

# Reacting to the Improbable: Handgun Carrying Permit Application Rates in the Wake of High-Profile Mass Shootings

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## Abstract

Fear of crime is a frequently cited reason individuals carry firearms. Mass shootings are particularly fear-inducing events, and for some incidents, media coverage inundates the public with details of these tragedies. This reporting may increase individuals' fear of such incidents and, subsequently, may spur demand for handgun carrying permits (HCPs). Newspaper reports have documented changes in HCP application rates following high-profile mass shootings. We empirically assess this possible relationship using HCP application rates in all 95 counties in Tennessee from 2008 through 2014. Results suggest certain high-profile mass shootings are significantly associated with increased HCP application rates.

## Keywords

firearm, concealed carry, weapon permit, mass murder, gun carrying

## Introduction

In recent years, multiple mass shootings within the United States have captured the nation's attention. These tragic events have sparked widespread debates about how best to protect ourselves and others from mass shooters. One of the more memorable and oft-repeated quotes from this debate heralds from the National Rifle Association's

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Wayne LaPierre: "The only thing that stops a bad guy with a gun is a good guy with a gun" (LaPierre, 2012: pp. 5). To protect oneself and others with a gun, one must be carrying a gun at the critical moment. Laws in all 50 states regulate the carrying of firearms in public, and, in general, one must apply for a permit to carry concealed firearms. In this research, we analyze whether applications for handgun carrying permits rise in response to certain high-profile mass shootings, using the state of Tennessee as the study location. We hypothesize that the occurrence of certain high-profile mass shootings will generate short-term increased public demand for handgun carrying permits.

### *Literature Review*

The logic behind how a high-profile mass shooting may be associated with an increase in handgun carry permit applications has four steps. First, a mass shooting must occur. Some mass shootings reach the second step by receiving widespread media attention, thus becoming "high profile." Third, members of the public who are exposed to news of these mass shootings, depending on the circumstances of the mass shooting and how the stories are framed, may develop an increased sense of fear or perceived risk of crime. These factors may motivate people to take the final step and apply for a handgun carry permit as a protective action against crime victimization.

The proliferation of the modern 24/7 cable news cycle and Internet news aggregation renders the nature of the media coverage of a mass shooting particularly important. Mass shootings that occur seemingly at random in public settings tend to receive greater levels of media attention (Duwe, 2000; Fox & Levin, 1998). Exposure to constant media coverage of a crime may influence people's perceptions and level of fear by making distant tragic events feel like they are happening or could happen in one's own neighborhood (Fox & DeLateur, 2014). Perfectly illustrating the notion that media coverage may make mass shootings seem likely to occur in one's community, *TIME* magazine released a cover following the Columbine tragedy picturing the shooters with the caption "Monsters Next Door" (Fox & DeLateur, 2014).

High-profile mass shootings are relatively infrequent events (Duwe, 2000); however, anecdotal evidence suggests people perceive the likelihood of being victimized by such incidents as far greater than their actual probability of victimization. A 2012 Gallup Poll surveyed adults and found 22% thought it "very likely" and 30% thought it "somewhat likely" that a Newtown-type shooting, which was the second deadliest mass shooting in U.S. history (at the time), would happen in their own community (Saad, 2012). Given the rarity of mass shootings, especially one the magnitude of Newtown, CT, these survey results suggest factors beyond objective probability analysis influence the public's perceptions of the frequency of such incidents.

The discrepancy in perceived likelihood of a mass shooting can be conceptualized as probability neglect (Sunstein, 2003). Probability neglect posits that the severity of extreme individual acts of violence may generate emotionally charged evaluations of risk that dismiss the low likelihood that such incidents are repeatable (Sunstein, 2003). A plausible factor contributing to individuals' probability neglect when it comes to

mass shootings is the news media's unprecedented ability to bring awareness of those shootings into homes nationwide.

Exposure to media reports of mass shootings may increase one's perceived risk of crime and, with it, fear of crime, potentially leading individuals to seek ways to protect themselves. Firearm ownership and carrying is often promoted within the United States as a credible protective measure against personal victimization. Although research has found that fear of crime may influence gun ownership (Lizotte & Bordua, 1980; D. A. Smith & Uchida, 1988) and planned defensive gun acquisition (Kleck, Kovandzic, Saber, & Hauser, 2011), only a few studies have evaluated changes in behavior as a result of fear associated with mass shootings.

Studies that have researched fear of crime following mass shootings have primarily evaluated the effects of incidents that occurred in academic settings. For example, a survey of students at the University of South Carolina found that both the Virginia Tech and Northern Illinois mass shootings, separately, increased respondents' overall fear of crime, fear of being murdered, and fear of being attacked with a weapon (Kaminski, Koons-Witt, Thompson, & Weiss, 2010). A separate survey of 122 female students assessing levels of fear before and after Columbine found that media portrayal of Columbine decreased respondents' feeling of safety (Stretesky & Hogan, 2001).

Using nationally representative surveys, researchers found students post-Columbine were significantly more likely to avoid school out of fear (Brener, Simon, Anderson, Barrios, & Small, 2002) and reported being mildly more fearful (Addington, 2003). Despite an increase in fear, student rates of weapon or gun carrying at school remained stable after the Columbine shooting (Brener et al., 2002). However, due to minimum age requirements, the majority of high school students were prohibited from legally purchasing, possessing, or carrying guns, increasing the difficulty for students to engage in these behaviors. Adults, not subjected to age restrictions, may be more likely (and are certainly more able) to respond to increased fear of crime, or mass shootings specifically, by engaging in gun-related behaviors they believe to be protective.

