# The Effect of ShotSpotter Technology on Police Response Times

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**JEL Codes:**

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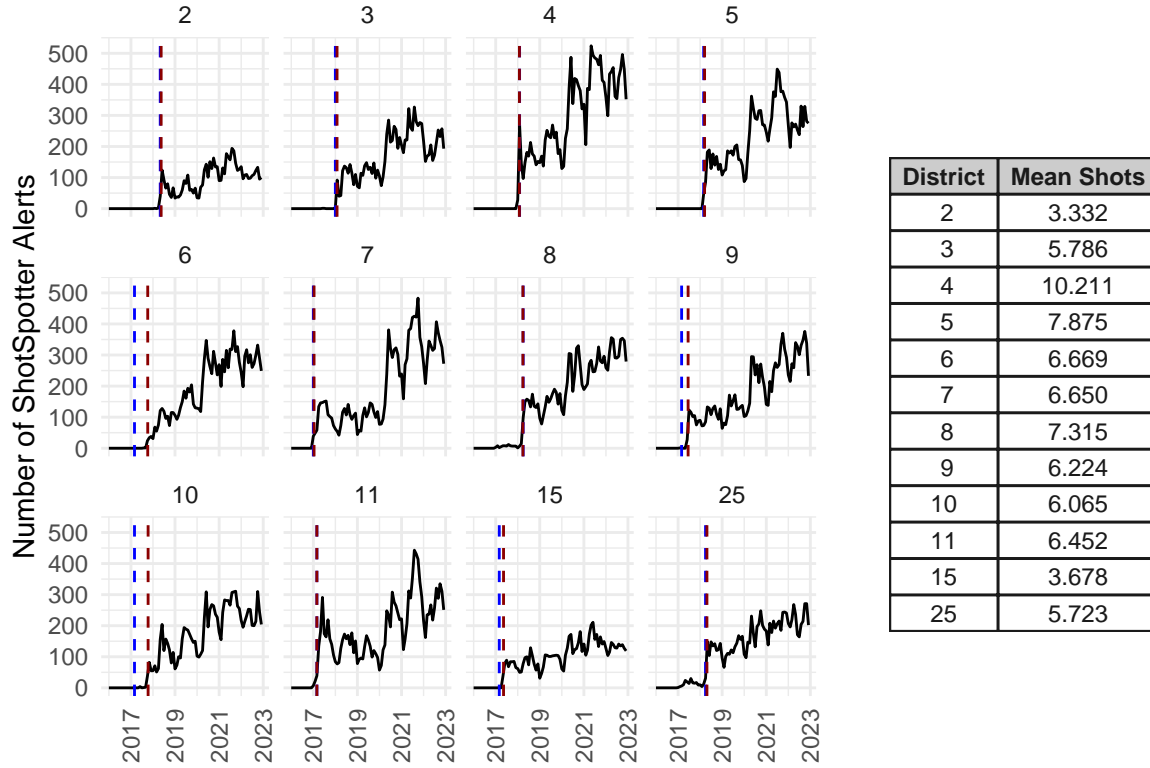
# 1 References

