Do Armed Civilians Stop Active Shooters More Effectively Than Uniformed Police?

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Abstract

The FBI tracks active shooting cases—where individuals attempt to kill people in public places, excluding those tied to robberies or gang violence. This study is the first to systematically compare how uniformed police and civilians with concealed handgun permits perform in stopping these attacks. Civilians with permits stopped the attacks more frequently and faced a lower risk of being killed or injured than police. Officers who intervened during the attacks were far more likely to be killed or injured than those who apprehended the attackers later. We also provide evidence that these numbers significantly underestimate the advantages of civilians over officers in stopping these attacks. We explore the implications of two possible identification problems. There is some evidence that passage of Constitutional Carry laws reduce the number of active shooting attacks.

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1. Introduction

Since 2000, the FBI has tracked active shooting cases, an event where an individual attempts to kill people in a public place, excluding shootings tied to robberies or gang violence. An "active shooting" could be as simple as a single shot fired at a lone human target, even if the shooter misses, to a mass shooting.

Yet, while this data has been collected by the FBI, there have been no studies by the FBI nor academics that systematically examined this data or police performance in stopping these attacks. One approach is to compare police with the alternative: civilians who have permitted concealed handguns. Comparisons can be made in the rate that armed citizens stop attacks, whether they increase or decrease the number of casualties, whether they accidentally shoot bystanders, and whether the individuals attempting to stop the attack were wounded or killed by the criminal. A key strength of our research is to examine these factors when police and armed civilians face similar violent situations.

A literature has emerged on mass public shootings, which are similar to active shootings but limits attacks to where four or more people have been murdered (see, e.g., Blau et al., 2016, Duwe et al., 2002, Duwe, 2020, Kleck, 2016, 2020, Kovandzic et al., 2002, Gius, 2018, Lott and Landes, 2001, Lott, 2010). These studies have concentrated on attacks in places that allow people to carry permitted concealed handguns or other gun control laws. There have been no studies on the much broader set of active shooting cases and none that focus on the effectiveness of police in stopping either active shooting or mass public shooting attacks.

Most civilians won't receive the same level of training as police. So, they may make mistakes and accidentally shoot bystanders or interfere with law enforcement, and they won't stop every active shooter situation. It is possible that, on average, police might perform better in confronting active shooters. But the right comparison isn't against perfection. Police officers often face tactical disadvantages because their uniforms make them easy targets. It is simple economics in that attackers face lower costs of avoiding those in uniforms or in knowing who to shoot first. Attackers who spot a uniformed officer can simply wait until the officer leaves, choose a different target, or strike the officer first — knowing the officer is definitely armed.

These tactical disadvantages explain why air marshals don't wear uniforms on airplanes. Ideally, we would compare outcomes between uniformed and plainclothes or off-duty officers, but the sample of non-uniformed cases is too small—only two such incidents exist. When attackers can easily identify who might stop them, they are more likely to shoot that person first.

Civilians, by contrast, can intervene anywhere they are allowed to carry concealed weapons before an attacker notices them. They also outnumber on-duty police officers by a wide margin. In 2024, 21.5 million Americans—about 8.2% of adults—held concealed handgun permits (Lott et al., 2024). In addition, 29 states allowed Constitutional Carry, which requires no permit at all. Surveys show that 7.2% of likely voters carry all the time, and another 8.4% carry some of the time.[1]

Compare that to the roughly 671,000 full-time sworn law enforcement officers in 2020.[2] If only a third are on duty at any given time, that leaves about 223,667 officers to protect a population of 340 million—less than 0.1% of the population.

Even though may police have more training and experience, uniformed officers face greater risks and challenges. They are less likely to be near an attack when it occurs, and when they are, they are more likely to be targeted and killed. This paper is the first to compare outcomes in active shooter events based on whether armed civilians or police intervened, highlighting key differences in effectiveness and risk.

2. Data

The FBI collects data on "active shooter" incidents; that is a situation where one or more individuals actively engage in killing or attempting to kill people in a public area.[3] The FBI excludes gang and drug-related violence as well as other criminal acts such as a robbery, to focus on cases where an attacker's sole goal is to murder people in a public place such as mall, school, or movie theater. Since law enforcement agencies do not collect this data in crime reports, the FBI worked with the Advanced Law Enforcement Rapid Response Training Center at Texas State University to collect these cases from news reports. Research done at the Office of Justice Programs and Office of Legal Policy, U.S. Department of Justice points out that while the FBI generally does a good job of identifying active shooting cases and catches all the cases where law enforcement stopped attacks, the research found out that the FBI missed news reports on some cases where civilians stopped attacks and misidentified others (Lott, 2021a).[4]

We rely on the work done at the U.S. Department of Justice to fill in these missing cases for civilians who stopped attacks, but the Crime Prevention Research Center went further to fill in the missing data for more of these cases from 2014 through 2023. The FBI

[1] McLaughlin & Associates, "National – Crime Prevention Research Center, General Election Voters," August 22, 2023.

[2] Sean E. Goodison, Local Police Departments Personnel, 2020, Bureau of Justice Statistics, November 2022 (https://bjs.ojp.gov/sites/g/files/xyckuh236/files/media/document/lpdp20.pdf). Connor Brooks, Primary State Law Enforcement Agencies: Personnel, 2020, Bureau of Justice Statistics, January 2024 (https://bjs.ojp.gov/document/psleap20.pdf). Connor Brooks, Federal Law Enforcement Officers, 2020 – Statistical Tables, Bureau of Justice Statistics, September 2022 (https://bjs.ojp.gov/document/fleo20st.pdf).

[3] "Active Shooter Incidents in the United States in 2023," Federal Bureau of Investigation, U.S. Department of Justice, Washington, D.C., 2024, p. 1 (https://www.fbi.gov/file-repository/2023-active-shooter-report-062124.pdf/view). See also https://www.fbi.gov/how-we-can-help-you/active-shooter-safety-resources

[4] See also Lott (2015) for a discussion on pre-2014 data by the FBI and Texas State University.

claims that there were 350 active shooting cases over those years, but we believe that there were 531 – the difference almost completely involving 166 additional active shooting incidents stopped by civilians. That data was based on Nexis searches and defensive gun use cases from the Heritage Foundation, Defensive Gun Use Tracker, Gun Violence Archive, the American Rifleman, and Reddit that met the FBI's definition of an active shooting.[5] We checked all those sources to see if they had cases that confirmed to the FBI's definition of active shootings, and only a small fraction of these cases met that definition.[6] For example, over the five years from 2019 to 2023, the Heritage Foundation identified 3,872 defensive gun uses. And the Gun Violence Archive in a list that doesn't contain all the same cases over the nine years from 2015 to 2023 has 14,514 defensive gun uses. As with the Texas State University data, all these cases were based on news reports. News reports are also increasingly being used in academic research, see e.g., Kleck (2020) and Viscusi and Blasinsky (2022).

The FBI and additional data we collected identifies if law enforcement stopped the attack in progress, the shooter committed suicide before law enforcement arrived, the shooter was apprehended after the attack at a different location, the shooter remains at large, or armed/unarmed citizens/security guards subdued or killed the attacker. Law enforcement and civilians are not counted as stopping the attack if shooter commits suicide or leaves the scene before they arrive. These cases comprise the omitted class for comparison purposes. The remaining cases are those that were stopped by armed citizens or by the police.

There were no cases where both armed civilians and law enforcement were at the scene stopping attack at the same time. When armed civilians stopped an attack, the police usually arrived well after the attacks had ended. There are two instances that come closest to police being on the scene at the same time as civilians who were trying to stop an attack. On June 21, 2021, a civilian with a concealed handgun permit had already long stopped the active shooting in Arvada, Colorado when police arrived. Unfortunately, he was fatally shot by a police officer. On November 23, 2018, a civilian with a concealed handgun permit at a mall in Hoover, Alabama was attempting to aid a wounded civilian when he was shot by police after the attack had ended.

[5] The keywords in Nexis and Google news searches included "murder" or "murdered" or "murders" or "wounded" and "gunfire," "shot," "shots," or "active shooting."
https://twitter.com/DailyDGU
• https://www.dailysignal.com/author/amy-swearer/
• https://datavisualizations.heritage.org/firearms/defensive-gun-uses-in-the-us/
• https://www.gunviolencearchive.org/
• https://www.americanrifleman.org/armed-citizen
• http://www.gooddiggin.com/-ramblings--smiles/stories-from-june-of-law-abiding-citizens-who-chose-not-to-become-just-another-victim
• https://www.reddit.com/r/dgu/

[6] So that people can check, the cases along with links to the news stories are available here (https://crimeresearch.org/2024/07/updated-cases-where-armed-citizens-have-stopped-active-shooter-incidents/).