There is evidence suggesting that the occurrence of mass shootings has implications for gun-related activities, both locally and nationwide. Local effects were observed in Arizona, where handgun sales increased 60% the day following the mass shooting at a shopping mall in Tucson, AZ, in which six people were killed and Congressional Representative Gabrielle Giffords was injured (Epstein, 2011). Colorado experienced a similar outcome in the days after 12 people were killed and 58 wounded in a movie theater in Aurora, CO, when background check requests for gun sales increased 40% (Winter, 2012). Importantly, the effects of mass shootings are not confined to the communities where they occurred; instead, their effects transcend immediate localities and have national implications. Wallace (2015) randomly selected six mass shootings that occurred between 2000 and 2010 and found that the number of background checks for gun sales significantly increased nationwide after the shootings. Anecdotal evidence on King County, WA, showed that concealed handgun permit applications nearly doubled in the days after the mass shooting in Aurora, CO, compared with the previous year, providing further support for the geographic

influence of mass shootings (Workman, 2012). Notably, these gun-related activities have been shown to recede over time (see Lee, 2013; A. Smith, 2014).

Although not examined in the context of mass shootings, researchers have examined factors associated with concealed handgun permit rates in the context of defensive gun activity. Research using aggregated crime rates has found crime unrelated to concealed handgun permit rates (Costanza & Kilburn, 2004; Costanza, Kilburn, & Miles, 2013; Thompson & Stidham, 2010). However, the aggregation of crime types disallows us from discerning whether specific crime types might have an impact. One study examined the effects of violent crime committed with and without firearms, separately, on concealed handgun permit and application rates in Florida. It found a positive impact of firearm violent crime on both permits issued and application rates, a positive impact of nonfirearm violent crime on permits issued rates, but a puzzling and unexplained negative impact on application rates (Carter & Binder, 2016).

Legal gun carrying has been linked to a number of contextual and sociodemographic factors. Gau (2008) found an inverse relationship between concealed handgun permit prevalence and communities' perceived adequacy of police presence (Gau, 2008). Research has shown concealed handgun permits and gun carrying for self-defense is more prevalent in rural areas than urban environments (Costanza et al., 2013; Felson & Pare, 2010) and in areas with larger minority populations (Felson & Pare, 2010; Stroud, 2012). From a cultural standpoint, research suggests legal gun carrying is positively related to concentrations of conservatism (Costanza & Kilburn, 2004; Costanza et al., 2013; Thompson & Stidham, 2010) and hunting or gun culture (Costanza et al., 2013; Thompson & Stidham, 2010). Similarly, an inverse relationship has been found between population density and concealed carry permits, suggesting that permits are more prevalent in rural areas (Costanza et al., 2013). The prevalence of concealed handgun permits is greater among men (Hood & Neeley, 2000; Schwaner, Furr, Negrey, & Seger, 1999) and positively related to education (Hood & Neeley, 2000). Finally, research has produced mixed results on whether economic factors influence legal handgun carrying (Costanza & Kilburn, 2004; Costanza et al., 2013; Hood & Neeley, 2000).

### ***Present Study***

In this study, we hypothesize that the occurrence of certain types of high-profile mass shootings, specifically those committed by strangers outside a residence, will lead to short-term increases in HCP application rates. We control for multiple factors that may impact HCP application rates, including socioeconomic indicators and local crime rates. To our knowledge, this is the first empirical study to assess whether mass shootings influence HCP application rates.

This study advances the literature in two main ways. First, existing research has relied upon either annual concealed handgun permit data (Carter & Binder, 2016; Costanza & Kilburn, 2004; Costanza et al., 2013) or cumulative total permits spanning multiple years (Thompson & Stidham, 2010) when assessing predictors of legal gun carrying; consequently, the ability to observe patterns in permit activity was limited.

We minimize these temporal limitations by using monthly HCP rates, which allows for greater confidence in detecting and accounting for variations over time. Second, changes in fear (Kaminski et al., 2010; Stretesky & Hogan, 2001) or general gun demand (Wallace, 2015) as outcomes of mass shootings have received scholarly attention; however, insight into patterns of handgun carrying permits following mass shootings has been limited to anecdotal evidence from news reports. To go beyond surface-level connections, we further the empirical understanding of the relationship between certain high-profile mass shootings and HCP applications through the application of regression analysis.

## Method

### Site Selection

We studied HCP application rates from January 2008 through November 2014 in all 95 counties in Tennessee, which is one of 33 states in the United States with a *shall-issue* law regarding handgun carrying (Law Center to Prevent Gun Violence, 2015; Tennessee Code Annotated § 39-17-1351). In general, a *shall-issue* law dictates that any individual who applies for a concealed carry permit and meets the objective criteria set forth by that particular state and the federal government shall be issued a license (Vernick, 2013; Webster, Vernick, Ludwig, & Lester, 1997). Particular to the state of Tennessee, the term *handgun carrying permit* (HCP) is used, as opposed to concealed carry permit, because permit holders are not legally required to conceal their handguns when carrying (see Summers, Moore, & Hale, 2005). In addition, residents are not legally able to open carry handguns without an HCP.

