Firearm Violence and Emergency-System Spillovers: Evidence from New York City EMS Dispatch Data

Zachary Santamaria*

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Abstract

Firearm violence imposes costs beyond deaths and injuries among shooting victims. We examine whether shootings create short-run spillover costs for nearby emergency medical services (EMS). We match New York City shooting incident records to EMS dispatch data from 2019 through 2025 and study 9.6 million non-shooting EMS calls. Our empirical model design compares non-shooting EMS calls in the same precinct before and after nearby shootings. We find that EMS response and travel times are elevated both before and after nearby shootings, indicating that shootings occur during broader local high-demand periods. However, post-shooting delays are significantly larger than pre-shooting placebo-lead delays. A same-precinct shooting in the prior hour is associated with an additional 33.8 seconds of response delay and 12.4 seconds of travel delay relative to the comparable pre-shooting window. The corresponding post-minus-pre delays are 29.8 seconds for response time and 11.2 seconds for travel time. Severity-split models report that lower-acuity EMS calls experience much larger delays than high-acuity calls. This is consistent with triage and local capacity strain. Our component analyses reports that most of the delay comes from non-travel operational time rather than ambulance travel alone. The results show that firearm violence creates short-run emergency-system externalities for patients not directly involved in shootings.

Keywords: firearm violence; emergency medical services; EMS response time; externalities; urban crime; public safety
JEL codes: I18; K42; H75; R41

*Corresponding author: Zachary Santamaria, SUNY Purchase, 735 Anderson Hill Road, Purchase, NY 10577. Email: zachary.santamaria@purchase.edu.

1 Introduction

Firearm violence imposes costs that extend beyond the deaths and injuries of shooting victims. Existing research documents effects on neighborhood economic activity, educational outcomes, mental health, and health care utilization among individuals who are not directly involved in violent incidents (Greenbaum and Tita, 2004; Sharkey, 2010; Song et al., 2023; Vasan et al., 2021). These findings suggest that the social costs of firearm violence are substantially broader than the direct medical and mortality costs borne by victims. One possible margin is the effect of firearm violence on the capacity of local emergency medical services. Emergency Medical Services (EMS), including ambulances and emergency personnel, operate with finite resources while demand varies across locations and time. A shooting can require an immediate concentration of emergency resources. If those resources would otherwise have been available to respond to unrelated medical emergencies, firearm violence can create a short-run congestion externality within the emergency medical system.

We examine whether shootings generate such spillovers in New York City. We combine New York City Police Department shooting incident records with incident-level EMS dispatch data from 2019 through 2025. Our analysis includes approximately 9.6 million non-shooting EMS calls and 7,731 shooting incidents across 78 police precincts. One identification challenge is that shootings are not randomly distributed across locations or time. Firearm violence may occur during periods of unusually high emergency demand or broader local disorder. A comparison of EMS calls after shootings with all other EMS calls could attribute pre-existing local conditions to the shooting itself. We address this by using a same-precinct lead-lag design. For each non-shooting EMS call, we measure whether a shooting occurred in the same precinct shortly before the call and whether a shooting occurred shortly afterward. The latter serves as a placebo lead. A future shooting cannot directly affect an earlier EMS response, but it can capture local conditions associated with both firearm violence and slower emergency response. Concomitantly, our primary estimand is the difference between post-shooting and pre-shooting exposure coefficients. Our model specification includes fixed effects for police

precinct, incident date, hour of day, EMS call type, and initial severity. A more restrictive specification replaces separate date and hour effects with date-hour fixed effects, comparing calls across precincts within the same citywide hour. We estimate effects for the first hour after a shooting, the following hour, and the two-to-four-hour window (the period two to four hours after a shooting).

Our results indicate that EMS response times are elevated both before and after same-precinct shootings, confirming that firearm violence tends to occur during periods when local emergency response is already slower. However, delays are significantly larger after shootings than before them. A same-precinct shooting during the previous hour is associated with an additional 33.8 seconds of total EMS response delay relative to the corresponding pre-shooting window. Ambulance travel time increases by 12.4 seconds. The date-hour fixed-effect specification produces similar estimates of 29.8 seconds for total response time and 11.2 seconds for ambulance travel time. Effects remain positive during the second hour after a shooting and become smaller during the two-to-four-hour window. The effects are concentrated among lower-acuity EMS calls. In the primary specification, the first-hour post-minus-pre response-time effect is 49.8 seconds for calls initially classified at severity levels 4 through 9, compared with 9.9 seconds for severity levels 1 through 3. The date-hour specification produces a similar pattern. This heterogeneity is consistent with EMS triage protecting the most urgent patients when system capacity becomes strained. Our response-time decomposition also indicates that most of the first-hour effect is not attributable to ambulance travel alone. Of the 33.8-second total response-time effect in the primary specification, 21.5 seconds occurs in the residual non-travel component and 12.4 seconds occurs during ambulance travel. The corresponding date-hour estimates are 18.7 and 11.2 seconds.

