, *157*(7), 777–782. doi:10.1001/archinte.157.7.777

Bartholow, B. D., Sestir, M. A., & Davis, E. B. (2005). Correlates and consequences of exposure to video game violence: Hostile personality, empathy, and aggressive behavior. *Personality & Social Psychology Bulletin*, *31*(11), 1573–1586. doi:10.1177/0146167205277205

Berkowitz, L., & Lepage, A. (1967). Weapons as aggressive-eliciting stimuli. *Journal of Personality and Social Psychology*, *7*(2, Pt.1), 202–207. doi:10.1037/h0025008

Bettencourt, B. A., & Kernahan, C. (1997). A meta-analysis of aggression in the presence of violent cues: Effects of gender differences and aversive provocation. *Aggressive Behavior*, *23*(6), 447–456. doi:10.1002/(SICI)1098-2337(1997)23:6<447::AID-AB4>3.0.CO;2-D

Blair, J. P., & Schweit, K. W. (2014). *A study of active shooter incidents, 2000-2013*. Washington, DC: Texas State University and the Federal Bureau of Investigation, U.S. Department of Justice.

Bordua, D. J. (1986). Firearms ownership and violent crime. In J. M. Byrne & R. J. Sampson (Eds.), *The social ecology of crime (pp. 156–188)*. New York, NY: Springer-Verlag.

Brenan, M. (2019). *Nearly half in U.S. fear being the victim of a mass shooting*. Retrieved from https://news.gallup.com/poll/266681/nearly-half-fear-victim-mass-shooting.aspx

Bronars, S., & Lott, J. R. (1998). Criminal deterrence, geographic spillovers, and the right to carry concealed handguns. *The American Economic Review*, *88*, 475–479.

Centers for Disease Control and Prevention. (2019). Web-based injury statistics query and reporting systems: Fatal injury data. https://www.cdc.gov/injury/wisqars/fatal.html

Cohen, D., & Nisbett, R. E. (1994). Self-protection and the culture of honor: Explaining southern homicide. *Personality and Social Psychology Bulletin*, *20*(5), 551–567. doi:10.1177/0146167294205012

Cook, P. J. (2013). The great American gun war: Notes from four decades in the trenches. *Crime and Justice*, *42*(1), 19–73. doi:10.1086/670397

Cook, P. J., & Ludwig, J. (2006). The social costs of gun ownership. *Journal of Public Economics*, *90*(1-2), 379–391. doi:10.1016/j.jpubeco.2005.02.003

Cook, P. J., Ludwig, J., & Samaha, A. M. (2009). Gun control after Heller: Threats and sideshows from a social welfare perspective. *UCLA Law Review*, *56*(5), 1041–1093.

Cook, P. J., Moore, M. H., & Braga, A. A. (2011). Gun control. In J. Q. Wilson & J. Petersilia (Eds.), *Crime and public policy (pp. 257–292)*. New York, NY: Oxford University Press.

Crifasi, C., Merrill-Francis, M., McCourt, A., Vernick, J., Wintemute, G., & Wesbter, D. (2018). Association between firearm laws and homicide in urban counties. *Journal of Urban Health : Health*, *95*(3), 383–390. doi:10.1007/s11524-018-0273-3

Cummings, P., Koepsell, T. D., Grossman, D. C., Savarino, J., & Thompson, R. S. (1997). The association between the purchase of a handgun and homicide or suicide. *American Journal of Public Health*, *87*(6), 974–978. doi:10.2105/ajph.87.6.974

Dahlberg, L. L., Ikeda, R. M., & Kresnow, M-J. (2004). Guns in the home and risk of a violent death in the home: Findings from a national study. *American Journal of Epidemiology*, *160*(10), 929–936. doi:10.1093/aje/kwh309

Dierenfeldt, R., Brown, T. C., & Roles, R. A. (2017). Re-considering the structural covariates of gun crime: An examination of direct and moderated effects. *Deviant Behavior*, *38*(2), 208–225. doi: 10.1080/01639625.2016.1196974

Donohue, J. J., Aneja, A., & Weber, K. D. (2019). *Right-to-carry laws and violent crime: A comprehensive assessment using panel data and a state-level synthetic control analysis.*

Doucette, M. L., Crifasi, C. K., & Frattaroli, S. (2019). Right-to-carry laws and firearm workplace homicides: A longitudinal analysis (1992-2017). *American Journal of Public Health*, *109*(12), 1747–1753. doi:10.2105/AJPH.2019.305307