### HCP Application Rates

The dependent variable for the present study was the monthly rate of HCP applications per 100,000 residents aged 21 years and over by county; those below 21 years of age are not legally allowed to hold HCPs under Tennessee law. Beginning in 2009, Tennessee's Department of Safety and Homeland Security published annual reports on HCP-related activities from the previous year; data extracted from these reports formed the dependent variable in this study (Tennessee Department of Safety, 2009-2015). HCP application totals were determined by summing the monthly number of original HCPs issued, HCPs renewed, HCPs issued to new residents, and HCPs denied. Renewals were included in the outcome variable due to how they are treated by the state: Tennessee considers an application for a permit that has been expired for up to 6 months to be a renewal. Given this, it is conceivable that someone allowed their HCP to expire, and then renewed in response to the occurrence of a mass shooting before the 6-month period passed.

Tennessee's HCP reports contain statistics on when the permit-issuing authority made decisions on applications and not when applications were initially submitted. The average time between application and issuance decision from January 2008

through February 2010 was 68 days, with a median of 66.5 days; however, from March 2010 through December 2014, the average processing time was 26 days, with a median of 24.5 days (Tennessee Department of Safety, 2009-2015). Therefore, we used different lead periods to determine when applications were submitted. For January 2008 through February 2010, we assumed that applications were submitted 2 months before permits were issued or denied. For March 2010 through December 2014, we assumed applications were submitted 1 month before permit issuance or denial.

To illustrate, the number of permits issued or denied in March 2009 was used as a proxy for applications filed in January 2009, whereas the number of permits issued or denied in March 2013 was used as the proxy for applications filed in February 2013. HCP data were interpolated for the 1 month of missing data that emerged from using two different time shifts (January 2010). Applications for HCPs are submitted to Tennessee's Department of Safety; thus, concerns over variations in time-to-issuance across counties are avoided due to the use of this centralized processing agent (Tennessee Code Annotated § 39-17-1351). Finally, a constant of "1" was added to the outcome variable and then logged to minimize the influence of outliers and facilitate the assessment of multiplicative variation without losing any observations.

### *High-Profile Mass Shootings*

Consistent with previous research (e.g., Duwe, 2000; Duwe, Kovandzic, & Moody, 2002; Fox & Levin, 1998), we used the Federal Bureau of Investigation's (FBI) definition of mass murder: a single incident with four or more fatal victims (Behavioral Analysis Unit, 2005). Multiple assumptions were used to create inclusion criteria for which mass homicides we hypothesize impact HCP application rates. First, we assumed events that an individual carrying a firearm could be reasonably expected to prevent, or disrupt, would be most likely to impact an individual's motivation to apply for an HCP. Therefore, we excluded bombings and arsons because a person carrying a gun arguably cannot interrupt such incidents given their immediacy and extremely limited intervention opportunities.

Second, we assumed that mass murders perpetrated by "strangers" are more likely to produce fear that may motivate an individual to apply for an HCP than those perpetrated by acquaintances, intimate partners, or family members. This assumption was grounded in research suggesting that crimes involving strangers generate more fear than those involving acquaintances (Lupton, 1999; Riedel, 1987). In addition, evidence suggests that the rarest form of mass murder, a random act in a public setting, receives the most media attention compared with other incident types (Duwe, 2000; Fox & Levin, 1998). This suggests that mass shootings where strangers are victimized may be more likely to propel individuals to take defensive actions than those where offenders knew their victims. We therefore omitted mass shootings where victims and offenders were known to each other with one exception: an event where the first three victims were killed inside a private residence and were acquainted with the perpetrator who then went on to kill three strangers in a public setting.

Third, we eliminated those mass murders that occurred in settings where an HCP is not needed to legally possess a firearm. This eliminates incidents that occurred in private residences due to the fact that Tennessee does not require people to obtain permits to purchase or register firearms that are kept in their homes. In other words, people could legally intervene or disrupt a mass shooting taking place in a home without an HCP; thus, we do not expect that fear induced by such incidents would lead one to apply for an HCP as a safety measure.

Notably, we did not exclude incidents that occurred in designated “gun free zones.” This is for two reasons. First, many of these locations do not have procedures in place to screen entrants for weapons. For example, Sandy Hook Elementary School was designated a “gun free zone” and had security measures in place to control access to the building (e.g., locked doors, video monitoring, and a protocol where staff had to “ring” visitors into the building), but none of these measures specifically screened people entering the building for weapons. Second, in some states, such as Michigan, those who have firearm carrying permits are within their rights to open carry firearms within so-called gun free zones.

Finally, the scope of media attention was an important consideration in our conceptualization of high-profile mass murders. Incidents drawing national publicity would generate a greater number of news reports leading to greater awareness of the incident and therefore may influence the activities of more people than incidents that do not receive national attention. We relied on two key components of popular news media when classifying mass shootings as high profile: geography and medium. For geography, two different scales of readership (nationwide and Tennessee-based) were captured by searching websites of popular newspapers. After comparing the most popular newspaper websites in the country (based on unique visits per month) from the beginning and end of our study period (Barthel, 2015; Seward, 2009), three news websites popular at both periods were selected as nationwide publicity barometers in this study: *The New York Times*, *Los Angeles Times*, and *USA Today*. Coverage of a mass shooting in all three of these news websites was required for an incident to be considered high profile. To ensure local knowledge of the incident, mass shootings must have also appeared in at least three of the four most popular online Tennessee newspapers (*Chattanooga Times Free Press*, *Commercial Appeal*, *Knoxville News Sentinel*, and *The Tennessean*) to be included in the present analysis.