This paper contributes to research documenting the external costs of firearm violence by identifying a short-run effect on public emergency-service delivery (Cook and Ludwig, 2006; Greenbaum and Tita, 2004; Song et al., 2023; Vasan et al., 2021). Further, we contribute to

research on medical service delivery, dispatch, congestion, and emergency-service performance (Brotcorne et al., 2003; Schmid, 2012; Park and Lee, 2019; Chikish et al., 2026; Asheim et al., 2025). The results indicate that firearm violence can temporarily reduce the timeliness of emergency care for patients who are not directly involved in shootings. This emergency-system spillover represents an additional and often overlooked component of the social cost of firearm violence.

2 Literature Review

There is a mature literature examining firearm violence as a source of costs borne by individuals who are not directly involved in a shooting. Within a public economics framework, these costs constitute externalities when individual decisions impose harms on others that are not reflected in the private costs borne by the parties directly involved. Cook and Ludwig (2006) estimate the relationship between gun prevalence and homicide. They quantify an external cost associated with household firearm ownership and report evidence that the costs of firearm violence extend beyond the direct injuries of the individuals involved. One theme within the research documents how violence changes behavior and local economic activity in affected areas. Greenbaum and Tita (2004) use business-establishment and homicide data from five U.S. cities to show that surges in violence are associated with changes in neighborhood economic activity. They report that these effects are concentrated within the service business sector in otherwise lower-crime areas. Sharkey (2010) finds evidence of short-run reductions in children's cognitive performance after nearby homicides. Using geographic variation in exposure to officer-involved killings, Ang (2021) similarly documents adverse educational and psychological outcomes among nearby students. Moreover, research identifies health consequences for individuals affected by firearm violence but not directly injured. Song et al. (2023) use commercial health insurance claims from 2007–2021 to examine the health and economic consequences of firearm injuries among children, adolescents, and

their family members. Their sample includes 2,052 young firearm-injury survivors matched to 9,983 individuals without firearm injuries. In the year following injury, survivors experience a 117 percent increase in pain disorders, a 68 percent increase in psychiatric disorders, and a 144 percent increase in substance use disorders relative to matched controls. Their annual health care spending increases by an average of $34,884. Further, they report evidence of spillovers within families. Parents of surviving children experience a 30–31 percent increase in psychiatric disorders, while mothers record 75 percent more mental health visits. Vasan et al. (2021) examine whether exposure to neighborhood shootings is associated with future mental health-related emergency department utilization among children. Using 128,683 pediatric emergency department encounters involving 54,341 children from 2014–2018 in the Philadelphia area, they compare utilization before and after nearby shootings. Their reported findings include that children residing within one-eighth of a mile of a shooting experience significantly higher odds of mental health-related emergency department visits following the incident. The adjusted odds ratio is 1.86 within 14 days of a shooting, declining to 1.49 within 30 days and 1.35 within 60 days. These studies illustrate that firearm violence is associated with health consequences and resource utilization beyond the populations directly involved. Our analysis examines a dimension of these externalities: whether shootings markedly change the timeliness of emergency services provided to unrelated patients.

2.1 Firearm Violence and Emergency Medical Resources

Firearm violence from gunshot injuries places substantial stress on emergency-care systems. Using U.S. hospital data, Royan et al. (2025) estimate approximately $7.7 billion in initial emergency department and inpatient costs for firearm injuries from 2016 through 2021, with inpatient treatment accounting for most of those costs. These estimates approximate direct treatment costs but ignore the opportunity cost of emergency capacity that may be unavailable for other incidents during events of firearm violence. Klassen et al. (2019) match active-shooter incidents to national EMS records to examine the operational demands