Examples in the FBI active shooting data where the police responded but did not stop the attack include the following:

> On May 3, 2023, between 11:59 a.m. and 12:08 p.m., a male shooter, 24, armed with a handgun, began shooting people inside Northside Family Medicine and Urgent Care in Atlanta, Georgia. One person (patient) was killed; four people (two employees) were wounded. The shooter was apprehended by law enforcement at another location.
>
> On June 5, 2014, at 3:25 p.m., 26-year-old Aaron Rey Ybarra began shooting inside Otto Miller Hall at Seattle Pacific University in Seattle, Washington. As he reloaded his shotgun, a student pepper-sprayed and tackled him. The student, along with others, restrained Ybarra until police arrived. Ybarra killed one person and wounded three.
>
> On January 20, 2017, at 7:36 a.m., 17-year-old Ely Ray Serna began shooting inside West Liberty-Salem High School in West Liberty, Ohio. After assembling his shotgun in a bathroom, Serna shot a student who walked in and fired at a responding teacher. He also shot through classroom door windows. Eventually, Serna returned to the bathroom, where school staff confronted and subdued him. Law enforcement then took him into custody. He wounded two students but killed no one.

A complete list of cases where civilians have stopped active shooting attacks as well as links to the underlying news stories is available at the Crime Prevention Research Center.[7] For example

> Around closing time at a suburban Indianapolis mall, a heavily armed gunman fired 24 times on a food court within 15 seconds. Several people were shot, three of them fatally. Almost as soon as the gunman began firing, a 22-year-old shopper with a concealed carry permit was able to shoot and kill him, stopping further bloodshed. No charges were filed against the armed citizen. Police say the good Samaritan had no police training or military background. Despite this, he was able to save countless lives.
>
> At the Gold Nugget nightclub in Panama City was closing, the suspect walked outside. After being locked out of the business and enraged over lost property, he got a firearm from his car and began firing into the club occupied by multiple patrons and staff. A patron who is a concealed weapon license holder intervened

[7] Staff, "UPDATED: Cases where armed citizens have stopped active shooter incidents," Crime Prevention Research Center, https://crimeresearch.org/2024/07/updated-cases-where-armed-citizens-have-stopped-active-shooter-incidents/ An Excel file that documents where attacks have occurred in places where permit holders are allowed to carry is available here https://crimeresearch.org/wp-content/uploads/2024/07/Cases-where-armed-citizens-have-stopped-active-shooter-incidents_2023-with-FBI-data-and-gun-free-zone-info_updated.xlsx

and fired multiple rounds, striking the suspect at least once. Officers said the patron's actions were determined to be in self-defense and the self-defense of others.

Researchers are increasingly relying on newspaper articles to create data sets, such as those compiled by the Gun Violence Archive, to study gun control. But these studies consistently overlook a key question: Do news articles reflect reality? Is this data accurate? The media's tendency to focus on dramatic incidents ties directly to the old journalism adage, "If it bleeds, it leads." For example, the media disproportionately covers defensive gun uses when the attacker is killed or wounded versus cases when a gun is simply brandished (Lott, 2021b).

Despite the well-known bias in news coverage, academic studies ignore how selective reporting distorts our understanding of gun violence. Our research tackles this gap by comparing how the media covers civilian and police interventions in active shooter incidents. We start by assuming that when legally armed civilians and police face similarly violent situations—such as the same number of people killed during an active shooting—the media will report both types of cases. To test that assumption, we measure whether there are systematic biases in how the media covers the cases where civilians and police stop active shootings. In Section 5, we dig deeper by analyzing the subset of high-threat cases where many lives were threatened to test the robustness of our findings and better understand the extent of media bias.

The dataset contains information on both police and armed citizen responses to active shooter events. The continuous and policy variables are summarized in Table 1. Binary and categorical variables are summarized in Table 2.

Table 1: Continuous variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Year	531	2019.76	2.59	2014	2023
Killed	531	1.76	4.41	0	58
Wounded	531	3.72	21.66	0	489
Casualties	531	5.47	24.79	0	547
Police officers killed	351	0.08	0.40	0	5
Police officers wounded	351	0.28	0.98	0	9
Constitutional carry law	531	0.26	0.44	0	1
Pct pop w/rtc permits	531	8.38	5.41	0	32.49
Population in 100,000 units	531	132.51	108.86	6.47	394.38

Note: Vermont has had a constitutional carry law since it became a state, zero concealed carry permits.

Table 2: Binary and categorical variables

Variable	Frequency	Percent
Active shooting incident stopped by police	158	30.86
Active shooting incident stopped by armed citizen	180	34.96
Neither	193	34.18
Armed citizen outcome		
(Percentages based on armed citizens responding first, N=180)		
Mass shooting averted	58	32.22
Suspect fired first	115	63.88
Suspect with gun, armed citizen fired first	7	3.88
Shot wrong person	1	0.56
Killed wrong person	0	0.00
Interfered with police	0	0.00
Had gun taken away	0	0.00
Armed citizen injured	45	25.00
Armed citizen killed	2	1.11
Police outcome		
Percentages based on police responding first, N=351		
Suspect killed at the scene	124	35.33
Suspect apprehended later at another location	106	30.20
Suspect committed suicide after police arrive	34	0.97
Other	87	24.78
At least one police officer killed	19	5.41
At least one police officer wounded	48	13.68

Police officer killed by friendly fire	2	0.57
Percentages based on police attempting to stop attack, N=158		
Police killed wrong person (civilian)	1	0.63
Police wounded wrong person (civilian)	1	0.63

Note: in one event, undercover officers shot and killed the wrong person after the shooter had fled.

The first takeaway, assuming our count is complete, is that armed citizens have stopped more active shooter incidents than the police have, although the difference is not statistically significantly. Also, armed citizens do not appear to interfere with the police or blunder so badly as to get their weapon taken away by the shooter or kill the wrong person. In a later section we test the hypothesis that innocent bystanders are equally likely to be shot by an armed citizen as by a police officer. Finally, according to police, armed citizens have stopped 58 active shooter events which otherwise were likely to have escalated into mass public shootings – where "many" people risked being murdered.

3. Methodology

The identification strategy is straightforward. We have data on individual active shooter incidents. We exploit the exogenous variation of the inherently unpredictable active shooter events. There is no simultaneity between the dependent variable, for example the number of casualties, and the independent variables such as a dummy variable for an armed citizen stopping the shooting or a dummy indicating that police stop the attack. The data set is an unbalanced panel dataset covering cities in nearly all states for the years 2014-2023. We include state and year dummy variables to control for unobserved heterogeneity and robust standard errors to control for any heteroskedasticity. Section 5 provides several alternatives to address the unbalanced nature of this panel.

There are three possible endogeneity problems left. First is the possibility of omitted variable bias. The second is a possible bias in what news stories the media covers. For example, does the media systematically ignore a nonrandom type of case involving either civilians or police? The third is armed civilians might deliberately avoid confronting the most dangerous attackers, leaving police to face the riskiest situations. As a result, police may end up handling cases with higher casualty counts.

With respect to omitted variable bias, it is necessary to ensure that the armed citizens face risks similar to those of police officers when confronting active shooter incidents. To make this comparison, we control for key factors such as the planning or lethality of the shooter and the type of venue (school, business, open area, etc.). We suspect that more detailed planning and greater lethality in attacks correlate with factors such as the number of shooters, the variety and quantity of weapons, the attacker's age, and whether the attacker used explosives, body armor, or additional weapons like knives. For instance, prior research (Lott, 2016, pp. 120–121) found that the deadliest mass public shootings often involved attackers carrying multiple types of firearms. By holding constant the degree of planning, the attack's lethality, and the venue type, we aim to isolate and compare the actual risk each group faces during these high-stakes encounters.

We also try to compare similar cases another way. While there are no cases involving armed civilians where four or more people have been killed, presumably because the civilians were already there or on the scene relatively quickly, there are 58 cases where the police stated that the armed citizen stopped an attack that likely would have otherwise resulted mass public shooting. In the robustness section, we compare that group of armed civilians to the 38 mass public shootings stopped by police.

We include state and year dummy variables in our regression models. In the robustness section we replace the state fixed effects with city fixed effects. While we effectively lose half of our sample, the results are the same.

Even after accounting for these different factors, the average number of casualties is higher for events where the police responded compared to events where armed citizens responded. This is what we would expect if armed citizens were on the scene and unknown to the shooter, allowing them to respond immediately. Police usually arrive later, giving the shooter time to wreak havoc.