We also considered the scope of television media attention to complete our categorization of a mass homicide as high profile. Accordingly, we searched Vanderbilt University’s Television News Archive to determine which mass shootings met our television criteria for national publicity by being reported in all three major television networks’ (ABC, CBS, and NBC) evening news telecasts. In sum, a mass shooting was defined as high profile in our study if it was reported in the following: all three television networks’ nightly news broadcasts, all three countrywide popular online newspapers, and at least three of the four most popular online Tennessee newspapers.

We began with a list maintained by *USA Today* of all mass killings in the United States to identify 198 incidents that occurred in the United States from January 2008 through November 2014. Given the large number of mass murders, at least one

**Table 1.** Mass Shootings Qualifying for the Present Study.

Date	City	State	Location	Fatalities
April 3, 2009	Binghamton	NY	Immigration services center	13
November 5, 2009	Killeen	TX	Military base	13
January 8, 2011	Tucson	AZ	Parking lot	6
April 2, 2012	Oakland	CA	University	7
July 20, 2012	Aurora	CO	Movie theater	12
August 5, 2012	Oak Creek	WI	Temple	6
December 14, 2012	Newtown	CT	Elementary school	27
June 7, 2013	Santa Monica	CA	Community college	5
September 16, 2013	Washington	DC	Military base	12
May 23, 2014	Isla Vista	CA	Apartment and street	6

occurred in almost every month during the study period. We designed our inclusion criteria to capture those mass murders that we hypothesize were most likely to impact HCP application rates. First, we excluded the 13 killings that were carried out with fire or bombs. Next, the eligibility pool was reduced to 79 when restricting incidents to only those involving strangers. Of these 79 mass murders, 41 occurred in places that were not private residences. In terms of media coverage, 26 of these 41 incidents were reported in all three selected national newspapers, and 11 of those were reported in at least three of four local popular Tennessee newspapers. Out of the 11 remaining incidents, one did not appear in all three network television news broadcasts. In sum, application of the above criteria yielded 10 eligible high-profile mass shootings. It is important to note that if we were too restrictive in our inclusion criteria, and failed to include mass homicides that impacted HCP application rates, our results would likely be biased away from finding an association in the expected direction.

Although this study originally was designed to investigate the effects of various types of high-profile mass murders on HCP application rates, the only mass murders that met our inclusion criteria were shootings. Because we hypothesized an immediate impact on HCP application rates that quickly dissipated, high-profile mass shootings were coded into a single variable, with a value of "1" for the month a mass shooting occurred and "0" otherwise. Finally, no two mass shootings included in this analysis occurred within the same month. See Table 1 for descriptions of these incidents.

### **Control Variables**

Based on extant literature on fear of crime and concealed handgun permits, a number of contextual and sociodemographic controls were utilized. Local crime was controlled for using county-level murder, aggravated assault, and robbery rates. Crime data were obtained from the Tennessee Crime Statistics Online Database, which accesses the Tennessee Incident Based Reporting System, or TIBRS (Tennessee

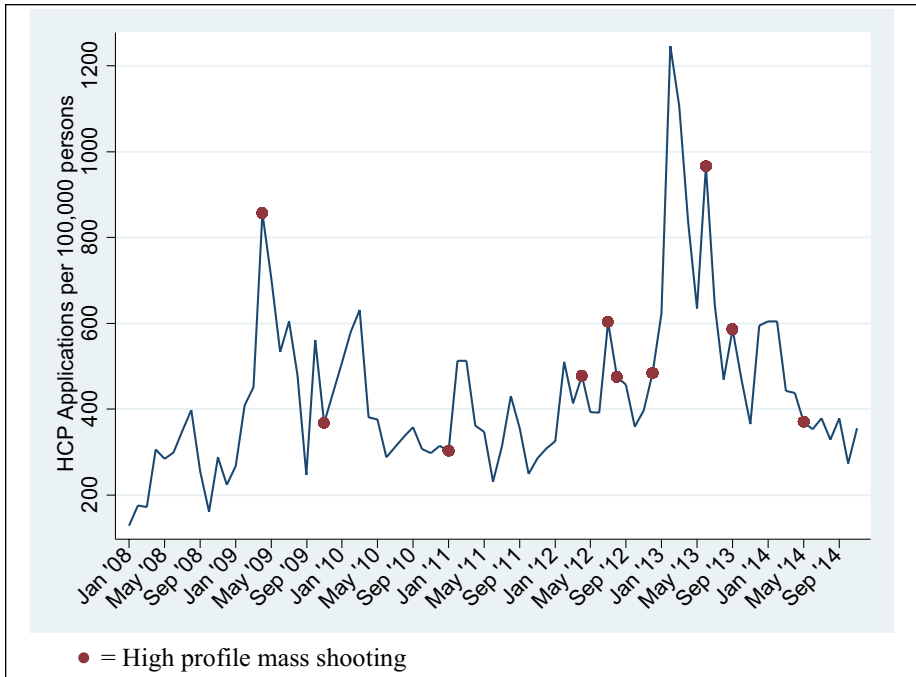


Bureau of Investigation, 2015). All law enforcement agencies in Tennessee are legally mandated to report crime statistics to the Director of the Tennessee Bureau of Investigation (Tennessee Code Annotated § 38-10-101); therefore, TIBRS is a rich and exhaustive data source for analyzing official crime incident reports.