associated with violent incidents. Separately, Brotcorne et al. (2003) review deterministic, probabilistic, and dynamic ambulance-location models. Their research focuses on uncertainty in emergency demand and vehicle utilization. Utilizing approximately 120,000 cardiac related medical events in Mississippi, David and Harrington (2010) examine how population density and geographic settlement patterns influence observed racial differences in EMS response performance. Schmid (2012) examines how ambulance dispatching affects response times under uncertain emergency demand. Moreover, using operational data from Vienna, their study finds that more flexible deployment policies reduce average response times from 4.60 to 4.01 minutes, an improvement of about 12.9 percent. Recent studies examine dispatch prioritization, traffic congestion, and ambulance efficiency. Park and Lee (2019) utilize simulations calibrated to historical emergency demand and traffic conditions in Seoul, Korea and find that optimized deployment reduces a patient risk-level index by approximately 11.2 percent relative to a greedy allocation policy, with undertriage, in which patient severity is underestimated during initial screening, imposing greater risks than overtriage. In New York City, Chikish et al. (2026) exploit the congestion pricing boundary at 60th Street in a difference-in-discontinuities framework. They estimate reductions of approximately 18–21 percent in vehicular traffic and 63–70 seconds, or 5–6 percent, in EMS travel times. Asheim et al. (2025) study roughly 239,000 medical emergencies in Norway and find that ambulance unavailability increases response times. Their instrumental-variable estimates associate a five-minute delay with increased hospital admissions and subsequent hospital costs. They did not find an increase in overall mortality.

2.2 Response Times and Patient Outcomes

Pons and Markovchick (2002) find no survival advantage associated with an eight-minute response threshold among trauma patients, which is consistent with the results reported by Blanchard et al. (2012), who similarly find no association with in-hospital mortality. By contrast, Wilde (2013) uses distance from EMS agency headquarters as an instrument

for response time and reports evidence that longer delays increase mortality and hospital admissions. Holmén et al. (2020) reports improved survival rates with shorter ambulance response times among patients experiencing out-of-hospital cardiac arrest.

Our study connects research on the indirect costs of firearm violence with the literature on congestible emergency-service resource allocation. Existing studies document spillovers in neighborhood economic activity, educational outcomes, mental health, and medical spending (Greenbaum and Tita, 2004; Sharkey, 2010; Song et al., 2023; Vasan et al., 2021). Separately, research establishes the importance of ambulance availability, geographic coverage, dispatch priorities, and traffic conditions for EMS response performance (Schmid, 2012; Park and Lee, 2019; Chikish et al., 2026; Asheim et al., 2025). We examine whether shootings generate an additional external cost through delays in emergency care for unrelated patients. We study this question using incident-level EMS dispatch data matched to New York City shooting incidents from 2019 through 2025. Our design compares non-shooting calls occurring shortly after a same-precinct shooting with analogous calls occurring shortly before a shooting, including specifications that account for date-hour shocks. The pre-shooting comparison helps distinguish temporal asymmetry from broader conditions associated with firearm violence. We further examine heterogeneity by medical severity and distinguish travel from non-travel components of response time. This framework allows us to investigate whether localized firearm violence is associated with temporary disruptions in emergency-service delivery for patients who are not directly involved in shootings.

3 Data

This paper matches New York City shooting incident records from the New York City Police Department (NYPD) to Emergency Medical Services (EMS) dispatch records. The analysis uses the 2019–2025 overlap between the two datasets. The unit of observation is a non-shooting EMS call. We exclude EMS calls that are likely to be directly related to

a shooting so that our analysis measures spillovers onto other emergency calls rather than response times for shooting victims themselves.

3.1 EMS Dispatch Data

The EMS data contain incident-level dispatch records for New York City. The records include the incident date and time, borough, police precinct, call type, initial severity, response time, and ambulance travel time. The sample is restricted to EMS calls from January 1, 2019 through December 31, 2025. The outcome variables are EMS response time and ambulance travel time, both measured in seconds. Response time captures the total time from the EMS incident timestamp to arrival on scene. Ambulance travel time represents the travel component of the response. Further, we construct a residual non-travel component:

$$\text{ResponseMinusTravel}_i = \text{ResponseTime}_i - \text{TravelTime}_i. \tag{1}$$

This residual measure represents the share of response time not explained by ambulance travel. Because the available data do not separately identify assignment, activation, staging, or dispatch components, this measure is interpreted as residual operational delay rather than a direct dispatch-delay measure. The final EMS analysis sample contains 9,600,714 non-shooting calls. Average response time is 657.9 seconds, and average ambulance travel time is 536.7 seconds.

3.2 Shooting Incident Data

The shooting data are obtained from the New York City Police Department (NYPD) Shooting Incident Data, published through the NYC Open Data portal (New York City Police Department, 2026). Each incident includes the shooting date and time, borough, police precinct, and geographic coordinates. We retain incidents with valid dates, precinct identifiers, and timing information for matching purposes. The analysis uses 7,731 shooting incidents from

January 1, 2019, through December 31, 2025. These incidents are used to construct local shooting-exposure measures for non-shooting EMS calls. Because we examine emergency-system spillovers rather than EMS responses to shooting victims, shooting incidents are treated as local shocks to EMS operations.