Given that we hypothesize that uniformed police are at a tactical disadvantage relative to civilians who are carrying concealed, the ideal experiment would be to compare uniformed police officers who are already on the scene in civilian clothes, but we can find only two cases where a non-uninformed officer was nearby when the attack occurred. An alternative approach is to provide additional qualitatively different predictions from this hypothesis, namely that if a uniformed officer is on the scene when an attack occurs, they are more likely to be killed or wounded than a civilian who is carrying concealed and thus not as quickly identifiable.

With respect to selection bias by the news media, if there is selective reporting it could have serious implications for any study of the relative effectiveness of armed citizens and police officers with respect to active shooter incidents. For example, if the news stories covered all the cases where civilians were involved in stopping attacks but systematically ignored police cases where few people were murdered or wounded, it would make it appear as if there were more casualties involving attacks stopped by police.

Yet, the opposite appears to be the case. News outlets tend to provide far more detail when police stop attacks than when civilians do. Of the 180 cases where permit holders stopped active shootings, 69 (38.3%) cases didn't mention the firearm used by the attacker. By contrast, of the 158 cases that police stopped, the type of weapon used by the attacker was omitted in only 12 (7.6%) of the cases. Not surprisingly, the cases that were missing this information had fewer casualties, with 1.9 fewer murders and 3.1 fewer people wounded.

There is a similar gap for news stories failing to mention the age of the attacker, with discussions of the attacks involving police much more likely to mention the attacker's age. Of the 180 cases where permit holders stopped active shootings, 33 (18%) of the cases didn't mention the age of the attacker. By contrast, of the 158 cases that police stopped, the age of the attacker was mentioned in all the cases. Not surprisingly, the cases that were missing this information had 1.8 fewer murders.

The simple regressions reported in Table 3 illustrate how murders, though not woundings, drive news coverage.

Table 3: Does Media Coverage Vary with the Number of Casualties?

Variables	(1) Killed	(2) Wounded	(3) Casualties
No information on weapon used	-1.164**	-0.477	-1.641
	(-2.07)	(-0.17)	(-0.51)
State and year fixed effects	Yes	Yes	Yes
Observations	531	531	531
No information on age	-1.347*	-0.196	-1.543
	(-1.88)	(-0.05)	(-0.38)
State and year fixed effects	Yes	Yes	Yes
Observations	531	531	531

Notes: t-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1

If armed civilians arrive at the scene faster and limit the number of people harmed, the media may give them less coverage than police. Still, we must ask whether the media finds civilian interventions inherently less newsworthy—even after controlling for the number of people killed or wounded and other factors.

To explore this, we ran a probit regression using a dummy variable as the dependent variable. This dummy equals 1 when a media report omits the type of weapon used, and 0 when it includes it. In our first model, we included several explanatory variables: whether an armed citizen or the police stopped the attack (with attacks stopped by neither as the reference group), the number of fatalities, the number of injuries, and fixed effects for states and years to account for variations in media coverage by location and time.

In our second estimate, we added venue indicators to determine whether certain locations—like schools—receive more detailed media coverage. We also included the number of attackers to test whether coordinated assaults garner greater attention. We performed a Chi-square test on the null hypothesis that media coverage of police and armed citizen interventions is equally likely, controlling for the other variables. Table 4a presents our results.

Table 4a: Does media coverage of the weapon used by the attacker vary between armed citizens and police?

Variable	(1) Missing	(2) Missing
Armed citizen stopped	0.477***	0.513***
	(5.40)	(5.78)
Police stopped	-0.426	-0.187
	(-1.03)	(-0.54)
Killed	-6.283*	-5.148*
	(-1.84)	(-1.79)
Wounded	-0.638	-0.199
	(-0.99)	(-0.34)
Commerce		0.402
		(0.59)
Open Space		0.322
		(0.64)
Residential area		0.018
		(0.20)
School		0.216
		(1.22)
Number of shooters		0.129
		(0.26)
State and year fixed effects	Yes	Yes
Observations	428	388
Chi2 test comparing civilians and police	21.61	16.26
P-value	0.000	0.000

Notes: probit regression; dependent variable is a dummy variable taking 1 if the weapon type is missing, zero if not missing, robust z-statistics in parentheses*** p<0.01, ** p<0.05, * p<0.1; chi-square tests the null hypothesis that the coefficients on armed citizen and police are equal. As a group the state and year fixed effects are statistically significant.

The coefficient on the armed citizen dummy variable is positive and highly significant. The chi-square test is also highly significant indicating that armed citizens get significantly more missing values than the police even if we control for the number killed, wounded, venue, and number of shooters, as well as state and year fixed effects. The results show that when a civilian stops an active shooting attack, news stories are 48-51 percent more likely to omit the type of firearm used than when police stop the attacks. This pattern holds even after controlling for other factors. The number of people killed is the only other variable that significantly influences whether reporters mention the weapons used. A one-percent increase in the number of deaths reduces the probability of omitting the weapon by 5-6 percent.

We used the same approach for the missing information on the age of the attacker, but since the attacker's age is never missing when the police stopped a shooter, the coefficient for police stops is perfectly predicted and missing from the probit regressions, so we have also provided OLS estimates. The results shown in Table 4b are consistent with those shown for missing information on the weapons used in the attack.

Table 4b: Does media coverage of the age of the attacker vary between armed citizens and police?

Variables	(1) OLS	(2) Probit	(3) OLS	(4) Probit
Armed citizen	0.112***	0.401**	0.103***	0.445**
	(3.16)	(1.99)	(2.86)	(2.11)
Police stopped	-0.058***		-0.055***	
	(-3.10)		(-2.95)	
Killed	-0.006**	-7.200**	-0.005**	-4.094**
	(-2.41)	(-1.99)	(-2.17)	(-2.37)
Wounded	0.001***	0.147	0.001***	0.201
	(3.06)	(0.38)	(2.66)	(0.60)
Commerce			-0.053	-0.142
			(-0.31)	(-0.15)
Government			-0.063	
			(-0.36)	
House of Worship			-0.071	
			(-0.41)	
Open Space			-0.037	-0.449
			(-0.21)	(-0.52)
Residential area			-0.040	0.005
			(-0.22)	(0.08)
School			-0.063	
			(-0.36)	
Health services			-0.080	
			(-0.45)	
Number of shooters			0.040	0.380
			(0.66)	(0.69)
State and year fixed effects	Yes	Yes	Yes	Yes
Observations	531	292	530	266
Chi2 test comparing armed citizen and police	29.45	3.38	24.88	3.91
	0.000	0.066	0.000	0.048

Note: robust t- or z-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1; chi-square tests the equality of the police and armed citizen coefficients.

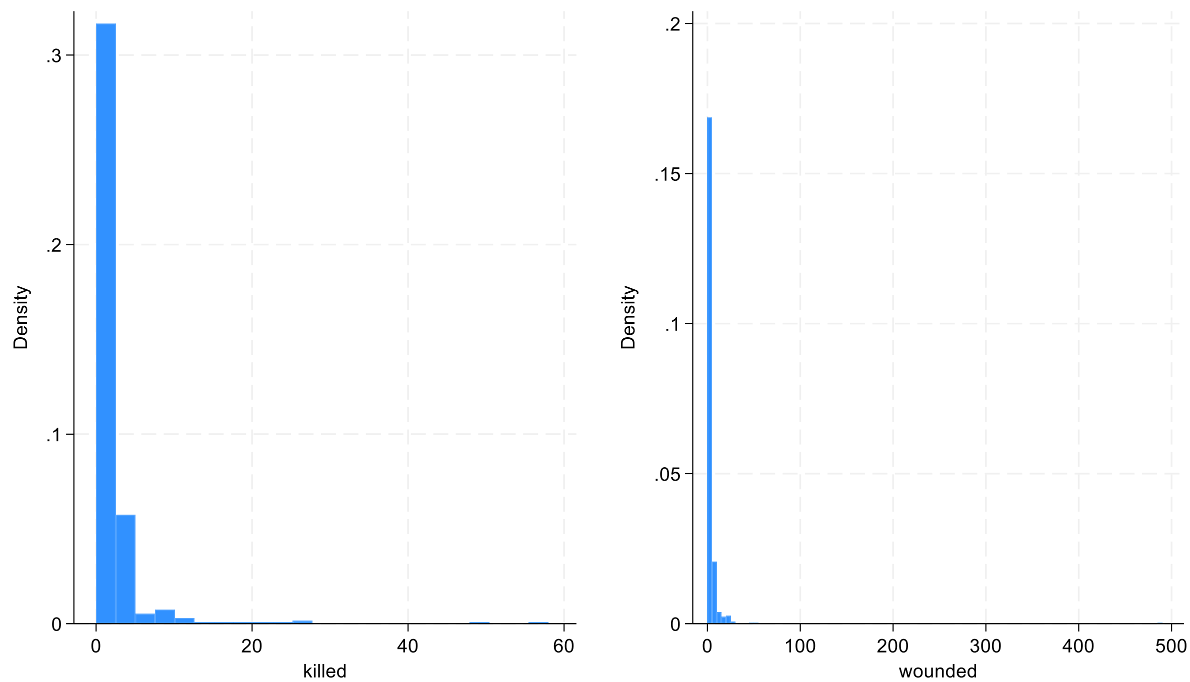
Again, the coefficient on the armed citizen variable remains positive and significant, while the OLS estimates show that when police stop the attack, the coefficients are negative and significant. These results indicate that news stories are significantly more likely to include the shooter's age when police intervene, and more likely to omit it when armed civilians do, even when the attacks are otherwise similar. The chi-square test is significant indicating that armed citizens get significantly more missing values than the police even if we control for the number killed, wounded, venue, and number of shooters, as well as state and year fixed effects.