Duggan, M. (2001). More guns, more crime. *Journal of Political Economy*, *109*(5), 1086–1114. doi: 10.1086/322833

Duwe, G., Kovandzic, T., & Moody, C. E. (2002). The impact of right-to-carry concealed firearm laws on mass public shootings. *Homicide Studies*, *6*(4), 271–296. doi:10.1177/108876702237341

Federal Bureau of Investigation. (2017). Crime in the United States: Expanded homicide data table 4. https://ucr.fbi.gov/crime-in-the-u.s/2017/crime-in-the-u.s.-2017/tables/expanded-homicide-data-table-4.xls

Fisher, J. C. (1976). Homicide in Detroit: The role of firearms. *Criminology*, *14*(3), 387–400. doi:10.1111/j.1745-9125.1976.tb00030.x

Fridel, E. E. (2016). Mass murder in the United States: 2006-2016. In P. Overberg, M. Hoyer, M. Hannan, J. Upton, B. Hansen, & E. Durkin (Eds.), *USA TODAY: Explore the data on U.S. mass killings since 2006*. Northeastern University. Retrieved from http://www.usatoday.com/story/news/nation/2013/09/16/mass-killings-data-map/2820423/

Fridel, E. E. (2017). A multivariate comparison of family, felony, and public mass murders in the United States. *Journal of Interpersonal Violence*, 088626051773928. doi:10.1177/0886260517739286

Gius, M. (2014). An examination of the effects of concealed weapons laws and assault weapons bans on state-level murder rates. *Applied Economics Letters*, *21*(4), 265–267. doi:10.1080/13504851.2013.854294

Green, G. S. (1987). Citizen gun ownership and criminal deterrence: Theory, research, and policy. *Criminology*, *25*(1), 63–81. doi:10.1111/j.1745-9125.1987.tb00789.x

Grinshteyn, E., & Hemenway, D. (2016). Violent death rates: The US compared with other high-income OECD countries, 2010. *The American Journal of Medicine*, *129*(3), 266–273. doi:10.1016/j.amjmed.2015.10.025

Hemenway, D., & Miller, M. (2000). Firearm availability and homicide rates across 26 high-income countries. *Journal of Trauma, Injury, Infection, and Critical Care*, *49*(6), 1227–1233.

Hemenway, D., Shinoda-Tagawa, T., & Miller, M. (2002). Firearm availability and female homicide victimization rates among 25 populous high-income countries. *JAMWA: Journal of the American Medical Women's Association*, *57*, 1–5.

Hemenway, D., Azrael, D., & Miller, M. (2017). Whose guns are stolen? The epidemiology of gun theft victims. *Injury Epidemiology*, 4(11), 1–5.

Hepburn, L., Miller, M., Azrael, D., & Hemenway, D. (2004). The effect of nondiscretionary concealed weapon carrying laws on homicide. *The Journal of Trauma*, *56*(3), 676–681. doi:10.1097/01.ta.0000068996.01096.39

Hepburn, L. M., & Hemenway, D. (2004). Firearm availability and homicide: A review of the literature. *Aggression and Violent Behavior*, *9*(4), 417–440. doi:10.1016/S1359-1789(03)00044-2

Hindelang, M. J. (1976). Criminal victimization in eight American cities: A descriptive analysis of common theft and assault. Ballinger.

Hupp, S. G. (2009). *From Luby's to the legislature: One woman's fight against gun control.* San Antonio, TX: Privateer Publications.

Kelly, R. (2010). *Active shooter report: Recommendations and analysis for risk mitigation*. New York, NY: New York City Police Department.

Killias, M. (1993a). *Gun ownership, suicide, and homicide: An international perspective.* Rome, Italy: UNICRI.

Killias, M. (1993b). International correlations between gun ownership and rates of homicide and suicide. *CMAJ: Canadian Medical Association Journal = Journal de L'Association Medicale Canadienne*, *148*(10), 1721–1725.

Killias, M., & Haas, H. (2002). The role of weapons in violent acts: Some results of a Swiss national cohort study. *Journal of Interpersonal Violence*, *17*(1), 14–32. doi:10.1177/0886260502017001002

Killias, M., & Markwalder, N. (2012). Firearms and homicide in Europe. In M. C. Liem & W. A. Pridemore (Eds.), *Handbook of European homicide research: Patterns, explanations, and country studies* (pp *261–272)*. New York, NY: Springer.