3.3 Panel Construction and Sample Restrictions

We merge EMS calls to shooting exposure measures using police precinct and incident time. The final dataset retains non-shooting EMS calls with valid response-time outcomes, travel-time outcomes, precinct identifiers, call type, and initial severity. The analysis sample includes 78 precincts, 57,469 date-hour cells, 180 call types, and 9 initial severity levels. EMS calls likely to be directly related to shootings are excluded before estimation. This restriction is central to the research design. The goal is to estimate whether shootings delay care for other emergencies nearby, not whether shooting victims themselves experience different response times.

3.4 Shooting Exposure Measures

For each non-shooting EMS call, we analyze whether a shooting occurred in the same police precinct shortly before or shortly after the call. We set a prior-shooting exposure indicator equal to one when a shooting occurred before the EMS call, within a specified time window. This is the post-shooting exposure from the perspective of the shooting event. A future-shooting exposure indicator variable equals one when a shooting occurs after the EMS call, within the same time window. Future exposure serves as a placebo lead because a future shooting cannot directly delay the current EMS response. It could be indicative of local conditions that predict both shootings and slower EMS response times. We let t_i denote the time of EMS call i, and let p_i denote its police precinct. Let t_s and p_s denote the time and precinct of shooting incident s. For each time window w, prior exposure is defined as:

$$\text{PriorShooting}_{ipw} = \mathbf{1}\left\{\exists s : p_s = p_i \text{ and } t_i - t_s \in w\right\}. \tag{2}$$

Thus, $\text{PriorShooting}_{ipw}$ equals one when EMS call i occurs within window w after a same-precinct shooting. Future exposure is defined as:

$$\text{FutureShooting}_{ipw} = \mathbf{1}\left\{\exists s : p_s = p_i \text{ and } t_s - t_i \in w\right\}. \tag{3}$$

Thus, $\text{FutureShooting}_{ipw}$ equals one when EMS call i occurs within the denoted window w before a same-precinct shooting. The windows are measured in hours, with $w \in \{0\text{–}1, 1\text{–}2, 2\text{–}4\}$. The estimate compares the prior-shooting exposure coefficient with the corresponding future-shooting placebo coefficient. This post-minus-pre design accounts for the fact that shootings may occur during broader local high-demand periods that already have slower EMS response times.

3.5 Summary Statistics

Table 1 summarizes our analysis sample. The dataset contains approximately 9.6 million non-shooting Emergency Medical Services (EMS) calls from January 1, 2019 through December 31, 2025. We match these calls to 7,731 shooting incidents. The sample covers 78 police precincts, 57,469 date-hour cells, 180 EMS call types, and 9 initial severity levels. Average response time is 657.9 seconds, and average ambulance travel time is 536.7 seconds.

Table 2 reports the distribution of EMS response-time outcomes. The outcomes are right-skewed. Mean total response time is 657.9 seconds, while the median is 481 seconds and the 90th percentile is 1,177 seconds. This skewness is expected in EMS data since a small share of calls experience very long delays.

Table 3 reports same-precinct shooting exposure counts. Same-precinct shooting exposure is rare relative to the full EMS sample. In the prior 0–1 hour window, 21,243 non-shooting EMS calls are exposed to at least one same-precinct shooting, equal to about 0.22 percent of

Table 1: Summary Statistics for EMS and Shooting Analysis Sample

Measure	Value
Non-shooting EMS calls	9,600,714
Shooting incidents used	7,731
Police precincts	78
Date-hour cells	57,469
EMS call types	180
Initial severity levels	9
Mean response time, seconds	657.9
Mean ambulance travel time, seconds	536.7

Table 2: Distribution of EMS Response-Time Outcomes

Outcome	Mean	Median	90th pct.	Max
Total response time	657.9	481	1,177	7,200
Response minus travel	121.2	22	156	7,189
Ambulance travel time	536.7	436	946	7,188

the sample. Future exposure is just as common.