These disparities raise a serious concern: when reports of civilian interventions lack detail, the media might also skip covering them altogether. If an armed citizen stops an attack without any casualties, are news outlets less likely to report the incident? If so, the truncated dataset overstates the likelihood of death or injury during civilian interventions, thus biasing the coefficient on armed citizens upward. As a result, the data unfairly undermine the effectiveness of armed citizens compared to police officers in active shooter scenarios. The Appendix expands on this point with a Monte Carlo demonstration and simulation test.

All of the dependent variables in this study are limited one way or another by the granular nature of the individual observations. There are several choices that can be made concerning how to analyze such data. If the dependent variable is binary and we are willing to assume a normal approximation, then we can test that the difference between two probabilities is equal to zero using Stata’s *prtest* command. If we are unwilling to make the normality assumption or want to use control variables, then we have to choose between probit and logit, with the attendant tradeoffs. Since the choice between probit and logit is somewhat arbitrary (Cameron and Trevidi 2010, pp. 459-479), we report the simple difference between two probabilities and the corresponding probit regression, but we estimate the corresponding logit results in the robustness section.

If the dependent variable is count data with a skewed distribution, like the number of people killed in the active shooter event, then we use a negative binomial regression model, which incorporates and collapses to the Poisson model if the mean and variance are approximately equal. (Cameron and Trividi 1998, pp. 59-85; Cameron and Trevidi 2010, pp. 567-581) Figure 1 shows the histograms for the number killed and the number wounded in active shooter attacks.

Figure 1: Histograms for people killed and people wounded



Obviously, both dependent variables are highly skewed with the majority of values close to or equal to zero with a small number of relatively large outliers. The mean number of people killed is 1.76 while the variance is 19.4. The corresponding values for the mean and variance for number killed are 3.72 and 469.2. These variances indicate very large, possibly significant, overdispersion leading us to choose the negative binomial model. Casualties, being the sum of these two variables, will also have a skewed distribution.

4. Results

4.1 Killed, wounded, and total casualties

We estimate four models for each of the categories (killed, wounded, and total casualties). Model (1) is a simple negative binomial regression of the number of people killed on the two variables of interest: was the incident stopped by police or by one or more armed citizens? Model (2) includes two control variables: a dummy variable indicating passage of a constitutional carry law, where a permit is no longer required to carry, and a continuous variable indicating the proportion of the adult population with concealed carry permits. These variables act as proxies for how likely it is that an armed citizen will be present during an attack. The sooner someone with a gun can respond, the fewer people the attacker can kill. In states with constitutional carry laws the percent of the adult population with permits might not provide a very accurate measure of how many people are carrying. Model (3) adds seven additional control variables: the number of shooters, the shooter's age and age-squared, the number of guns the shooter was armed with, whether the shooter used a rifle or shotgun, and if the shooter used multiple weapon types. We use these variables to control for the intentional lethality of the shooter. Finally, in Model (4) we add variables controlling for the use of other weapons (explosives or knives), body armor and the type of venue (commerce, government, health services (e.g., hospital, doctor or dentist office), churches or other houses of worship, outdoors in open space, and schools). The omitted category for weapons is handguns and the omitted class for venue is residential neighborhood.

All models include the state population as an exposure variable as well as state and year fixed effects. A chi-square test of the equality of the coefficients on armed citizens and police is reported in the bottom two rows. Results for the number of victims killed are presented in Table 5.

Table 5: Victims killed in Attacks Stopped by Armed Civilians or Police

Variables	(1)	(2)	(3)	(4)
Armed citizen	-2.490***	-2.501***	-2.025***	-1.859***
	(-5.67)	(-5.75)	(-4.69)	(-4.65)
Police	0.963***	1.017***	0.724**	0.974***
	(3.07)	(3.22)	(2.45)	(3.04)
Constitutional carry law		-1.002**	-0.866*	-0.577
		(-1.97)	(-1.74)	(-1.22)
Percent population with right-to-carry permits		0.032	0.039	0.059
		(0.51)	(0.56)	(0.84)
Number of shooters			0.394	0.089
			(0.89)	(0.16)
Age of shooter			-0.121**	-0.096*
			(-2.49)	(-1.91)
Age squared			0.001**	0.001*
			(2.45)	(1.75)
Number of guns			0.430***	0.485***
			(2.60)	(2.73)
Rifle			1.467***	1.157***
			(3.20)	(2.70)
Shotgun			-0.782	-0.660
			(-1.12)	(-0.93)
Multiple weapon types			0.585	0.184
			(1.12)	(0.37)
Explosives				0.449
				(0.33)
Knife				0.728
				(0.77)
Body armor				1.156
				(1.08)
Commerce				0.922
				(1.42)
Government				-0.211
				(-0.26)
Health services				0.600

				(0.71)
House of Worship				2.818***
				(2.59)
Open Space				-0.566
				(-0.84)
School				0.574
				(0.76)
State and year fixed effects	Yes	Yes	Yes	Yes
Observations	531	531	467	467
Chi2 test comparing armed citizen and police	44.37	43.50	32.32	35.45
P-value	0.000	0.000	0.000	0.000

Notes: negative binomial; coefficients are the change in the number killed as the dummy variables go from zero to one; robust z-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1; chi-square tests the null hypothesis that the coefficients on armed citizen and police are equal; all models include state population as an exposure variable. As a group the state and year fixed effects are statistically significant.

Table 5 shows that armed citizens reduce the number of deaths in active shooter incidents significantly more than the police do. In fact, armed citizens reduce the number of people killed by 1.9-2.5 while the police increase the number killed by 0.7 to 1.0 in comparison to the omitted class (shooters who are arrested later or stopped by unarmed citizens or stop of their own accord). This does not mean that calling the police results in more deaths. In the absence of an armed civilian on the scene, there is no other choice otherwise the death toll would be higher. The results simply indicate that police are less effective than armed citizens in reducing the number of deaths associated with active shooter incidents. If the police were already in the location and not in uniform, the number of casualties would almost certainly be lower. The Chi-square test of the equality of the armed citizen and police is significantly different from zero for all four models. Also, states with a constitutional carry law experience fewer people killed in active shooter incidents (0.6 to 1.0), significantly different from zero at the 10 percent or better level in two out of three models, presumably because there are more armed citizens available in public places to stop attacks.

While more guns and rifles are associated with more people being killed, the results show that adding each additional gun to the mix has about a three to four times larger impact on the number of people killed than simply using a rifle. The older the age of the attacker the more people who are killed and it increases at an increasing rate. Houses of Worship also resulted in about 2.8 more people killed in each incident.

The results for the number of people wounded in these incidents are shown in Table 6.

Table 6: Number of people wounded in Attacks Stopped by Armed Civilians or Police

Variables	(1)	(2)	(3)	(4)
Armed citizen	-3.718***	-3.769***	-2.925***	-2.884***
	(-4.78)	(-4.71)	(-5.08)	(-5.12)
Police	0.354	0.399	0.245	0.325
	(0.77)	(0.86)	(0.54)	(0.65)
Constitutional carry law		-1.550**	-1.342*	-1.155
		(-2.06)	(-1.85)	(-1.58)
Percent population with right-to-carry permits		0.191	0.257	0.225
		(1.17)	(1.53)	(1.25)
Number of shooters			0.655	-0.302
			(0.62)	(-0.21)
Age of shooter			-0.240***	-0.230***
			(-3.13)	(-2.74)
Age squared			0.003***	0.002**
			(2.71)	(2.42)
Number of guns			1.074***	1.071***
			(2.71)	(2.63)
Rifle			2.722***	2.635***
			(3.53)	(3.44)
Shotgun			-0.397	-0.615
			(-0.32)	(-0.48)
Multiple weapon types			0.330	0.120
			(0.36)	(0.13)
Explosives				2.979
				(0.85)
Knife				-0.622
				(-0.27)
Body armor				0.657
				(0.34)
Commerce				0.823
				(0.74)
Government				0.797
				(0.59)
Health services				-0.714
				(-0.46)
House of Worship				1.903
				(1.14)
Open Space				0.275
				(0.25)
School				0.605
				(0.52)
State and year fixed effects	Yes	Yes	Yes	Yes
Observations	531	531	467	467
Chi2 test comparing armed citizen and police	23.96	23.55	24.17	22.35
P-value	0.000	0.000	0.000	0.000

Notes: negative binomial; coefficients are the change in the number wounded as the dummy variables go from zero to one; robust z-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1; chi-square tests the null hypothesis that the coefficients on armed citizen and police are equal; all models include state population as an exposure variable. As a group the state and year fixed effects are statistically significant.