Also, because research suggests illegal gun acquisition increases violent crime (see Stolzenberg & D'Alessio, 2000), it may also indirectly influence HCP application rates through violent crime; thus, we included TIBRS data on monthly stolen guns per 100,000 county residents to account for this possibility. Law enforcement presence was operationalized as the annual number of uniformed officers per 100,000 county residents (FBI, 2009-2014). To accurately capture total police presence, the number of county-level law enforcement officers was added to the number of city-level law enforcement officers for cities located in that particular county, with the number of officers in cities spanning more than one county allocated evenly among each county. The extent to which a county was considered urban reflected the percentage of a county's population living in an urban setting in 2010, according to U.S. Census data. Hunting culture was captured through the annual number of supplemental hunting permits by county per 100,000 residents (Tennessee Wildlife Resources Agency, personal communication, April 9, 2015). Conservatism was represented as the percentage of voters by county who voted for the Republican presidential candidate in the 2008 and 2012 elections, with data interpolated to obtain monthly estimates (Tennessee Secretary of State, 2015).

Data on percent female, percent Black or African American alone, and percent aged 25 and older with a bachelor's degree were obtained from the American Community Survey's 5-year estimates for each year from 2009 through 2014, with data extrapolated for 2008 when estimates were unavailable. Two economic indicators were used in this study: monthly unemployment rates (Bureau of Labor Statistics, 2015) and logged annual income per capita (Bureau of Economic Analysis, 2015). All annual data were entered for January of the corresponding year and then interpolated to obtain values for the remaining months. Finally, in 2009, Tennessee enacted four laws (Public Chapters 101; 428; 431; 606) over approximately a 4-month period expanding the rights of HCP holders (Tennessee Department of Safety, 2014). A single binary variable was used to represent the law change, assigning all months prior to the first full month (May 2009) the first new law was enacted a value of "0" and all following months a value of "1."

We employed a multilevel mixed-effects linear regression model with monthly observations clustered by county to estimate the impact of high-profile mass shootings on HCP application rates. There were 83 observations for each of the 95 counties in the analysis. McDowall, McCleary, Meidinger, and Hay (1980) identified three sources of noise that could influence results of time series analysis: trends, seasonality, and random error. Accordingly, trends were controlled for by incorporating both linear and curvilinear monthly trend variables. A binary variable for each month of the calendar year was used to address seasonality. Model diagnostics revealed serial autocorrelation in the time series data; subsequently, to compensate for this, within-group errors were specified as having an autoregressive structure order of "1." Exploration of



**Figure 1.** Statewide HCP application rates by month per 100,000 residents aged 21 years and older in Tennessee, January 2008 through November 2014.

Note. • = high-profile mass shooting; HCP = handgun carrying permit.

model residuals demonstrated that accounting for these three sources of noise considerably improved model fit. To counter any heteroscedasticity in the model, robust standard errors were reported. Finally, the robustness of estimates from our main model was assessed through a series of additional analyses. All statistical tests in this study were completed using the statistical software program Stata v14, and regression models were executed using Stata's "mixed" command.

## Results

Overall, HCP application rates in Tennessee were extremely volatile from January 2008 through November 2014. Statewide, HCP application rates were lowest (129 per 100,000) at the beginning of the study period (January 2008), and peaked in February 2013 (1,246 per 100,000). See Figure 1 for trends in HCP application rates over the study period. During this period, counties averaged 218 HCP applications per 100,000 residents aged 21 years and older (Table 2).

Results of the multilevel mixed-effects regression model are reported in Table 3. Selected high-profile mass shootings were significantly and positively related to logged HCP application rates ( $\beta = .11, p < .001$ ). On average, HCP application rates in

months containing a high-profile mass shooting were more than 11% higher than months without such incidents.

Four control variables were significantly related to HCP application rates. Both economic indicators were significantly and positively related to HCP application rates: percent unemployed ( $\beta = .05, p < .001$ ) and logged income per capita ( $\beta = .50, p < .01$ ). A one percentage point increase in unemployment rates corresponded to a 5% increase in HCP application rates. As an elasticity, a 1% increase in income per capita was associated with a 0.5% increase in HCP application rates. HCP-related laws were also estimated to be significantly and positively related to HCP applications ( $\beta = .06, p < .01$ ). This indicates that HCP application rates were approximately 6% higher after these laws were enacted compared with before May 2009. Although small, a significant relationship was found between percent conservative and HCP application rates ( $\beta = .01, p < .05$ ). In other words, a one percentage point increase in conservatism was related to an approximately 1% increase in HCP application rates.

None of the remaining sociodemographic or contextual variables were significantly associated with HCP application rates. In addition, none of the three local violent crime rates were significantly related to the outcome variable. These null findings will be examined more in-depth in the ensuing section.