Table 3: Same-Precinct Shooting Exposure Counts

Window	Prior exposure	Prior share	Future exposure	Future share
0–1 hour	21,243	0.22%	21,723	0.23%
1–2 hours	20,167	0.21%	22,435	0.23%
2–4 hours	37,192	0.39%	45,383	0.47%

Table 4 splits EMS calls by initial severity. High-acuity calls are severity levels 1 through 3. Lower-acuity calls are severity levels 4 through 9. Lower-acuity calls represent most non-shooting EMS calls. These calls have substantially longer average response and travel times. This pattern is consistent with EMS triage because lower-priority calls are more likely to experience delays when system capacity is strained. Emergency medical services (EMS) use a triage system to prioritize calls according to the severity and urgency of the patient's medical condition. More specifically, during dispatch, operators make an assessment based on information provided by callers. They then assign a priority classification from the caller information which determines the urgency of the response. Life-threatening emergencies,

such as cardiac arrests, generally receive the highest response priority.

Table 4: EMS Calls by Initial Severity Group

Acuity group	Calls	Mean response	Mean travel	Prior 0–1h exposure	Future 0–1h exposure
High acuity	3,567,518	441.5	408.2	7,881	8,001
Lower acuity	6,033,196	785.9	612.7	13,362	13,722

Finally, multiple-shooting exposure is uncommon. In the prior 0–1 hour window, 21,109 EMS calls are exposed to a single same-precinct shooting, while only 134 are exposed to multiple same-precinct shootings. For this reason, the multiple-shooting intensity analysis is treated as exploratory rather than as evidence of a clear dose-response.

4 Empirical Strategy

An empirical challenge at hand is that shootings are not randomly timed across precincts or hours. Shootings may occur during broader periods of local disorder, high emergency demand, or public-safety strain. A rudimentary comparison of Emergency Medical Services (EMS) calls after shootings to all other EMS calls would confound the effect of the shooting with the conditions that made a shooting more likely in the first place. We address this by using a same-precinct lead-lag design. For each non-shooting EMS call, we compare response outcomes after recent same-precinct shootings to response outcomes before future same-precinct shootings. The future-shooting exposure serves as a placebo lead. A future shooting cannot delay the current EMS call, but it can capture local conditions that predict both shootings and slower EMS response times. We determine whether an estimated shooting effect appears before the shooting occurs. We illustrate the logic with a timing example. Suppose a non-shooting EMS call occurs in a precinct shortly before a shooting in that same precinct. The later shooting cannot delay the earlier EMS call, but it may reveal that the precinct was already experiencing localized conditions associated with slower EMS response, such as unusually high emergency demand from other calls. By contrast, a non-shooting EMS

call shortly after the same shooting may reflect both those pre-existing local conditions and the additional burden created by the shooting itself. Our post-minus-pre contrast therefore compares EMS delays after shootings to EMS delays before shootings in the same precinct and time window. Although we label the post-shooting exposure variable as prior shooting exposure, the word prior refers to the timing of the shooting relative to the EMS call. We define a prior shooting as a shooting that occurred before the EMS call. From the perspective of the shooting event, this is a post-shooting EMS call. A future shooting is a shooting that occurs after the EMS call. From the perspective of the shooting event, this is a pre-shooting EMS call.

4.1 Baseline Same-Precinct Exposure Models

Let Y_i denote the EMS outcome for non-shooting call i. The primary outcomes are total response time and ambulance travel time, measured in seconds. Let $p(i)$ denote the police precinct of call i, $d(i)$ the incident date, $h(i)$ the hour of day, $c(i)$ the EMS call type, and $s(i)$ the initial severity level. For each time window $w \in \{0\text{–}1, 1\text{–}2, 2\text{–}4\}$, we estimate:

$$\begin{aligned} Y_i = &\sum_w \beta_w \text{PriorShooting}_{iw} + \sum_w \gamma_w \text{FutureShooting}_{iw} \\ &+ \alpha_{p(i)} + \lambda_{d(i)} + \eta_{h(i)} + \theta_{c(i)} + \kappa_{s(i)} + \varepsilon_i. \end{aligned} \tag{4}$$

The fixed effects account for differences across precincts, citywide shocks by date, regular differences across hours of the day, call-type composition, and severity differences. Standard errors are clustered by precinct and incident date. The coefficients β_w measure the association between EMS outcomes and shootings that occurred in the same precinct before the EMS call. The coefficients γ_w measure the association between EMS outcomes and shootings that occurred in the same precinct after the EMS call. Because future shootings cannot directly affect current response times, γ_w accounts for local pre-shooting conditions that may be

associated with EMS delays. We estimate a more granular date-hour fixed-effect specification:

$$\begin{aligned} Y_i = &\sum_w \beta_w \text{PriorShooting}_{iw} + \sum_w \gamma_w \text{FutureShooting}_{iw} \\ &+ \alpha_{p(i)} + \lambda_{\tau(i)} + \theta_{c(i)} + \kappa_{s(i)} + \varepsilon_i, \end{aligned} \tag{5}$$

where $\lambda_{\tau(i)}$ denotes fixed effects for each citywide date-hour cell. This specification compares EMS calls across precincts within the same citywide hour while controlling for call type and initial severity.