Armed citizens reduce the number of people wounded in active shooter incidents by 2.9-3.8 while the police have no significant effect. This difference in effectiveness is significant at better than the one percent level. Constitutional carry laws reduce the number of people wounded by 1.1-1.6 and are significant at the 5-10 percent level for a two-tailed z-test in two of three models. The results for the age of the attacker and the use of multiple guns and whether a rifle is used are very similar to the results in Table 5.

The results for the total number of people killed and injured in active shooter incidents are shown in Table 7.

Table 7: Total Casualties in Attacks Stopped by Armed Civilians and Police

Variables	(1)	(2)	(3)	(4)
Armed citizen	-6.129***	-6.176***	-4.968***	-4.805***
	(-6.25)	(-6.24)	(-6.41)	(-6.52)
Police	1.197*	1.280**	0.809	1.162*
	(1.86)	(1.98)	(1.36)	(1.75)
Constitutional carry law		-2.394**	-2.195**	-1.805*
		(-2.36)	(-2.25)	(-1.93)
Percent population with right-to-carry permits		0.177	0.262*	0.259
		(1.17)	(1.71)	(1.57)
Number of shooters			1.050	-0.219
			(0.71)	(-0.12)
Age of shooter			-0.347***	-0.320***
			(-3.53)	(-2.99)
Age squared			0.004***	0.004***
			(3.16)	(2.65)
Number of guns			1.592***	1.619***
			(3.33)	(3.21)
Rifle			4.181***	3.861***
			(3.75)	(3.60)
Shotgun			-0.955	-1.147
			(-0.63)	(-0.73)
Multiple weapon types			0.707	0.248
			(0.58)	(0.21)
Explosives				3.576
				(0.73)
Knife				0.393
				(0.14)
Body armor				2.061
				(0.81)
Commerce				1.800
				(1.23)
Government				0.811
				(0.47)
Health services				-0.269
				(-0.15)
House of Worship				4.648**
				(1.96)
Open Space				-0.257
				(-0.17)

School				1.074
				(0.70)
State and year fixed effects	Yes	Yes	Yes	Yes
Observations	531	531	467	467
Chi2 test comparing armed citizen and police	41.45	40.95	40.57	40.20
P-value	0.000	0.000	0.000	0.000

Notes: negative binomial; coefficients are the change in the number of casualties as the dummy variables go from zero to one; robust z-statistics in parentheses*** p<0.01, ** p<0.05, * p<0.1; chi-square tests the null hypothesis that the coefficients on armed citizen and police are equal; all models include state population as an exposure variable. As a group the state and year fixed effects are statistically significant.

As might be expected, the results for the total number of casualties show that armed citizens reduce the number of casualties significantly more than the police do. Armed citizens reduce the number of casualties by 4.8-6.2 while police response results in a small increase that is significant in three out of four models. Constitutional carry states have significantly fewer people killed and wounded in active shooter events than other states presumably because more armed citizens are available to intervene quickly and effectively.

Overall, the results are very similar for all three injury categories. The number of people killed, wounded, or the total number of casualties is significantly reduced if armed citizens stop the attack compared to the situation where the police stop the attack. Constitutional carry states have significantly fewer casualties in active shooter incidents presumably because the probability of an armed citizen being on the premises is higher.

4.2 An alternative identification strategy

We hypothesize that armed citizens stop active shooter incidents with fewer casualties than police because they have a tactical advantage. Uniformed police usually arrive minutes later or are targeted first because they're easily identifiable. So armed civilians are more likely already at or near the scene, wear plain clothes, and carry concealed weapons, allowing them to act quickly before the shooter identifies the threat.

While we have worked to control for factors like the planning or lethality of the shooter—and will later compare mass public shootings stopped by armed citizens with those stopped by police—some argue that armed civilians somehow avoid the most dangerous attackers, leaving police to confront the riskiest situations and resulting in higher casualty counts. While that theory sounds plausible, we need evidence to evaluate it. To test it properly, we need an instrumental variable—one that is exogenous with respect to casualty numbers but does closely predict whether an armed civilian intervenes.

We focus on gun-free zones, which exist in every state and include venues like schools, government buildings, and some private businesses. These areas legally prevent civilians from carrying guns, making civilian intervention less likely. Because the laws governing gun-free zones is determined long before any attack, it's exogenous to casualties. This allows us to generate an instrument by regressing the dummy variable for an armed civilian stopping an attack on the dummy variable for a gun-free zone and replacing the armed citizen dummy variable with its predicted value.

However, strong evidence shows that serious attackers often target gun-free zones, knowing armed civilians are unlikely to be there. The diaries and manifestos of mass shooters reveal that many of them explicitly choose these locations because they expect their victims to be defenseless.[8]

We expect gun-free zones to increase casualties in mass shooting events. This positive association inflates the estimated coefficient on the instrumented armed citizen variable, reducing or even eliminating the observed difference in casualties between armed civilians and police. Because this bias works against our hypothesis—that armed civilians hold a strategic advantage—we are confident in using the instrumental variable approach. Our appendix includes a Monte Carlo simulation that reinforces this point.

We identified 249 incidents in our dataset where the venue's gun-free status could be confirmed. Gun-free zones are negatively correlated with armed citizens stopping attacks, and those zones are exogenous to casualty counts because they're established long before the attacks—almost always decades earlier. States adopted Right-to-Carry laws to replace complete concealed carry bans or restrictive May Issue laws, but they initially included long lists of gun-free zones (Lott, 2010). Over time, states consistently reduced the number of these zones. None of the Right-to-Carry or Constitutional Carry states added more gun-free zones over time, so the gun-free zones in place during the 2014–2023 study period had already existed for decades before the incidents occurred.

The presence of armed civilians capable of stopping an attack depends not only on whether there is a gun-free zone, but also whether a state allows constitutional carry and the percentage of adults holding concealed handgun permits. However, potential shooters

[8] The 2012 Batman movie theater shooter scouted seven theaters within 20 minutes of his apartment that were showing the new Batman movie that night—and chose the only one that banned guns. In 2015, Charleston Church shooter Dylann Roof told a friend he initially planned to target a school but "couldn't get into the school because of the security," so he "just settled for the church." Similarly, the Nashville Covenant School shooter had originally considered the Green Hills Mall as her primary target but rejected it because it had "too much security" and allowed people to carry permitted concealed handguns—unlike the school she ultimately attacked. Staff, "Friend of Dylann Roof says suspect planned attack on College of Charleston," Fox News, November 28, 2015 (https://www.foxnews.com/us/friend-of-dylann-roof-says-suspect-planned-attack-on-college-of-charleston). John R. Lott, Jr., "Colorado shooter single out Cinemark theater because it banned guns?" Fox News, September 10, 2012 (https://www.foxnews.com/opinion/did-colorado-shooter-single-out-cinemark-theater-because-it-banned-guns). Lydia Fielder and Tony Garcia, "Nashville school shooter purchased 7 guns, planned attack on multiple locations, police say," WSMV, March 27, 2023 (https://www.wsmv.com/2023/03/28/nashville-school-shooter-purchased-7-guns-planned-attack-multiple-locations-police-say/). For a longer list of cases, see Staff, "UPDATED: How mass killers pick out venues where their victims are sitting ducks," Crime Prevention Research Center, March 28, 2023 (https://crimeresearch.org/2023/03/vince-vaughn-explains-the-obvious-how-mass-killers-pick-out-venues-where-their-victims-are-sitting-ducks/).

may hesitate to attack if they perceive a higher chance of encountering armed citizens, thus deterring attacks altogether. The effect on whether an active shooter stops an attack could be positively or negatively related to these other two variables. In any case, the existence of a gun-free zone is exogenous to any particular active shooter event.

We created our instrument by estimating a probit model with the dependent variable being the dummy variable corresponding to an armed civilian stopping an active shooter. The independent variables are the venue being a gun-free zone, a dummy variable for a constitutional carry law, and a continuous variable for the proportion of the adult population with a concealed carry permit. The instrument is the resulting predicted value. Since we include the constitutional carry law dummy and the percent of the population with concealed carry permits in the second stage regressions, the gun-free zone dummy is the identifying variable. The results for the first stage are presented in Table 8.