# 2 Figures

Figure 1: ShotSpotter Alert Trends and Enactment Dates

*Note:* This figure depicts only districts that have ShotSpotter technology. The x-axis is months, while the y-axis is the number of ShotSpotter alerts aggregated to the monthly level. The table on the right shows the average number of shots per-day in a ShotSpotter district. In Chicago, 12 of 22 police districts have ShotSpotter technology. The dashed red line shows the treatment date used in the main results, while the blue line shows the treatment date given from public records.
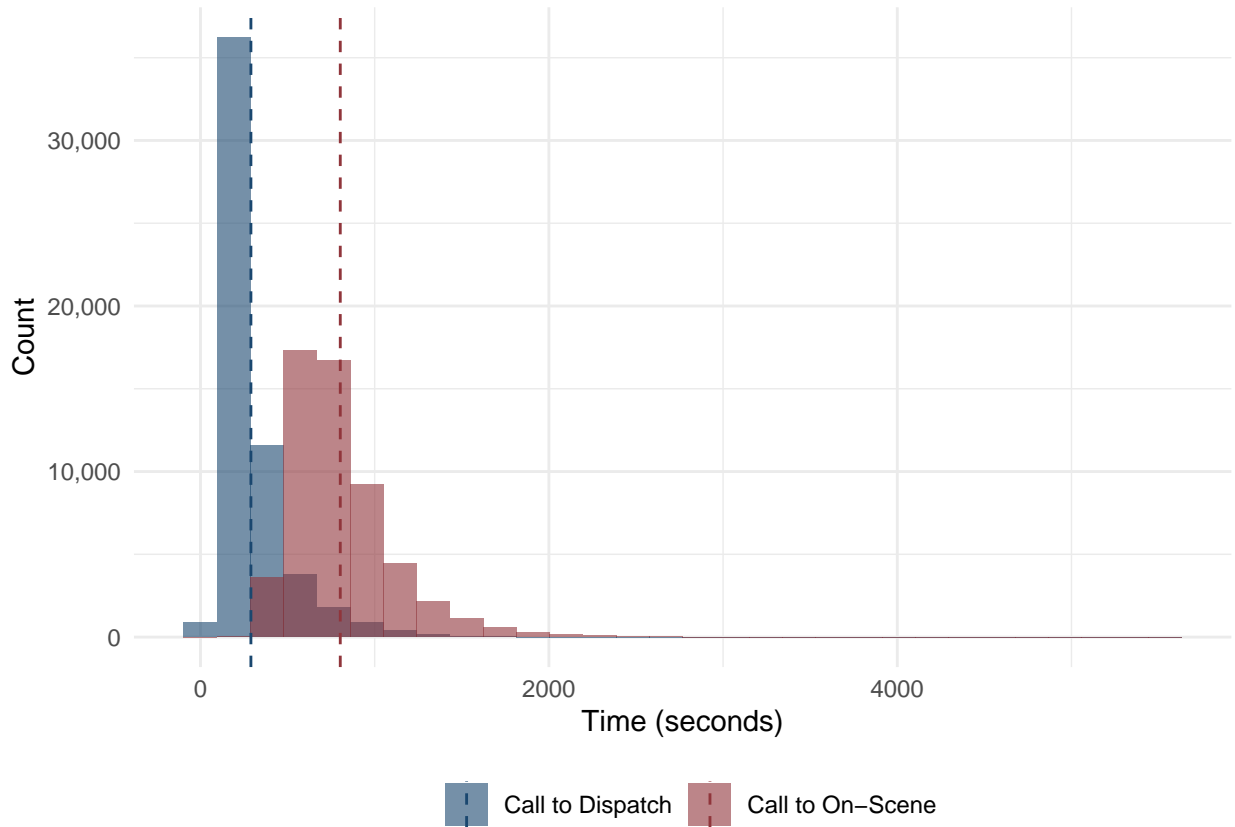
Figure 2: Distribution of Outcome Variables