4.2 Lead and Post-Minus-Pre Tests

The preferred estimand is the post-minus-pre contrast:

$$\Delta_w = \beta_w - \gamma_w. \tag{6}$$

A positive value of Δ_w indicates that EMS response times are higher after a same-precinct shooting than before a same-precinct shooting in the corresponding time window. This reported value nets out local conditions that are already present before shootings. The lead coefficients are interpreted as follows: if future-shooting coefficients are positive, EMS times are already elevated before firearm violence takes place. This would indicate that shootings happen during broader local high-demand periods. The post-minus-pre contrast reports whether EMS delays become even larger after shootings than before shootings. Evidence of a positive post-minus-pre contrast is consistent with an additional short-run emergency-system burden from firearm violence. We estimate the contrasts separately for the 0–1 hour, 1–2 hour, and 2–4 hour windows. If shootings create short-run EMS congestion, the largest effects should appear in the first hour after the shooting and should fade in later windows.

4.3 Severity and Component-Split Models

We next test whether post-shooting delays differ by EMS call acuity. We split calls into high-acuity and lower-acuity groups based on initial severity. High-acuity calls are severity levels 1 through 3. Lower-acuity calls are severity levels 4 through 9 or missing. We then re-estimate the post-minus-pre models separately for each group. This test helps distinguish between general disruption and triage-based capacity strain. If EMS systems protect the highest-priority calls when resources are strained, then lower-acuity calls should experience larger post-shooting delays. Larger effects for lower-acuity calls would therefore support an emergency-capacity interpretation. We also decompose response time into ambulance travel time and residual non-travel response time:

$$\text{ResponseMinusTravel}_i = \text{ResponseTime}_i - \text{TravelTime}_i. \tag{7}$$

Our decomposition helps distinguish delays associated with physical travel conditions from delays associated with other operational constraints. The travel-time component may reflect traffic, street closures, police activity, or routing changes around the shooting area, among other factors. The non-travel component may reflect dispatch queuing, ambulance availability, staging, assignment delay, and other operational pressures. Because the data do not separately observe each operational timestamp, the residual component should be interpreted as non-travel operational delay rather than a direct measure of dispatch delay.

4.4 Multiple-Shooting Intensity

As an exploratory robustness check, we test whether EMS delays are larger when multiple shootings occur in the same precinct and time window. We distinguish between single-shooting exposure and multiple-shooting exposure:

$$
\begin{aligned}
Y_i = &\sum_w \beta_{1w} \text{SinglePrior}_{iw} + \sum_w \beta_{2w} \text{MultiplePrior}_{iw} \\
&+ \sum_w \gamma_{1w} \text{SingleFuture}_{iw} + \sum_w \gamma_{2w} \text{MultipleFuture}_{iw} + \mathbf{FE}_i + \varepsilon_i.
\end{aligned} \tag{8}
$$

The corresponding post-minus-pre contrasts compare prior and future exposure separately for single-shooting and multiple-shooting windows. We treat this analysis as exploratory because multiple-shooting exposure is relatively rare in the same-precinct one-hour window. The test is useful for checking whether a dose-response pattern is present.

5 Results

Throughout the results tables, *** indicates $p < 0.001$, ** indicates $p < 0.01$, and * indicates $p < 0.05$. All reported effects are measured in seconds.

5.1 Post-Minus-Pre Estimates

Table 5 reports the post-minus-pre estimates. Emergency Medical Services (EMS) response and travel times are elevated both before and after nearby shootings, consistent with firearm violence occurring during broader local high-demand periods. We examine whether the post-shooting delay exceeds the pre-shooting placebo delay. A same-precinct shooting in the prior hour is associated with an additional 33.8 seconds of response delay and 12.4 seconds of travel delay relative to the comparable future-shooting window. The date-hour fixed-effect specification gives similar results. The first-hour post-minus-pre effect is 29.8 seconds for response time and 11.2 seconds for travel time. Effects remain positive in the 1–2 hour window and fade in the 2–4 hour window. This pattern is consistent with a short-run emergency-system externality concentrated in the first two hours after a shooting.