Kleck, G. (1979). Capital punishment, gun ownership, and homicide. *American Journal of Sociology*, *84*(4), 882–910. doi:10.1086/226865

Kleck, G. (1984). The relationship between gun ownership levels and rates of violence in the United States. In D. B. Kates (Ed.), *Firearms and violence: Issues of public policy* (pp. 99–135). Cambridge, MA: Ballinger.

Kleck, G. (1997). *Targeting guns: Firearms and their control*. New York, NY: Aldine de Gruyter.

Kleck, G. (2004). Measures of gun ownership levels for macro-level crime and violence research. *Journal of Research in Crime and Delinquency*, *41*(1), 3–36. doi:10.1177/0022427803256229

Kleck, G., & Hogan, M. (1999). National case-control study of homicide offending and gun ownership. *Social Problems*, *46*(2), 275–293. doi:10.1525/sp.1999.46.2.03x0189g

Kleck, G., & Patterson, E. B. (1993). The impact of gun control and gun ownership levels on violence rates. *Journal of Quantitative Criminology*, *9*(3), 249–287. doi:10.1007/BF01064462

Kovandzic, T. V., & Marvell, T. B. (2003). Right-to-carry concealed handguns and violent crime: Crime control through gun decontrol? *Criminology & Public Policy*, *2*(3), 363–396. doi:10.1111/j.1745-9133.2003.tb00002.x

Krouse, W. J., & Richardson, D. J. (2015). *Mass murder with firearms: Incidents and victims, 1999–2013*. Washington, DC: Congressional Research Service.

Lester, D. (1988). Firearm availability and the incidence of suicide and homicide. *Acta Psychiatrica Belgica*, *88*(5-6), 387–393.

Liang, K.-Y., & Zeger, S. L. (1986). Longitudinal data analysis using generalized models. *Biometrika*, *73*(1), 13–22. doi:10.1093/biomet/73.1.13

Lin, P.-I., Fei, L., Barzman, D., & Hossain, M. (2018). What have we learned from the time trend of mass shootings in the U.S.? *PLoS One*, *13*(10), e0204722. doi:10.1371/journal.pone.0204722

Liu, G., & Wiebe, D. J. (2019). A time-series analysis of firearms purchasing after mass shooting events in the United States. *JAMA Network Open*, *2*(4), e191736. doi:10.1001/jamanetworkopen.2019.1736

Loftin, C., McDowall, D., Curtis, K., & Fetzer, M. D. (2015). The accuracy of the Supplementary Homicide Report rates for large U.S. cities. *Homicide Studies*, *19*(1), 6–27. doi:10.1177/1088767914551984

Lott, J. R. (2000). *More guns, less crime: Understanding crime and gun control laws*. Chicago, IL: Universtiy of Chicago Press.

Lott, J. R. (2018). *Concealed carry permit holders across the United States: 2018*. Crime Prevention Research Center, Knoxville, TN URL: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3233904#:~:text=Despite%20the%20expectations%20of%20many,of%20American%20adults%20have%20permits

Lott, J. R., & Landes, W. M. (2000). *Multiple victim public shootings*. Unpublished paper.

Lott, J. R., & Mustard, D. B. (1997). Crime, deterrence, and right-to-carry concealed handguns. *The Journal of Legal Studies*, *26*(1), 1–68. doi:10.1086/467988

Lott, J. R., & Whitley, J. E. (2001). Safe-storage gun laws: Accidental deaths, suicides, and crime. *The Journal of Law and Economics*, *44*(S2), 659–689. doi:10.1086/338346

Luca, M., Malhotra, D., & Poliquin, C. (2019). *The impact of mass shootings on gun policy*. Retrieved from https://www.hbs.edu/faculty/Publication%20Files/16-126_ce055015-fc1c-4a8c-9a8a-8a9361d808bb.pdf

Ludwig, J. (1998). Concealed-gun-carrying laws and violent crime: Evidence from state panel data. *International Review of Law and Economics*, *18*(3), 239–254. doi:10.1016/S0144-8188(98)00012-X

Magaddino, J. P., & Medoff, M. H. (1984). An empirical analysis of federal and state firearm control laws. In D. B. Kates (Ed.), *Firearms and Violence: Issues of Public Policy* (pp. 225–258). Cambridge, MA: Ballinger.