Table 8: First stage probit model: Dependent Variable is the Dummy for whether an Armed Citizen Stopped an Attack

Variables	(1)
Gun-free zone	-0.387***
	(-6.57)
Constitutional carry law	-0.194***
	(-3.44)
Percent population with right-to-carry permits	0.006
	(1.10)
Observations	249
Chi2 test for weak instruments	43.15
P-value	0.000

Note: z-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

The coefficient on the identifying variable (gun-free zone) is highly significant, with the Chi-square test statistic much greater than 10, indicating that we have a strong instrument for armed citizen response (Bound, Jaeger, and Baker, 1995; Stock and Yogo, 2005). A venue switching to a gun-free zone decreases the probability of an armed citizen stopping an attack by 39 percentage points. Passing a constitutional carry law significantly reduces the probability of armed citizens stopping active shooters presumably by reducing the number of active shooting events overall. The proportion of the population with concealed carry permits has no significant effect. The instrumental variable results for the number of victims killed or wounded are presented in Table 9.

Table 9: Negative binomial instrumental variable estimation

Variables	(1)	(2)	(3)	(4)
		Killed		
AC instrumented	-0.516	-1.491*	-0.548	0.835
	(-0.76)	(-1.95)	(-0.61)	(0.95)
Police	1.221***	1.139***	0.603	0.607
	(2.87)	(2.71)	(1.44)	(1.43)
State and year fixed effects	Yes	Yes	Yes	Yes
Chi2 test comparing armed citizen and police	5.840	10.06	1.545	0.0577
P-value	0.016	0.002	0.214	0.810
		Wounded		
AC instrumented	-1.949**	-3.383***	-3.636***	-3.980***
	(-2.08)	(-3.52)	(-3.45)	(-3.30)
Police	0.081	-0.104	-0.477	-0.164
	(0.17)	(-0.23)	(-0.83)	(-0.29)
State and year fixed effects	Yes	Yes	Yes	Yes
Chi2 test comparing armed citizen and police	4.149	10.65	7.594	7.847
P-value	0.042	0.001	0.006	0.005
		Casualties		
AC instrumented	-2.533*	-4.740***	-4.140***	-3.292**
	(-1.89)	(-3.43)	(-2.65)	(-2.11)
Police	1.235*	0.966	0.022	0.435
	(1.73)	(1.37)	(0.03)	(0.54)
State and year fixed effects	Yes	Yes	Yes	Yes
Chi2 test comparing armed citizen and police	7.705	16.55	6.266	4.522
P-value	0.006	0.000	0.012	0.034
Observations	249	249	204	204

Notes: Z-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1; negative binomial; control variables suppressed to conserve space; models are the same as those in Tables 5-7; coefficients are the change in the dependent variable (e.g., number killed) as the dummy variable goes from zero to one; the chi-square tests the null hypothesis that the coefficients on armed citizen and police are equal; all models include state population as an exposure variable.

The results remain consistent with Tables 5–7, although the standard errors are larger. In 11 of the 12 models, the coefficient on the instrumented armed citizen variable is smaller than the corresponding police response coefficient. The one exception—model four on the number of people killed—shows a larger armed citizen coefficient, but it is not significantly different from the police coefficient. In 10 out of the 12 estimations, the instrumental variable coefficient for the armed citizen dummy is significantly smaller than the corresponding police coefficient.

Next, we use the control function approach (Wooldridge 2015; Mullahy 1997) as an alternative method for instrumenting the armed civilian variable. In the first stage, we regress the armed citizen dummy on the gun-free zone dummy and all other exogenous variables. We then plug the residuals from this regression into the equation of interest as an additional explanatory variable. This process yields a consistent estimate of the coefficient on armed citizen.

However, on top of the sample size being reduced by more than 50%, this method has an additional limitation: we can't use a probit model to generate residuals due to its nonlinear structure and bounded dependent variable. As a result, we rely on ordinary least squares in the first stage, which provides consistent but inefficient second-stage estimates.

We include these results in the robustness section of the online supplemental materials. They confirm our main finding: active shooter events stopped by armed citizens result in fewer casualties than those stopped by police. The results also support our interpretation of an upward bias in the instrumental variable estimates shown in Table 9.

4.3 Is it more dangerous for armed citizens or police?

In this section we look at the probability of being killed if the person responding is an armed citizen compared to the same risk for a police officer. The dependent variable is a dummy variable indicating that there were one or more deaths among the first responders. In this case we can use the simple difference between two means to see if the probabilities are equal. The result is shown in Table 10.

Table 10: Difference between two probabilities that armed civilians or police are killed or wounded in stopping active shooter events

	Cases	Deaths	Probability
Armed citizen	180	2	0.011
Police stopped	158	26	0.165
Difference			-0.153
Z-score			-5.11
P-value			0.000
	Cases	Injuries	Probability
Armed citizen	180	45	0.250
Police stopped	158	95	0.601
Difference			-0.358
Z-score			-6.55
P-value			0.000

Note: assumes normal distribution.

According to the simple difference between two probabilities analysis, the police are significantly more likely to be killed or wounded in an active shooter event than an armed citizen. For example, the probability of an armed citizen being killed while attempting to stop an active shooter is one percent. The corresponding probabilities for police officers responding to an active shooter incident is 16.5 percent. The results for non-fatal injuries are similar. The corresponding probit regression results are presented in Table 11.

Table 11: Probit models: probabilities that armed citizens or police are killed or injured

VARIABLES	(1) Fatality	(2) Injury
Police stopped	0.164***	0.244***
	(3.30)	(5.09)
Armed citizen		0.271***
		(5.70)
State and year fixed effects	Yes	Yes
Observations	201	471
Chi2 test comparing armed citizen and police	10.89	0.43
P-value	0.000	0.510

Notes: z-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1; for fatalities, the armed citizen dummy predicted the outcome perfectly; the chi-square tests the null hypothesis that the coefficient for armed citizens equals that for police.

These results corroborate some of the simple analysis above. With respect to the probability of being killed while stopping an active shooter event, an armed citizen has a zero probability of being killed compared to the police officer's 9.4 percent. This difference is highly significant. However, the probabilities with respect to a first responder being injured is almost exactly the same for both armed citizens and police officers. Overall, it is safer for first responders if they are already on the premises, respond quickly with a concealed weapon, and are not wearing a uniform.

With respect to unfortunate mishaps, Table 2 shows that armed citizens have shot the wrong person once while police officers have shot the wrong person twice. Table 2 also shows that armed citizens have never killed the wrong person, while the police have killed the wrong person three times including friendly fire. Table 12 shows the result of a simple analysis of the difference between the two probabilities of shooting the wrong person.

Table 12: Probability of shooting wrong person

	Cases	Shootings	Probability
Armed citizen	180	1	0.006
Police stopped	158	4	0.025
Difference			-0.020
Z-score			-1.50

P-value	0.13

Note: assumes normal distribution; includes cases where officers were killed by friendly fire.

Although the probability that the police will shoot the wrong person is over four times higher than that of armed citizens, both probabilities are very small and the difference between them is not significantly different from zero, presumably because both events are extremely rare. We estimated the probit model with state and year fixed effects and a full list of control variables. The results were the same.

4.4 Comparing the risk to police stopping active shooters at the scene of their attacks to cases where they caught these attackers later.

As noted earlier, the data doesn't credit law enforcement with stopping an attack if officers apprehend the attacker later or at a different location. But this distinction raises an important question: What risks do officers face when confronting an attacker during the crime versus confronting the same criminal later—when police have the advantage of time, planning, and location?

We looked at 158 cases where law enforcement stopped attacks in progress and compared them to 106 cases where officers arrested the attackers later. The difference in officer fatalities between these two scenarios is striking: 26 officers died when confronting attackers during the crime, while only one officer was killed when making arrests after the fact.

This comparison is especially powerful because it involves similar types of violent offenders. In fact, those who manage to escape and are caught later may be even more dangerous, do more planning, or are more cunning or experienced, suggesting they could pose a greater threat to officer safety. Yet the data show that officers face far more risk when they respond to an attack that the shooter initiates than when they make arrests under conditions which the police control. See Table 13.

Table 13: Comparing the rates that police are killed when the active shooter initiates the attack versus when the police catch the attacker at a later time

	Cases	Deaths	Probability
Police arrest later	106	1	0.009
Police stop attack in progress	158	25	0.158
Difference			-0.149
Z-score			-3.98
P-value			0.000
	Cases	Injuries	
Police arrest later	106	6	0.057
Police stop attack in progress	158	90	0.57
Difference			-0.51
Z-score			-8.49
P-value			0.000

Note: assumes normal distribution.