### *Additional Analyses*

Numerous strategies were employed to examine the robustness of our key finding that certain mass shootings are significantly associated with increased HCP applications rates. Please note that in this section, we only report the most pertinent results from each additional analysis performed, but full results of these analyses are available from the corresponding author upon request.

First, there is potential, particularly for selected mass shootings that occurred near the end of the month, that the impact of an incident on HCP application rates may extend into the month following a mass shooting. Such a spillover effect would mean that our original construct of the key independent variable would not capture the full impact of the incident on HCP application trends. We therefore tested whether the observed impact remained when the indicator for mass shootings was positive for both the month an incident occurred and the month after. A change in the direction or significance of the estimated impact would cast doubt on the original finding. Using this extended impact period, high-profile mass shootings remained significantly related to HCP application rates ( $p < .001$ ) and the estimated effect was actually greater than our original model ( $\beta = .14$  vs.  $\beta = .11$ ).

Also related to the construction of the key independent variable is the issue of mass killings that occurred in Tennessee during the study period. If these incidents are related to HCP application rates, our original results would likely be biased away from finding the hypothesized effect. Furthermore, finding that HCP application rates are impacted by local incidents that did not meet our inclusion criteria may imply that geographic proximity to mass murders may be more important than the circumstances of the actual incidents. We restructured our key independent variable to include the

**Table 2.** County-Level Descriptive Statistics for Control Variables, January 2008 Through November 2014.

Variable	<i>M</i>	<i>SD</i>	Minimum	Maximum
HCP application rate	217.63	120.18	0.00	1,098.05
Murder rate	0.35	1.37	0.00	39.03
Assault rate	27.22	19.98	0.00	192.12
Robbery rate	3.41	5.65	0.00	53.22
Income per capita	31,620.80	6,207.48	19,441.00	69,439.00
Officers per 100k	203.36	86.25	85.11	1,032.69
Hunting permits per 100k	2,673.11	1,213.57	396.28	6,625.49
Guns stolen per 100k	12.30	9.48	0.00	89.35
% Female	51.48	2.29	35.74	56.70
% African American	7.22	10.42	0.00	52.68
% Urban	33.6	26.9	0.00	97.24
% Conservative	65.38	8.39	35.87	79.41
% Unemployed	9.83	2.79	3.70	29.80
% Education attainment	9.62	4.74	1.02	35.93

Note. HCP = handgun carrying permit.

five local mass killings that occurred in Tennessee during our study period. Using this revised variable, mass shootings remained statistically significant ( $p < .001$ ), but the magnitude of the relationship decreased compared with our original model ( $\beta = .07$  vs.  $\beta = .11$ , respectively). This reduction in the magnitude of the relationship suggests people may be cognizant of the differences among mass shootings and respond to mass shootings by taking into account aspects of the events and not merely their occurrence or geographic proximity.

Because our dependent variable was generated based on an average amount of time elapsed, its construction warrants additional scrutiny. We originally estimated the month applications were submitted using the average number of days per month it took to process applications. To test the accuracy of this calculation, we reestimated HCP application rates using artificially inflated processing times that were 1 and 2 months longer than the actual reported average processing times. If either of these counterfactual outcomes is significantly correlated to mass shootings, it would suggest that the dependent variable used in the main analysis may have been inaccurately constructed. When inflating the processing time by 1 month, mass shootings remained statistically significant ( $p < .01$ ), but the strength of the relationship was reduced considerably compared with the original finding ( $\beta = .03$  vs.  $\beta = .11$ , respectively). In contrast, inflating the processing time by 2 months indicated that high-profile mass shootings were unrelated to HCP application rates ( $\beta = -.01$ ,  $p = .568$ ). Together, these results provide mixed support for our original finding.

Another aspect of our dependent variable worthy of reconsideration is the possibility that applicants may vary systematically by type of HCP application. It is

**Table 3.** Multivariate Regression Results of High-Profile Mass Shootings on Logged HCP Application Rates in 95 Tennessee Counties, January 2008 Through November 2014 (N = 7,885).

Independent variable	Coefficient	SE <sup>a</sup>	95% CI	
			UL	LL
Mass shootings	0.11***	0.009	0.09	0.13
Murder rate	<0.01	0.003	<-0.01	0.01
Assault rate	<-0.01	<0.001	<-0.01	<0.01
Robbery rate	<0.01	0.001	<-0.01	<0.01
% Unemployed	0.05***	0.006	0.04	0.06
Income per capita (ln)	0.50**	0.188	0.13	0.87
Officers rate	<-0.01	<0.001	<-0.01	<0.01
% Female	0.02	0.010	<-0.01	0.04
% Black	<-0.01	0.003	-0.01	<0.01
% Educational attainment	<0.01	0.008	-0.01	0.02
HCP-related laws	0.06*	0.029	<0.01	0.12
% Urban	<-0.01	0.001	<-0.01	<0.01
% Conservative	0.01*	0.004	<0.01	0.02
Hunting permit rate	<0.01	<0.001	<-0.01	<0.01
Guns stolen rate	<0.01	<0.001	<-0.01	<0.01

Note. HCP = handgun carrying permit; CI = confidence interval; UL = upper limit; LL = lower limit.