McDowall, D. (1991). Firearm availability and homicide rates in Detroit, 1951-1986. *Social Forces*, *69*(4), 1085–1099. doi:10.2307/2579303

McDowall, D. (1995). Firearms and self-defense. *The Annals of the American Academy of Political and Social Science*, *539*(1), 130–140. doi:10.1177/0002716295539001010

McDowall, D., Lizotte, A. J., & Wiersema, B. (1991). General deterrence through civilian gun ownership: An evaluation of the quasi-experimental evidence. *Criminology*, *29*(4), 541–559. doi:10.1111/j.1745-9125.1991.tb01079.x

McDowall, D., Loftin, C., & Wiersema, B. (1995). Easing concealed firearms laws: Effects on homicide in three states. *The Journal of Criminal Law and Criminology (1973-)*, *86*(1), 193–206. doi:10.2307/1144006

Menard, S. (1995). *Applied logistic regression analysis: Sage university series on quantitative applications in the social sciences*. Thousand Oaks, CA: Sage.

Miller, M., Azrael, D., & Hemenway, D. (2002). Rates of household firearm ownership and homicide across US regions and states, 1988-1997. *American Journal of Public Health*, *92*(12), 1988–1993. doi:10.2105/ajph.92.12.1988

Miller, M., Hemenway, D., & Azrael, D. (2007). State-level homicide victimization rates in the US in relation to survey measures of household firearm ownership, 2001-2003. *Social Science & Medicine (1982)*, *64*(3), 656–664. doi:10.1016/j.socscimed.2006.09.024

National Public Radio. (2012). Only thing that stops a bad guy with a gun is a good guy with a gun. https://www.npr.org/2012/12/21/167824766/nra-only-thing-that-stops-a-bad-guy-with-a-gun-is-a-good-guy-with-a-gun

National Threat Assessment Center. (2019). *Protecting America's schools: A U.S. Secret Service analysis of targeted school violence*. U.S. Secret Service, Washington, D.C: Department of Justice.

Newport, F. (2015). *Majority say more concealed weapons would make U.S. safer*. Retrieved from https://news.gallup.com/poll/186263/majority-say-concealed-weapons-safer.aspx

Newton, G. D., & Zimring, F. (1969). Firearms and Violence in American Life: A Staff Report to the National Commission on the Causes and Prevention of Violence. U.S. Government Printing Office.

Nisbett, R. E., & Cohen, D. (1996). *Culture of honor: The psychology of violence in the South*. Boulder, CO: Westview Press.

O'Brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality & Quantity*, *41*(5), 673–690. doi:10.1007/s11135-006-9018-6

Overberg, P., Hoyer, M., Hannan, M., Upton, J., Hansen, B., & Durkin, E. (2016). Explore the data on U.S. mass killings since 2006. Retrieved from http://www.usatoday.com/story/news/nation/2013/09/16/mass-killings-data-map/2820423/

Phillips, L., Votey, H. L., & Howell, J. (1976). Handguns and homicide: Minimizing losses and the costs of control. *The Journal of Legal Studies*, *5*(2), 463–478. doi:10.1086/467559

Planty, M., & Truman, J. (2013). *Firearm violence, 1993-2011*. Washington, D.C.: Bureau of Justice Statistics, U.S. Department of Justice. Special report 241730

Plassmann, F., & Tideman, T. N. (2001). Does the right to carry concealed handguns deter countable crimes? Only a count analysis can say. *The Journal of Law and Economics*, *44*(S2), 771–798. doi:10.1086/323311

Reeping, P. M., Cerda, M., Kalesan, B., Wiebe, D. O J., Galea, S., & Brana, C. C. (2019). State gun laws, gun ownership, and mass shootings in the US: Cross sectional time series. *The British Medical Journal*, *364*(1542), 1–6.

Ressler, R. K., Burgess, A. W., & Douglas, J. E. (1988). *Sexual homicide: Patterns and motives*. Lexington, MA: Lexington Books.

Rokaw, W. M., Mercy, J. A., & Smith, J. C. (1990). Comparing death certificate data with FBI crime reporting statistics on U.S. homicides. *Public Health Reports*, *105*(5), 447–455.