Table 14: Probit models: Probabilities that police are killed when the active shooter initiates the attack or the police initiate the confrontation

Variables	(1) Killed	(2) Killed	(3) Wounded	(4) Wounded
Police arrest later	-0.036	-0.129	0.085	0.226**
	(-0.42)	(-0.88)	(1.07)	(2.09)
Police stop attack	0.145**	0.211**	0.305***	0.393***
	(2.27)	(2.53)	(4.51)	(3.75)
Number of shooters		1.755		
		(0.01)		
Age of shooter		-0.433**		-0.138**
		(-2.16)		(-2.24)
Age squared		0.005**		0.002**
		(2.18)		(2.22)
Number of guns		-0.468		0.185
		(-0.89)		(0.99)
Rifle		1.904		0.463
		(1.63)		(1.25)
Shotgun		1.119		-0.506
		(0.86)		(-0.69)
Multiple weapon types		1.398		1.850***
		(1.27)		(3.78)
Body armor		-3.178		-1.490
		(-1.45)		(-1.45)
Commerce		0.001		-0.480
		(0.00)		(-0.79)
Government		-0.299		0.161
		(-0.20)		(0.23)
Health services		1.966		0.406

		(1.12)		(0.41)
Open Space		1.224		0.569
		(0.75)		(0.91)
House of Worship				-2.047*
				(-1.70)
School				-0.621
				(-0.74)
Constant	-1.474	6.501	-1.405*	-0.210
	(-1.39)	(0.04)	(-1.67)	(-0.12)
State and year fixed effects	Yes	Yes	Yes	Yes
Observations	201	171	271	255
Chi2 test comparing armed citizen and police	6.84	6.00	16.97	8.57
P-value	0.009	0.014	0.000	0.003

Notes: z-statistics in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$; chi-square tests the null hypothesis that the risk to police who arrest attackers later and who stop an attack in progress are equal.

The estimates in Table 14 show that officers who stopped attacks were over four times more likely to be killed and almost 3.6 times more likely to be injured than officers who apprehended these attackers later.

Finally, we asked whether police who arrested attackers later faced fewer injuries or deaths because S.W.A.T. teams helped capture them. Since S.W.A.T. officers receive specialized training to handle violent situations, they might reduce the risk of officers being shot. However, our analysis found that the presence of S.W.A.T. officers had no statistically significant impact on the likelihood of officer deaths or injuries.

5. Robustness tests

We re-estimated our models in several ways to test their robustness. None of the robustness checks negated our earlier findings. All results, code, and data are in the online supplemental materials.

When a dependent variable contains too many zeros, a standard negative binomial model may produce biased and inconsistent estimates and overstate standard errors. In such cases, a zero-inflated negative binomial (ZINB) or zero-inflated Poisson model is preferable (Greene 1994; Lambert 1992). Since 50.49% of our observations for the number of people killed were zero, we conducted a Vuong (1998) test to compare the fit of the negative binomial and ZINB models. The test found no significant difference (log-likelihood difference = 0 within 8 decimal places), so we selected the standard negative binomial model. Still, we ran ZINB models and found consistent results: armed citizens significantly reduced the probability of victim death or injury compared to police intervention.

We also found that the log of the dispersion parameter was significantly greater than zero, indicating severe overdispersion across all regressions in Tables 5 to 7. This supported our choice of the negative binomial model over the Poisson. However, since

Poisson models can be more efficient when overdispersion is mild, we also estimated Poisson and zero-inflated Poisson models for all three outcome variables—deaths, injuries, and total casualties (Cameron and Trivedi 1998, pp. 59–85). In every model, civilians who stopped active shooter events significantly reduced casualties compared to police responses. We used population as an exposure variable in our regressions, assigning it a coefficient of one. When we removed that variable, the results remained unchanged across all three casualty measures.

We re-estimated the regressions from Section 4.1 (Tables 5 to 7) using city-fixed effects instead of state-fixed effects. While 52% of observations included multiple entries per city, this approach significantly reduced the effective sample size. Still, it allowed us to account for potential differences across police departments at the city level. The results remained unchanged.

- For Table 5 (killings): All results were consistent.
- For Table 6 (woundings): Columns 1 and 2 remained stable; columns 3 and 4 did not converge due to the smaller sample.
- For Table 7 (casualties): Columns 1, 2, and 3 were unaffected; column 4 did not converge.

We examined whether police involvement in higher victim counts resulted from a few extreme mass shootings. In our dataset, the maximum number of people killed, wounded, and total casualties in events stopped by armed citizens were 26, 20, and 46, respectively. For police-stopped cases, the maxima were 49, 53, and 102. We re-estimated the models using only cases within the armed citizen maxima. The results remained consistent: active shooter incidents stopped by armed citizens resulted in significantly fewer deaths and injuries than those stopped by police.

Panel data offer important advantages, but those benefits are reduced when the panel is unbalanced. Our dataset is quite unbalanced, given that 284 cities have only one observation, so impossible to correct for unobserved heterogeneity with fixed effects for those observations. To address this concern, we estimated the model several ways. First, we ran a pooled OLS model without state or year dummies across all three outcomes—people killed, wounded, and total casualties—and found no change. Next, we estimated a pure cross-sectional model by aggregating across years for each city. Again, the results remained consistent. We then built a balanced panel of state-year data using 50 states over 10 years. For each state-year, we calculated totals for people killed, wounded, and total casualties; we also summed the number of police and armed citizen stops and averaged the remaining variables, manually generating a dummy for constitutional carry. We set missing values to zero in years with no active shooter incidents. This balanced panel produced the same results in all but one of 12 tests that correspond to Tables 5 to 7, and in that one case the result wasn't significantly different from zero.

Finally, we compared the likelihood of first responders being killed in mass public shootings (defined as incidents where four or more people were killed, excluding the shooter). Armed citizens likely stopped 58 such attacks, with 2 of them killed (3.4%).

Police intervened in 39 mass public shootings and suffered 13 fatalities (33.3%). This difference in fatality rates was statistically significant. Similar results were found for the number of armed civilians and police wounded, and total casualties for each, in likely or actual mass shootings.

6. Discussion

The evidence supports the role of armed citizens in stopping active shooter attacks. Unlike uniformed police, armed civilians are already present when an attack begins and don't stand out as immediate threats. In contrast, police face serious disadvantages. They're rarely present when an attack begins, and if a would-be attacker spots a nearby officer, he's likely to delay the assault, choose a different location, or target the officer first.

Even after controlling for the number of casualties. the locations of attacks, and fixed effects, the media devotes more coverage to cases stopped by police than those stopped by civilians. Reports of civilian interventions often omit key details and are presumably more likely to not be reported at all. The evidence we provide on the underreporting of civilian cases implies that our results are biased against showing the benefits of armed civilians. The identification problem would be more of an issue here if went in the opposite direction and biased the results in favor of armed civilians.

The results remain consistent using an instrumental variable approach to test the alternative hypothesis that armed civilians avoid potentially serious active shooter events. With one exception, the instrumented armed citizen coefficient is smaller than the corresponding police response coefficient. In 10 out of the 12 estimations, the instrumental variable coefficient for the armed citizen dummy is significantly smaller than the corresponding police coefficient.

Off-duty, undercover, or plainclothes officers may benefit from the same tactical edge as armed civilians. Unfortunately, with only two recorded cases involving non-uniformed officers confronting shooters, we don't yet have enough data to compare their effectiveness directly.

Our research clearly shows that armed civilians stop potential mass shootings more effectively than uniformed police. This outcome doesn't reflect poorly on law enforcement—it highlights the tactical disadvantages uniformed officers face. Uniforms make them easy targets, and delayed arrival gives attackers more time to cause harm. These results support a larger conclusion: dispersing armed civilians throughout public areas increases safety, while gun-free zones make the public more vulnerable. That finding aligns with other research showing that the vast majority of mass public shootings occur in areas where civilians can't legally carry firearms (Lott, 2010; Crime Prevention Research Center, 2025). The results also provide evidence that Constitutional Carry laws reduce the number of attacks.

Critics argue that civilians lack the training police receive and may make things worse by intervening. But our data directly contradict that concern. Armed civilians don't interfere with police or shoot bystanders—and they consistently prevent more injuries and deaths than uniformed officers during active shooter events. They are also less likely to be killed stopping such events than are the police.

All results, programs, and data are available in the online supplemental materials.

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Appendix: Simulation of media bias

Our hypothesis is that media ignore cases where there is an active shooter who is stopped by one or more armed citizens, but the number of people killed or injured is small. This is exactly the type of outcome we prefer, namely a potentially dangerous situation that results in few casualties. In the media, this relatively good news is no news. It should not be ignored; it should be celebrated.