<sup>a</sup>Robust standard errors.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

plausible that the population applying to renew their HCPs are less motivated by mass shootings than those applying for original HCPs, as they have already demonstrated a desire to carry firearms in public by previously having a permit. Also, it is also possible that the observed impact of mass shootings may be spurious if there happens to be an influx in the number of renewals due to expiration in the same month in which a mass shooting occurred. Therefore, we analyzed only original HCP applications as these are most likely to be responsive to the actual mass shooting. After narrowing the population to exclusively those applying for original HCPs, high-profile mass shootings remained a significant and positive predictor of HCP application rates ( $\beta = .11, p < .001$ ).

Given the sustained effect found for high-profile mass shootings thus far, it is important to further investigate the lack of effect found for local violent crime. The null relationship found between local violent crime and HCP application rates may have been due to our failure to use the specific types of crime most likely to produce fear and demand for HCPs. Accordingly, we restricted local violent crime to only incidents that were both gun-involved and occurred outside of the home. Extending these more fear-inducing criteria to local violent crime failed to yield any results that were substantially different from those observed in our original regression model.

The final additional analysis that we conducted focused on the effects of changes in legislation that occurred during our study period. It is plausible that the full impact of HCP-related laws enacted in the middle of 2009 may not have been instantaneous, as we originally modeled it. Therefore, higher HCP application rates during the latter part of our study period may have reflected a delayed or gradual effect of HCP-related laws instead of increased frequency of high-profile mass shootings. We attempted to minimize the potential for delayed or gradual effects of legislation by limiting the study period to the first full year after HCP-related laws were enacted. Using a study period of 2010 through 2014 did not alter regression results: high-profile mass shootings were significantly and positively related to HCP application rates ( $\beta = .11, p < .001$ ).

## Discussion

In this research, we hypothesized that, despite their infrequency, the occurrence of certain types of high-profile mass shootings will spur greater demand for HCPs, specifically those committed by strangers outside a residence. Monthly county-level data from January 2008 through November 2014 were used to assess this relationship, with the supposition that fear of crime stemming from the occurrence of a mass shooting may serve as a motivating factor for obtaining an HCP. Support for this hypothesis is found in the results of the multilevel mixed-effects linear regression model reported in Table 3. Select high-profile mass shootings were significantly associated with short-term increases in HCP application rates. Specifically, the occurrence of a high-profile mass shooting was associated, on average, with an approximately 11% increase in HCP application rates. This positive and significant relationship was largely maintained throughout a series of additional analyses that consistently demonstrated that certain high-profile mass shootings were associated with increases between an 11% and 14% increase in HCP application rates.

Findings from the present analysis have a range of implications. First, results support extending Sunstein's (2003) concept of probability neglect to mass shootings. Emotions following a mass shooting, plausibly inflamed by media coverage, may overwhelm peoples' assessments of the likelihood that they will be victimized in a future mass shooting, leading to heightened levels of fear and causing them to react by seeking HCPs for protection. Second, evidence suggests the media's influence on defensive gun activities is not bounded geographically. We observed that certain mass shootings were associated with increased HCP application rates in Tennessee, where no high-profile mass shootings occurred during the study period. The impact of mass shootings, therefore, may not be restricted locally; instead, their effects likely extend beyond where they geographically occurred.

Interestingly, none of the three local violent crime rate variables (murder, aggravated assault, or robbery) were significantly associated with HCP application rates. Citizens are far more likely to encounter any of these three violent crimes in their communities than a mass shooting. What is further notable about violent crime is its persistent null relationship with HCP application rates through a series of sensitivity analyses, including when restricted to only gun-involved incidents that occurred

outside the home. It is possible that local violent crime may indeed be unrelated to HCP application rate, or this null finding may be the result of how violent crime was modeled. Violent crime may not produce an instantaneous effect (as we modeled) on HCP application rates; instead, it is possible the impact of local violent crime on demand for HCPs may be lagged or cumulative in nature. Our null finding contrasts research by Carter and Binder (2016) who found a positive association between concealed carry applications and gun-involved crime. Although we did not measure how much attention is paid to local crime rates by individuals, these results suggest that when it comes to decisions on legal defensive gun carrying, individuals may find mass shootings more threatening than crime rates in their communities.

A number of other findings are worth noting. First, both economic predictors included in the model were significantly related to HCP application rates. We found unemployment rates were positively related to HCP application rates, contrary to prior research (Carter & Binder, 2016). Conversely, the positive relationship found between income per capita and HCP application rates aligns with existing literature (Costanza & Kilburn, 2004; Hood & Neeley, 2000). Second, coinciding with previous research (Costanza & Kilburn, 2004; Costanza et al., 2013; Thompson & Stidham, 2010), demand for HCPs was greater among more conservative populations. Finally, the significant and positive relationship for HCP-related laws suggests that state-level legislative action expanding gun rights has the potential to influence gun activity.