*Note:* The two outcome variables are call-to-dispatch and call-to-onscene. Call-to-dispatch is time it takes for a police officer to be dispatched to the scene of the reported crime from the time of the 911 call. Call-to-On-Scene is the time from 911 call to the time a police officer arrives at the scene of the reported crime. The sample drops outliers greater than three standard deviations from the mean for each outcome, however, the main results are consistent when including these outliers (see Appendix Figure BLANK).
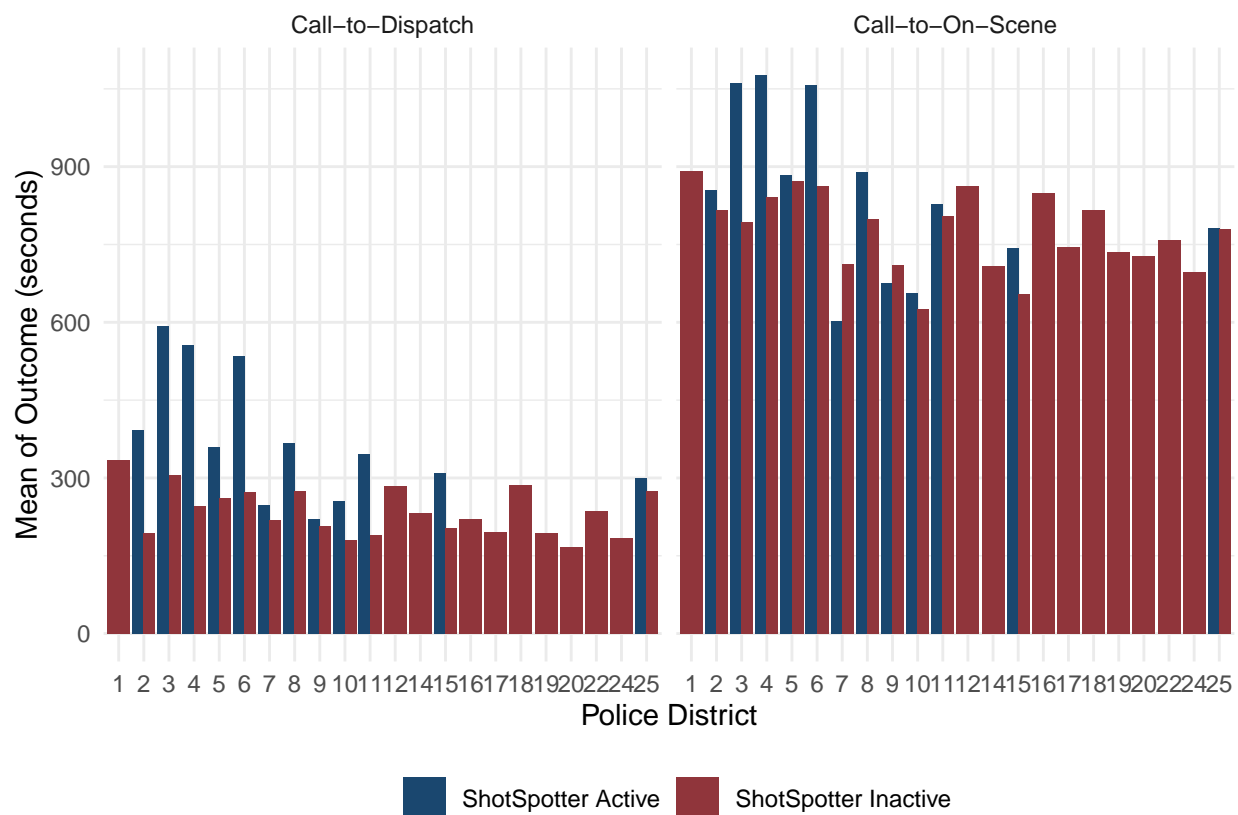
Figure 3: Averages for Outcomes with ShotSpotter Activated/Inactive