Table 5: Post-Minus-Pre Effects of Same-Precinct Shootings on EMS Response Times

Specification	Outcome	Window	Prior	Future	Post–Pre	p-value
Model 1	Response time	0–1h	76.1	42.3	33.8^{***}	< 0.001
Model 1	Response time	1–2h	49.5	25.7	23.8^{**}	0.009
Model 1	Response time	2–4h	25.2	13.0	12.3	0.228
Model 1	Travel time	0–1h	41.7	29.3	12.4^{*}	0.018
Model 1	Travel time	1–2h	23.8	13.1	10.7^{*}	0.031
Model 1	Travel time	2–4h	9.6	5.0	4.7	0.370
Date-hour FE	Response time	0–1h	48.5	18.7	29.8^{***}	< 0.001
Date-hour FE	Response time	1–2h	26.5	6.0	20.4^{*}	0.012
Date-hour FE	Response time	2–4h	9.5	-3.2	12.7	0.140
Date-hour FE	Travel time	0–1h	27.7	16.6	11.2^{*}	0.024
Date-hour FE	Travel time	1–2h	13.0	3.0	10.0^{*}	0.047
Date-hour FE	Travel time	2–4h	2.7	-2.9	5.6	0.244

5.2 Severity Heterogeneity

Table 6 reports first-hour effects by initial severity group. The delay is much larger for lower-acuity calls. In the primary specification, the response-time effect is 49.8 seconds for lower-acuity calls, compared with 9.9 seconds for high-acuity calls. The corresponding travel-time effects are 17.1 seconds for lower-acuity calls and 6.4 seconds for high-acuity calls. The date-hour fixed-effect model shows the same pattern. Lower-acuity calls experience a 41.7-second response-time delay in the first hour after a nearby shooting. The corresponding effect for high-acuity calls is 10.1 seconds. This pattern supports an EMS capacity interpretation. After nearby shootings, lower-acuity calls experience larger delays, while high-acuity calls are relatively protected.

5.3 Response-Time Components

Table 7 decomposes the first-hour effect into total response time, response time net of travel time, and ambulance travel time. In the primary specification, the total response-time effect is 33.8 seconds, with 21.5 seconds occurring in response time net of travel and 12.4 seconds

Table 6: Severity Heterogeneity in 0–1 Hour Post-Minus-Pre EMS Delays

Specification	Acuity group	Outcome	Prior	Future	Post–Pre	p-value
Model 1	High acuity	Response time	23.6	13.7	9.9^{**}	0.009
Model 1	High acuity	Travel time	17.6	11.2	6.4	0.063
Model 1	Lower acuity	Response time	109.3	59.5	49.8^{***}	< 0.001
Model 1	Lower acuity	Travel time	56.7	39.5	17.1^{*}	0.037
Date-hour FE	High acuity	Response time	18.3	8.2	10.1^{**}	0.009
Date-hour FE	High acuity	Travel time	13.2	6.8	6.5	0.065
Date-hour FE	Lower acuity	Response time	68.7	27.0	41.7^{***}	< 0.001
Date-hour FE	Lower acuity	Travel time	37.0	22.5	14.5	0.057

occurring during ambulance travel. The date-hour fixed-effect model shows the same pattern. The total response-time effect is 29.8 seconds. The response-minus-travel effect is 18.7 seconds, and the travel-time effect is 11.2 seconds. These estimates show that post-shooting delays are concentrated primarily in the non-travel component, which is consistent with dispatch, queuing, EMS staging, ambulance availability, or other operational constraints.

Table 7: Component Decomposition of 0–1 Hour Post-Minus-Pre EMS Delays

Outcome	Prior	Future	Post–Pre	p-value
Primary specification				
Total response time	76.1	42.3	33.8^{***}	< 0.001
Response minus travel	34.4	13.0	21.5^{***}	< 0.001
Ambulance travel time	41.7	29.3	12.4^{*}	0.018
Date-hour fixed effects				
Total response time	48.5	18.7	29.8^{***}	< 0.001
Response minus travel	20.8	2.1	18.7^{***}	< 0.001
Ambulance travel time	27.7	16.6	11.2^{*}	0.024

Figure 1 reports post-minus-pre estimates from specifications with precinct and date-hour fixed effects. Panel A presents response-time effects across shooting-exposure windows. Panel B compares first-hour response-time effects for high- and lower-acuity calls. Panel

C decomposes the first-hour response-time effect into ambulance travel and non-travel components. All estimates are measured in seconds. Statistical significance is denoted by *** $p < 0.001$, ** $p < 0.01$, and * $p < 0.05$.