As with any study, this study has a number of limitations. First, HCP application rates in only one state were tested for a relationship with high-profile mass shootings. Tennessee's association with southern gun culture, where gun carrying for protective purposes and opposition to carrying restrictions are most prevalent (Brennan, Lizotte, & McDowall, 1993; Felson & Pare, 2010), limits the generalizability of our findings to other geographic regions. Second, there was considerable volatility in HCP application rates over the study period, suggesting there is potential omitted variable bias in this analysis. For instance, HCP applications rates were highest 2 months after the mass shooting in Newtown, CT. This heightened demand for HCP applications may have been due to characteristics unique to the fallout surrounding the Newtown shooting or may have been influenced by other factors, such as the reelection of a Democratic president. The potential lingering effect associated with certain incidents also pertains to the extent to which the impact of mass shootings on HCP application rates was captured. It is possible incidents that occurred at the end of the month may have influenced HCP application rates in the ensuing month, whereas the effects of incidents that occurred near the beginning of the month were more likely to have been contained in the single month for which we modeled the effect.

We also did not test whether the number of fatalities or nonfatally wounded victims in mass shootings was influential in HCP application rates. Relatedly, our standard for "high profile" only considered the geographic scope of media coverage and not the intensity of media attention given to particular mass shootings. It is reasonable to expect that some mass shootings had a greater impact than others. Indeed, Duwe (2000) found that the extent of media coverage given to particular mass shootings varies and the number of individuals wounded in mass shootings was a strong predictor

of media coverage; subsequently, some incidents in our study may have greater impact on HCP application rates than others.

Also worth considering are the implications stemming from the restrictiveness of our selection criteria and the possibility mass shootings that were excluded from our analysis could have impacted HCP application rates. Because of the fear often produced by mass shootings, individuals in this emotional state may not consider whether having a permit would have facilitated the disruption of the incident. For example, some people may experience fear upon learning that five people were killed in their residence and react by seeking an HCP even though it is not legally required to have an HCP to own a gun in one's own house. Although mass murders not included in our analysis may have impacted HCP application rates, it is important to note that the exclusion of these incidents would bias our results toward a null effect.

To our knowledge, this is the first study to empirically evaluate the effects of mass shootings on HCP application rates, which presents opportunities for further research. Future research must consider the causal mechanism when assessing gun-related activities following mass shootings. The debate over expanding restrictions on firearms often intensifies after a mass shooting. This typically contentious discussion of gun rights makes it plausible that the subsequent increased demand for guns and gun-related activities may be the result of fear of gun control legislation (or fear of losing gun rights) rather than fear of the incident itself. Indeed, evidence exists suggesting that fear of gun restrictions may increase gun-related activities (Koper & Roth, 2002). An important factor to consider when attempting to decipher whether changes in gun-related activities are the product of fear of gun control or fear of crime is whether all forms of gun activity are equally scrutinized following mass shootings. For example, bans on assault rifles and high-capacity magazines are frequently debated following mass school shootings (Kleck, 2009). In this case, it is logical to assume that at least a portion of heightened public demand for assault rifles and high-capacity magazines may be spurred by fear of potential bans. Conversely, changes in particular gun activities that are not being threatened by gun control efforts following mass shootings are less likely to be driven by fear of gun control.

Another reason to suspect the contribution of fear of gun control to increased HCP application rates may have been lessened in the present study relates to the laws specific to our study location. Tennessee does not require a permit to purchase a gun (handgun, shotgun, or rifle), as some states do; thus, the outcome variable used in this study reflects a very specific form of gun activity (the ability to carry a handgun in public, concealed or openly). In other words, purchasing a gun out of fear of it becoming banned (e.g., assault rifle) does not influence our outcome variable. Fear of gun control would only impact our outcome variable if there is fear of losing the right to carry handguns in public.

Thus, the use of broad outcome measures, such as federal background check requests (e.g., Wallace, 2015), when testing for the effects of mass shootings inhibits the ability to decipher whether heightened gun-related activity is due to fear of gun control or fear of the actual incident. Although concealed carry rights typically receive less attention following mass shootings compared with other gun-related activities



(e.g., the purchase of assault rifles and high-capacity magazines), and thus are less likely the result of fear of gun control, being able to explicitly differentiate between fear of actual incidents and fear of gun restrictions would help clarify the driving force behind changes in specific types of gun activity following mass shootings.

Finally, future research should seek to further evaluate fear of crime as the mechanism linking mass shootings to heightened demand for HCPs on a more micro level. Results from the present study demonstrate on the county level that mass shootings may increase demand for HCPs; however, individual-level data would help strengthen the hypothesized causal mechanisms for such a relationship. Moving forward, studies should seek to identify specific motivating factors for seeking guns or legal gun carrying capabilities. Obtaining such information would provide insight into the public's perception of mass shootings and the influence of the media in shaping that perception.

## Conclusion

Mass shootings are truly tragic events that not only impact the family and friends of victims but also often draw widespread media attention and stir the emotions of millions of people around the country. For some, these emotions may translate into action. In this article, we examined whether certain high-profile mass shootings lead to an increased demand for HCPs. Results suggest that the occurrence of certain high-profile mass shooting significantly increased HCP application rates. By comparison, individuals are far more likely to be victims of local violent crime; yet, none of the three local violent crimes (murder, aggravated assault, and robbery) examined in this study were related to demand for HCPs. Despite the widespread attention directed toward high-profile mass shootings, there has been relatively little empirical attention directed at the impact of these events. Such a gap in the literature presents many opportunities for future research to add valuable insight into how the public perceives and responds to mass shootings, as well as delve deeper into the specifics of why people seek the ability to legally carry a gun in public.

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