*Note:* Each police district is on the x-axis and the average of each outcome (seconds) is on the y-axis. Any ShotSpotter-enabled police district has two bars, one for the average outcome when ShotSpotter is enacted, and another for when ShotSpotter is inactive. There are 12 of 22 police districts in Chicago that receive ShotSpotter technology.
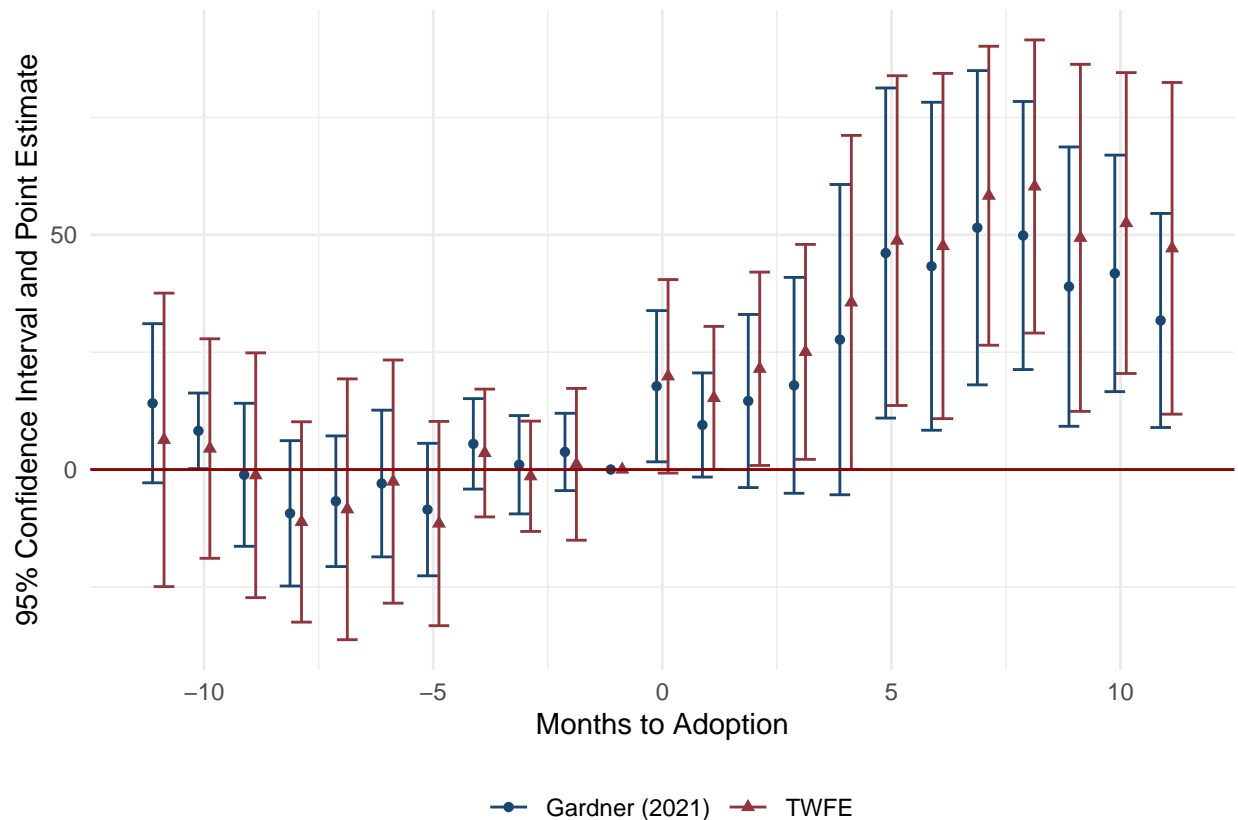
Figure 4: Event Study (Call-to-Dispatch)

*Note:* The x-axis denotes the number of months pre/post adoption of ShotSpotter technology. The y-axis denotes the 95% confidence