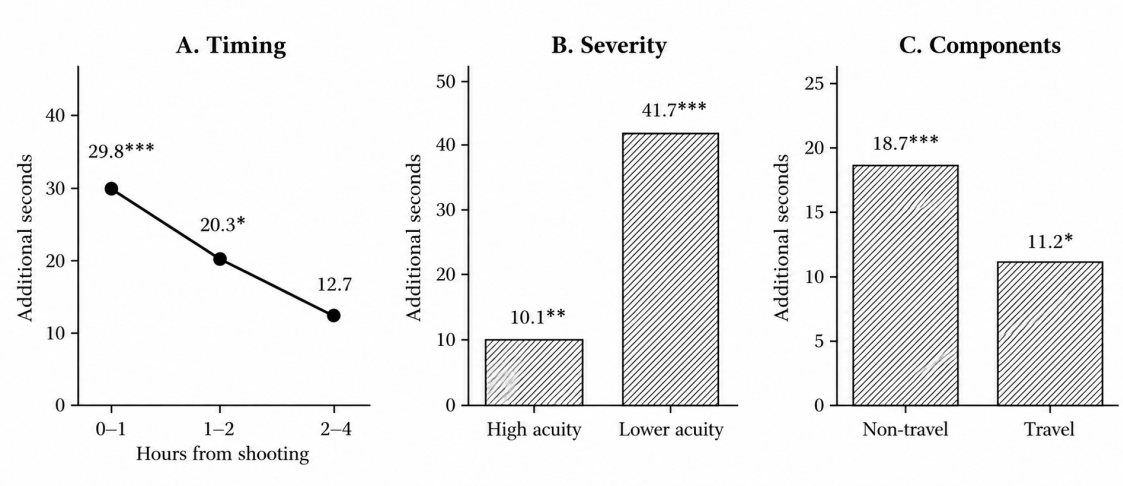


Figure 1: Post-Minus-Pre Effects of Same-Precinct Shootings on EMS Response Times

5.4 Multiple-Shooting Intensity

Multiple-shooting exposure is rare. In the prior 0–1 hour window, only 134 non-shooting EMS calls are exposed to multiple same-precinct shootings, compared with 21,109 calls exposed to a single shooting. Our one-versus-multiple estimates are descriptive and exploratory rather than treated as evidence of a clear dose-response test. For single-shooting exposure, the first-hour post-minus-pre response-time effect is 33.6 seconds in the primary specification and 29.2 seconds in the date-hour fixed-effect specification. The corresponding travel-time effects are 12.6 seconds and 11.3 seconds. The incremental multiple-shooting contrasts are noisy and generally insignificant in the first two hours. A significant incremental coefficient appears in the 2–4 hour response-time window in the primary specification.

6 Conclusion

This paper examines whether firearm violence creates negative spillovers onto emergency medical care for patients who are not directly involved in shootings. Using approximately 9.6 million non-shooting EMS calls and 7,731 New York City shooting incidents from 2019 through 2025, we compare EMS outcomes immediately after same-precinct shootings with outcomes immediately before same-precinct shootings. The pre-shooting exposure measures serve as placebo leads that help account for local conditions associated with both firearm violence and slower emergency response.

Our results show that EMS response times are already elevated before shootings, indicating that shootings tend to occur during periods of local emergency-system strain. The increase after a shooting, however, is substantially larger. In the primary specification, the first-hour post-minus-pre effect is 33.8 seconds for total response time and 12.4 seconds for ambulance travel time. A specification with date-hour fixed effects produces similar estimates of 29.8 seconds and 11.2 seconds. Effects remain positive during the second hour and largely dissipate within two to four hours. The pattern across call severity and response-time components provides additional evidence consistent with a capacity mechanism. Lower-acuity calls experience substantially larger post-shooting delays than high-acuity calls, while the largest share of the total response-time effect occurs outside the ambulance travel component. These reported results are consistent with a system in which scarce emergency resources are redirected toward higher-priority incidents when local demand rises. The available data do not separately identify dispatch queuing, ambulance assignment, staging, activation, or other operational components, so the residual response-time measure should not be interpreted as a direct estimate of any single mechanism.

The findings offer evidence insofar broadening the set of costs associated with firearm violence. Shootings affect not only victims and nearby communities but also the operation of emergency medical services used by unrelated patients. In this setting, firearm violence creates a short-lived but measurable emergency-system externality by reducing the timeliness

of care delivered to other callers. Accounting for these spillovers provides a more complete measure of the social costs generated by urban firearm violence.

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