Rosengart, M., Cummings, P., Nathens, A., Heagerty, P., Maier, R., & Rivara, F. (2005). An evaluation of state firearm regulations and homicide and suicide death rates. *Injury Prevention*, *11*(2), 77–83. doi:10.1136/ip.2004.007062

Seitz, S. T. (1972). Firearms, homicides, and gun control effectiveness. *Law & Society Review*, *6*(4), 595–614. doi:10.2307/3052950

Semenza, D. C., Stansfield, R., & Link, N. W. (2020). The dynamics of race, place, and homicide context in the relationship between firearm dealers and gun violence. *Justice Quarterly*.

Siegel, M., Pahn, M., Xuan, Z., Ross, C. S., Galea, S., Kalesan, B., … Goss, K. A. (2017). Firearm-related laws in all 50 U.S. states, 1991-2016. *American Journal of Public Health*, *107*(7), 1122–1129. doi:10.2105/AJPH.2017.303701

Siegel, M., Ross, C. S., & King, C. (2013). The relationship between gun ownership and firearm homicide rates in the United States, 1981-2010. *American Journal of Public Health*, *103*(11), 2098–2105. doi:10.2105/AJPH.2013.301409

Siegel, M., Xuan, Z., Ross, C. S., Galea, S., Kalesan, B., Fleegler, E., & Goss, K. A. (2017). Easiness of legal access to concealed firearm permits and homicide rates in the United States. *American Journal of Public Health*, *107*(12), 1923–1929. doi:10.2105/AJPH.2017.304057

Smith, T. W., & Son, J. (2015). *General Social Survey final report: Trends in gun ownership in the United States, 1972-2014*. Chicago, IL: NORC at the University of Chicago.

Sorenson, S., & Berk, R. (2001). Handgun sales, beer sales, and youth homicide. *Journal of Public Health Policy*, *22*(2), 182–197. doi:10.2307/3343459

Steidley, T., Ramey, D. M., & Shrider, E. A. (2017). Gun shops as local institutions: Federal firearms licensees, social disorganization, and neighborhood violent crime. *Social Forces*, *96*(1), 265–298. doi:10.1093/sf/sox039

Stolzenberg, L., & D'Alessio, S. J. (2000). Gun availability and violent crime: New evidence from the National Incident-Based Reporting System. *Social Forces*, *78*(4), 1461–1482. doi:10.2307/3006181

Studdert, D. M., Zhang, Y., Rodden, J. A., Hyndman, R. J., & Wintemute, G. J. (2017). Handgun acquisitions in California after two mass shootings. *Annals of Internal Medicine*, *166*(10), 698–706. doi:10.7326/M16-1574

Wallace, L. N. (2015). Responding to violence with guns: Mass shootings and gun acquisition. *The Social Science Journal*, *52*(2), 156–167. doi:10.1016/j.soscij.2015.03.002

Webster, D. W., McCourt, A. D., Crifasi, C. K., Booty, M. D., & Stuart, E. A. (2020). Evidence concerning the regulation of firearms design, sale, and carrying on fatal mass shootings in the United States. *Criminology & Public Policy*, *19*(1), 171–212. doi:10.1111/1745-9133.12487

Wellford, C. F., Pepper, J. V., & Petrie, C. V. (2005). *Firearms and violence: A critical review*. Washington, D.C.:The National Academies Press.

Wiersema, B., Loftin, C., & McDowall, D. (2000). A comparison of Supplementary Homicide Reports and National Vital Statistics System homicide estimates for U.S. counties. *Homicide Studies*, *4*(4), 317–340. doi:10.1177/1088767900004004002

Wolfgang, M. (1958). Patterns in Criminal Homicide. The University of Pennslyvania Press.

Wright, J. D., & Rossi, P. H. (1991). *Armed and considered dangerous: A survey of felons and their weapons*. Hawthorne, NY: Aldine de Gruyter.

Zimmerman, P. R. (2014). The deterrence of crime through private security efforts: Theory and evidence. *International Review of Law and Economics*, *37*, 66–75. doi:10.1016/j.irle.2013.06.003

Zimring, F. (1968). Is gun control likely to reduce violent killings? *University of Chicago Law Review*, *35*, 21–37.

Zimring, F. (1972). The medium is the message: Firearm caliber as a determinant of death from assault. *The Journal of Legal Studies*, *1*(1), 97–123. doi:10.1086/467479

Zimring, F. (1991). Firearms, violence and public policy. *Scientific American*, *265*(5), 48–54. doi:10.1038/scientificamerican1191-48