intervals and point estimates (in seconds). The red errorbars/points represent confidence intervals/point estimates from OLS estimation while the blue are from Gardner (2021) two-stage difference-in-difference estimators which are robust to heterogeneous treatment effects in staggered adoptions. All pre/post periods are normalized by the month before ShotSpotter adoption. Controls are synonymous with the preferred specification. Standard errors are clustered at the district level.
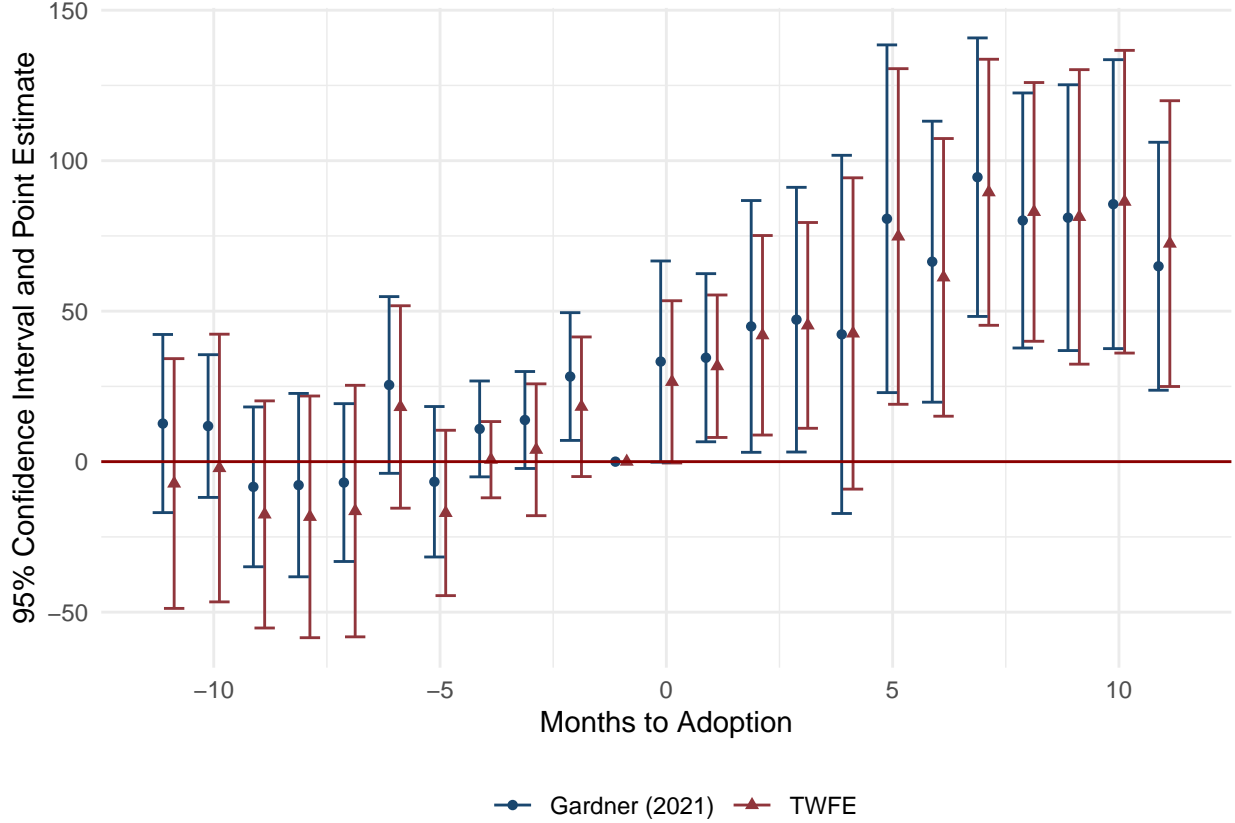
Figure 5: Event Study (Call-to-On-Scene)