Further, we hypothesize that the coefficient on the armed citizen dummy variable will be substantially biased upward by the omission of these relatively uninteresting cases. In this appendix we report a simulation test of this hypothesis.

Suppose the counterfactual that all armed citizen cases are reported along with all cases involving the police.

We created a dependent variable derived from two sources: 300 observations from armed citizen cases and 300 from police-involved cases. In each case we generated a simulated variable that is inspired by the actual observations in the dataset.

In our dataset, the mean of the number of victims killed in armed citizen cases is 0.4, with a variance of 4. The mean of the number of victims killed in police-involved cases is 2.4 with a variance of 26.

It was difficult to generate exactly the same distributions, so we settled on a distribution of armed citizen cases that had a lower mean and lower variance than the distribution of police cases. See Appendix Table 1.

Appendix Table 1: Summary of complete sample

Variable	Obs	Mean	Std. dev.	Min	Max
y armed cit.	300	1.606667	2.665013	0	17
x police	300	2.716667	4.367299	0	31

We then did a negative binomial regression of a dependent variable consisting of N=1..., 300 armed-citizen cases and N=301…, 600 police cases on two dummy variables, one for armed citizens and one for police. Since the amount of bias is the point of the exercise, we omitted the intercept to get estimates of coefficients for armed citizens and police.

The results are in Appendix table 2.

Appendix Table 2: Negative binomial regression on complete dataset

Negative binomial regression	Number of obs = 600
Dispersion: mean	Wald chi2(2) = 129.94
Log likelihood = -1120.637	Prob > chi2 = 0.0000

z	Coefficient	Std. err.	z	P>|z|	[95% conf. interval]	
ac	.4741616	.1005976	4.71	0.000	.276994	.6713293
police	.9994056	.0962922	10.38	0.000	.8106765	1.188135
/lnalpha	.8811009	.0874527			.7096967	1.052505
alpha	2.413555	.211072			2.033374	2.864819

LR test of alpha=0: chibar2(01) = 1259.37 Prob >= chibar2 = 0.000

We then dropped the half of the armed citizen cases with the smallest number of people killed (mostly zeros). This had the effect of increasing the mean number of people killed in those cases.

The new means and standard errors of the two types of data are shown in Appendix Table 3.

Appendix Table3: truncated data

Variable	Obs	Mean	Std. dev.	Min	Max
armed cit. y	150	3.213333	3.009129	0	17
police x	300	2.716667	4.367299	0	31

Obviously, the mean for the armed citizens is higher for the truncated sample, 3.23 compared to .474 for the entire sample.

We then did a regression on the truncated sample. The results are in Table 4.

Appendix Table 4: Negative binomial regression on truncated dataset

Negative binomial regression Number of obs = 450

Dispersion: mean Wald chi2(2) = 289.25

Log likelihood = -989.4034 Prob > chi2 = 0.0000

z	Coefficient	Std. err.	z	P>|z|	[95% conf. interval]	
ac	1.167309	.1067445	10.94	0.000	.9580934	1.376524
police	.9994056	.0767258	13.03	0.000	.8490258	1.149785

```
    /lnalpha |   .3350114   .0941621                      .1504571    .5195657
-------------+----------------------------------------------------------------
       alpha |   1.397956   .1316345                      1.162365    1.681297
------------------------------------------------------------------------------
LR test of alpha=0: chibar2(01) = 853.64             Prob >= chibar2 = 0.000
```

The estimated coefficient for armed citizens has more than doubled, from 0.474 using all the data to 1.17 using the truncated sample with the smaller values of the dependent variable removed.

This demonstration shows that ignoring the lower half of the distribution of active shooter cases stopped by armed citizens increases the coefficient on the armed citizen dummy (and shrinks the difference between the coefficients on the ac dummy and the coefficient on the police dummy.

The coefficient estimate on the police dummy is exactly the same for both samples.

However, this is just one example, and it could be non-representative. For this reason, we also simulated the exercise 1000 times to generate a sampling distribution of the two sets of coefficients and enabling us to compute the implied selection bias. The results of that experiment are shown in Table 5.

Table 5: Means of the estimated coefficients on the armed citizen dummy for the full sample and the truncated sample, Monte Carlo sampling distributions.

```
. summarize b_ac b_ac_trunc

    Variable |        Obs        Mean    Std. dev.       Min        Max
-------------+---------------------------------------------------------
        b_ac |      1,000    .4753848    .0966592   .1655144   .7639163
  b_ac_trunc |      1,000    1.166052    .0946104   .8586616   1.427116
```

The mean of the coefficient estimates for the effect of an armed citizen stopping an active shooter for the complete sample is .475, the mean for the truncated sample is 1.166. The coefficient is biased upward by ignoring active shooter cases stopped by armed citizens. We test the significance of this bias in Table 6.

Table 6: Testing if the bias in the coefficient on the armed citizen dummy is significantly different from zero.

```
. gen diff_ac = b_ac_trunc - b_ac

. gen diff_police = b_police_trunc - b_police

. ttest diff_ac=0

One-sample t test
------------------------------------------------------------------------------
```

Variable	Obs	Mean	Std. err.	Std. dev.	[95% conf. interval]	
diff_ac	1,000	.6906676	.0001943	.0061455	.6902863	.691049

mean = mean(diff_ac) t = 3.6e+03

H0: mean = 0 Degrees of freedom = 999

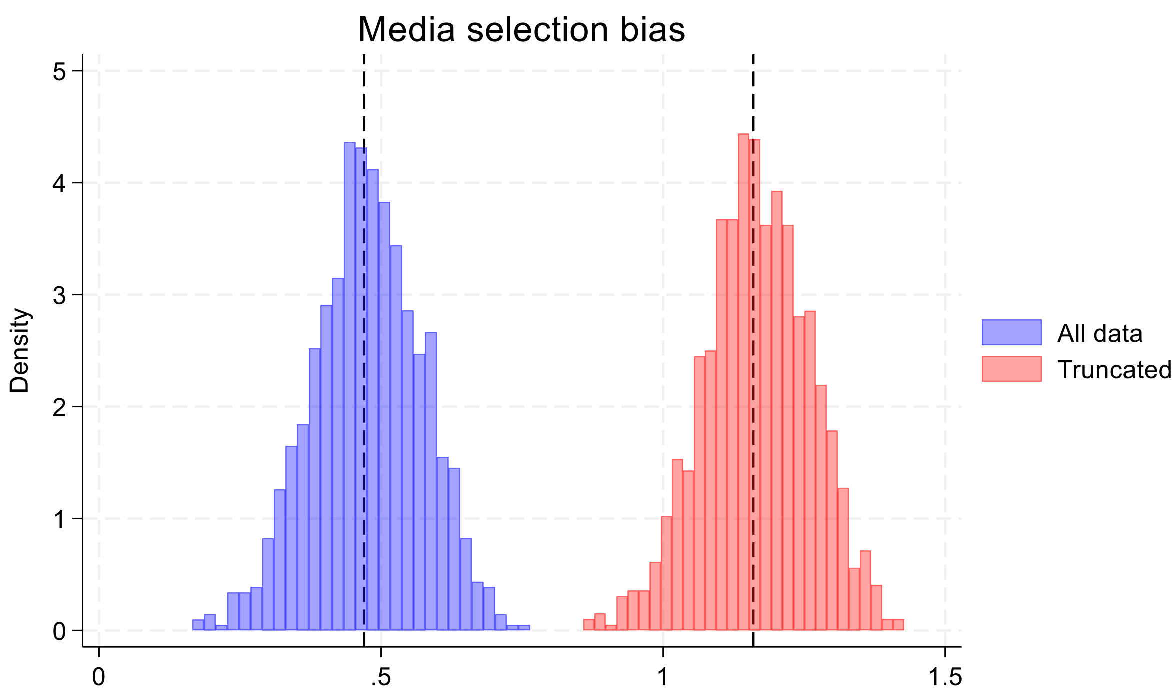
Ha: mean < 0 Ha: mean != 0 Ha: mean > 0

Pr(T < t) = 1.0000 Pr(|T| > |t|) = 0.0000 Pr(T > t) = 0.0000

The bias is positive (.691) and highly significant.

The Monte Carlo sampling distributions for the coefficient on the armed citizen dummy variable are shown in Appendix Figure 1.

Appendix Figure 1



The coefficient estimates on the police dummy are unaffected.

. summarize b_police b_police_trunc

Variable	Obs	Mean	Std. dev.	Min	Max
b_police	1,000	.9438897	.0952657	.6151856	1.195941
b_police_t~c	1,000	.9438897	.0952657	.6151856	1.195941