*Note:* The x-axis denotes the number of months pre/post adoption of ShotSpotter technology. The y-axis denotes the 95% confidence intervals and point estimates (in seconds). The red errorbars/points represent confidence intervals/point estimates from OLS estimation while the blue are from Gardner (2021) two-stage difference-in-difference estimators which are robust to heterogeneous treatment effects in staggered adoptions. All pre/post periods are normalized by the month before ShotSpotter adoption. Controls are synonymous with the preferred specification. Standard errors are clustered at the district level.

Figure 6: Effect of ShotSpotter on Call-to-Dispatch by Priority/Call Description
*Note:* The first row denotes the aggregate effect from the preferred specification on call-to-dispatch times in seconds, by priority. Rows 2-6 denote the top five most frequent 911 call descriptions within each priority. Each errorbar represents the 95
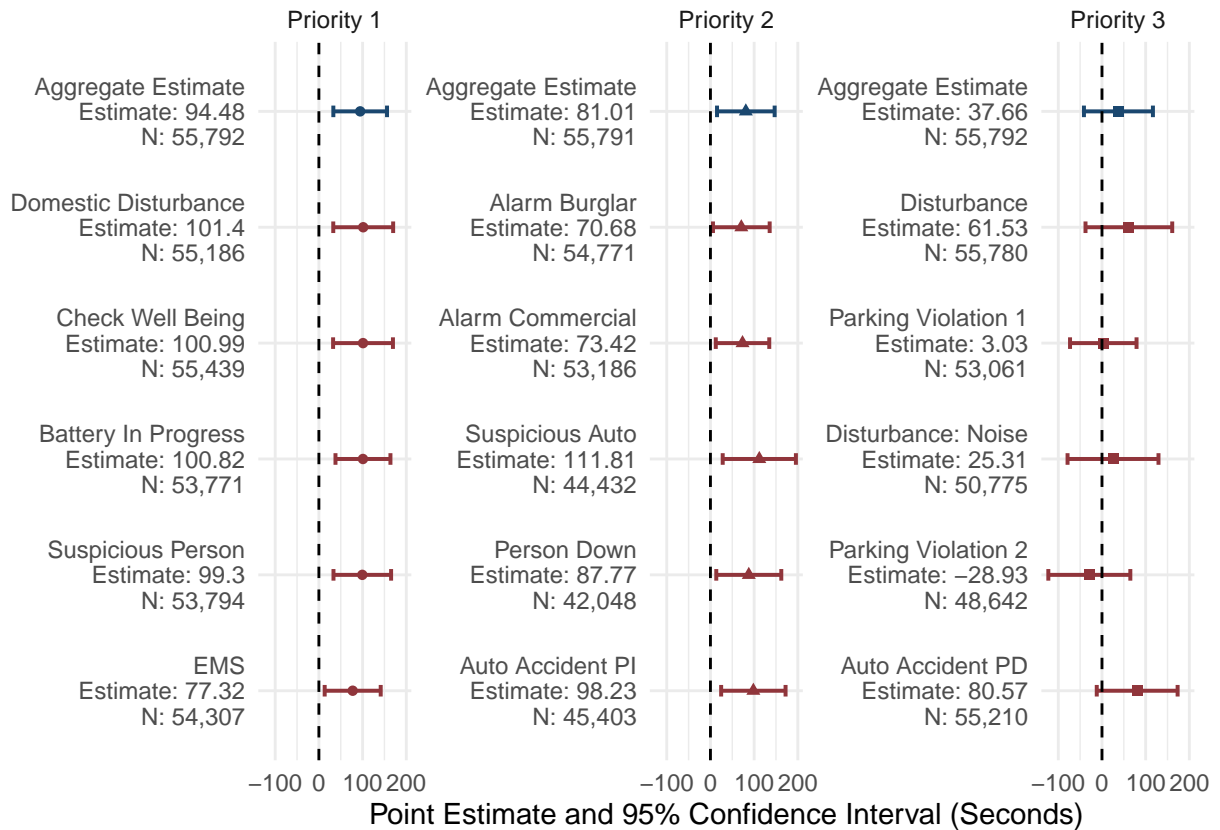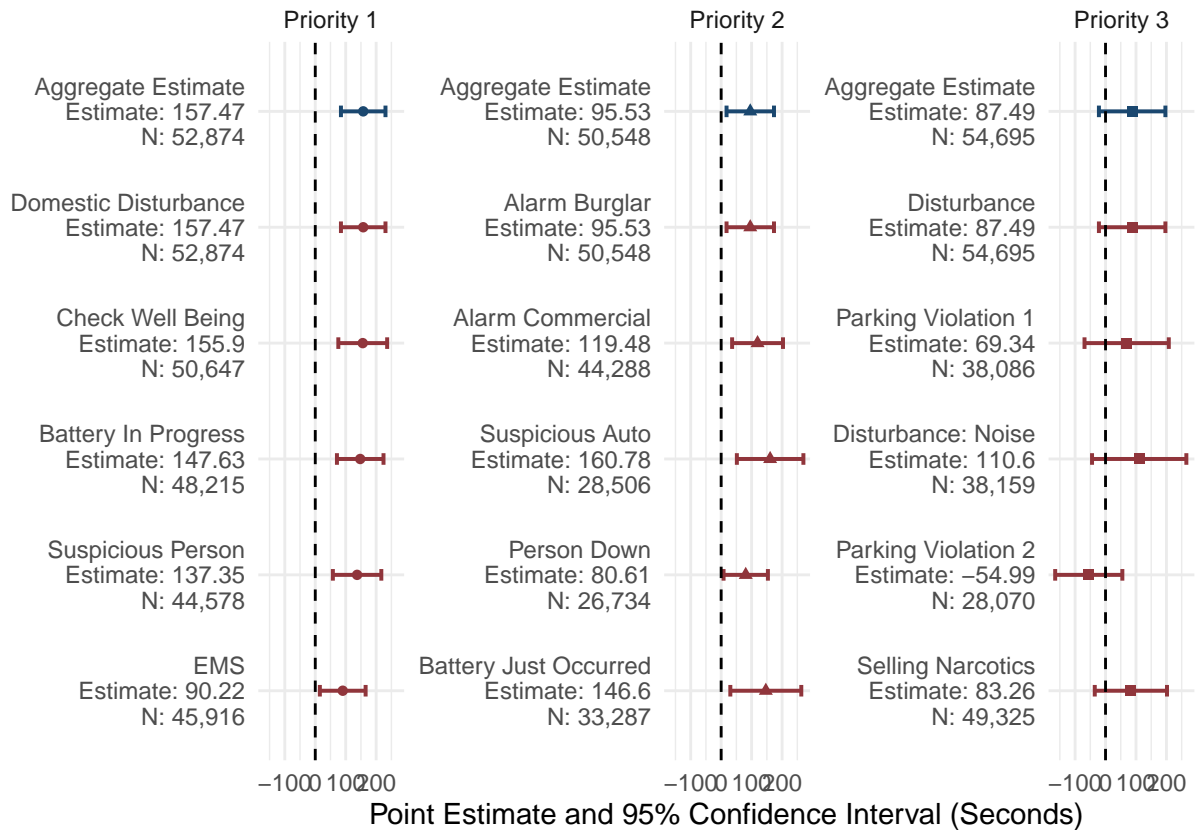
Figure 7: Effect of ShotSpotter on Call-to-On-Scene by Priority/Call Description
*Note:* The first row denotes the aggregate effect from the preferred specification on call-to-dispatch times in seconds, by priority. Rows 2-6 denote the top five most frequent 911 call descriptions within each priority. Each errorbar represents the 95

# 3 Tables

Table 1: Summary Statistics of Response Times (seconds)

|  | Mean | Std. Dev. | Median | Min | Max |
|---|---|---|---|---|---|
| **Main Outcomes:** | | | | | |
| Call to Dispatch (Priority 1) | 289.38 | 201.04 | 223.92 | 40.82 | 2,136.20 |
|  | (4.82 mins) | (3.35 mins) | (3.73 mins) | (0.68 mins) | (35.60 mins) |
| Call to On-Scene (Priority 1) | 802.44 | 295.46 | 737.45 | 103.00 | 5,577.00 |
|  | (13.37 mins) | (4.92 mins) | (12.29 mins) | (1.72 mins) | (92.95 mins) |
| **Controls/Secondary Outcomes:** | | | | | |
| Number Dispatches | 151.62 | 48.88 | 145.00 | 33.00 | 451.00 |
| Priority 1 | 64.86 | 24.25 | 62.00 | 8.00 | 244.00 |
| Priority 2 | 29.04 | 11.15 | 28.00 | 0.00 | 131.00 |
| Priority 3 | 57.71 | 23.38 | 54.00 | 7.00 | 272.00 |
| Number Arrests | 20.46 | 7.08 | 20.00 | 2.00 | 55.00 |
| Arrest Rate | 0.14 | 0.03 | 0.14 | 0.02 | 0.38 |
| Number SST Alerts | 2.57 | 4.46 | 0.00 | 0.00 | 71.00 |
| Officer Hours | 1,205.34 | 316.58 | 1,196.00 | 200.50 | 3,431.50 |
| Number Gun Victimizations | 0.37 | 0.70 | 0.00 | 0.00 | 8.00 |

*Note:*

Units are in seconds unless otherwise noted. Data is at the district-by-day level. Call to Dispatch represents the amount of time from the 911 call to the dispatcher finding and dispatching a police officer to the scene. Dispatch to On-Scene is the time from dispatch to the scene of the reported crime. Priority 1 refers to an immediate dispatch, Priority 2 a rapid dispatch, and Priority 3 a routine dispatch. Officer Hours are the number of working hours sworn police officers work. Number of SST Alerts is the number of ShotSpotter alerts. Note that New Years Eve/New Years Day/Fourth of July are excluded from the sample as ShotSpotter Alerts can be as high as 392 on these days.

Table 2: Effect of ShotSpotter Rollout on Response Times (OLS)

| | | | | | Officer Hours | |
| --- | --- | --- | --- | --- | --- | --- |
| | | | | | > Median | <= Median |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Panel A: Call to Dispatch* | | | | | | |
| ShotSpotter Activated | 93.203*** | 94.480*** | 102.737*** | 92.370*** | 38.221** | 178.246*** |
| | (31.051) | (29.541) | (29.922) | (28.934) | (18.233) | (50.570) |
| Border District Activated | | | | 14.643 | | |
| | | | | (20.019) | | |
| Mean of Dependent Variable | 289.377 | 289.377 | 289.377 | 289.377 | 255.198 | 323.554 |
| Observations | 55,792 | 55,792 | 55,792 | 55,792 | 27,895 | 27,897 |
| Wild Bootstrap P-Value | 0.008 | 0.003 | | 0.006 | 0.062 | 0.001 |
| | | | | | | |
| *Panel B: Call to On-Scene* | | | | | | |
| ShotSpotter Activated | 144.281*** | 143.804*** | 159.733*** | 140.889*** | 87.153*** | 220.132*** |
| | (34.308) | (33.256) | (33.462) | (32.803) | (27.742) | (56.916) |
| Border District Activated | | | | 20.245 | | |
| | | | | (21.543) | | |
| Mean of Dependent Variable | 802.444 | 802.444 | 802.444 | 802.444 | 745.249 | 859.637 |
| Observations | 55,791 | 55,791 | 55,791 | 55,791 | 27,895 | 27,896 |
| Wild Bootstrap P-Value | | | | | | |
| FE: Day-by-Month-by-Year | X | X | X | X | X | X |
| FE: District | X | X | X | X | X | X |
| Control Variables | | X | X | X | X | X |
| Gardner (2021) Robust | | | | X | | |

*Note:*

* p < 0.1, ** p < 0.05, *** p < 0.01

Standard errors are clustered by district. Shotspotter is activated in 12 of the 22 police districts in Chicago. Panel A shows the time from entry call to dispatched officer. Panel B shows time from the dispatched officer to on scene. Controls in all models include controls for officer hours and number of dispatches.

Table 3: Effect of Number of ShotSpotter Alerts on Response Times (OLS)

| | (1) | (2) | (3) | (4) | Officer Hours > Median (5) | Officer Hours <= Median (6) |
|---|---|---|---|---|---|---|
| *Panel A: Call to Dispatch* | | | | | | |
| Number SST Alerts | 10.412*** | 10.026*** | 14.205*** | 9.901*** | 5.578*** | 9.956*** |
| | (2.918) | (2.960) | (3.946) | (2.886) | (1.948) | (2.339) |
| Border Police District | | | | 17.668 | | |
| | | | | (19.108) | | |
| Mean of Dependent Variable | 289.377 | 289.377 | 289.377 | 289.377 | 255.198 | 323.554 |
| Observations | 55,792 | 55,792 | 55,792 | 55,792 | 27,895 | 27,897 |
| | | | | | | |
| *Panel B: Call to On-Scene* | | | | | | |
| Number SST Alerts | 13.884*** | 13.255*** | 20.493*** | 13.056*** | 8.820*** | 11.711*** |
| | (3.215) | (3.271) | (4.241) | (3.201) | (2.404) | (2.636) |
| Border Police District | | | | 27.914 | | |
| | | | | (20.760) | | |
| Mean of Dependent Variable | 802.444 | 802.444 | 802.444 | 802.444 | 745.249 | 859.637 |
| Observations | 55,791 | 55,791 | 55,791 | 55,791 | 27,895 | 27,896 |
| FE: Day-by-Month-by-Year | X | X | X | X | X | X |
| FE: District | X | X | X | X | X | X |
| Control Variables | | X | X | X | X | X |
| Gardner (2021) Robust | | | | X | | |

*Note:*
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Standard errors are clustered by district. Shotspotter is activated in 12 of the 22 police districts in Chicago. Panel A shows the time from entry call to dispatched officer. Panel B shows time from the dispatched officer to on scene. Controls in all models include controls for officer hours and number of dispatches.

## Table 4: Effect of ShotSpotter Enactment on Arrest Rates (OLS)

| | | Arrest Rate by Most Frequent Arrest Calls | | | | |
|---|---|---|---|---|---|---|
| | Arrest Rate | Domestic Battery | Domestic Disturbance | Robbery | EMS | Battery |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| ShotSpotter Activated | -0.007*** | -0.018** | -0.003 | -0.018* | -0.006 | -0.011** |
| | (0.002) | (0.007) | (0.004) | (0.009) | (0.005) | (0.004) |
| Mean of Dependent Variable | 0.147 | 0.347 | 0.134 | 0.666 | 0.156 | 0.152 |
| Observations | 55,792 | 50,068 | 55,186 | 29,550 | 54,307 | 53,771 |
| FE: Day-by-Month-by-Year | X | X | X | X | X | X |
| FE: District | X | X | X | X | X | X |

*Note:*

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Standard errors are clustered by district. Shotspotter is activated in 12 of the 22 police districts in Chicago. Panel A shows the time from entry call to dispatched officer. Panel B shows time from the dispatched officer to on scene. Controls in all models include controls for officer hours and number of dispatches.