An Evaluation of Crime Gun Intelligence Center Improvements Implemented in Washington, DC, 2016-2019

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October 30, 2019

GOVERNMENT OF THE DISTRICT OF COLUMBIA
MURIEL BOWSER, MAYOR

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We would like to express our gratitude to our partners at the Metropolitan Police Department, Chief Peter Newsham, Assistant Chief Robert Contee, Commander Leslie Parsons, Leeann Turner, Matthew Bromeland, and Heidi Fieselmann for helping to shepherd this project from grant writing to implementation to evaluation. Special thanks to Kristen deTineo, Christie Weidner, and Jonathan Earle at the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF), Karen Wiggins and Jonathan Pope at Department of Forensic Sciences (DFS), and Dineen Baker at the U.S. Attorney's Office (USAO) for sharing invaluable insights and feedback, as well as Peter Casey, Rebecca Johnson, Nat Mammo, Ryan T. Moore, and Kevin Wilson at The Lab @ DC for general guidance and feedback.

[2] Felix Owusu, Anita Ravishankar, and Daniel Sebastian are all MPD employees who are Agency Fellows with The Lab @ DC. As Agency Fellows, they spend part of their time contributing to collaborative projects between The Lab and MPD as well as Lab projects in other policy areas. In an intentionally collaborative effort, Lab and MPD staff work closely throughout the process to evaluate CGIC 2.0; however, all final decisions on quantitative methods were made by the Director of The Lab @ DC (first David Yokum, then Sam Quinney) and all final results on the impact of CGIC 2.0 were produced by Lab staff and approved by the Director.

Abstract

The Metropolitan Police Department (MPD) was awarded a grant from the Department of Justice (DOJ) Office of Justice Programs (OJP) Bureau of Justice Assistance (BJA) to enhance the capabilities of the Washington, DC Crime Gun Intelligence Center (CGIC). The DC CGIC is a multi-agency collaboration aimed at reducing gun violence in the District. Alongside MPD, the Department of Forensic Sciences (DFS), the U.S. Attorney's Office (USAO), and the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF), the CGIC employs ATF's National Integrated Ballistic Information Network (NIBIN) to link ballistic evidence across cases where the same gun is used multiple times, with the goal of identifying, detaining, and prosecuting the most active shooters in the city. In performing those functions, the CGIC aims to reduce gun crime in Washington, DC. The grant supported collective efforts to build on the existing DC CGIC — specifically, to improve the speed with which ballistic evidence is processed and entered into NIBIN and distributed to MPD's detectives, and to enhance the capacity of MPD, DFS, and the CGIC to use output from NIBIN. This set of improvements, referred to as "CGIC 2.0," was piloted in DC's Seventh Police District (7D). We conducted descriptive analyses to shed light on the relationship between the implementation of the CGIC 2.0 improvements and case clearance rates, prosecutorial outcomes, and on detectives' perceptions of the utility of the CGIC. We find some preliminary evidence to suggest that NIBIN information, and CGIC products generally, are useful to advancing the investigatory process. We also use a quasi-experimental research design to evaluate the causal impact of the CGIC 2.0 enhancements on violent crime outcomes. We find no measurable effect on violent crime rates, ShotSpotter alerts, calls for service for sounds of gunshots, or arrest rates as measured during the study period. If the CGIC 2.0 enhancements had significant effects on violent crime outcomes, those effects may take more time to be realized than was possible during the grant period. Therefore, we recommend maintaining the current implementation of CGIC 2.0 in 7D and revisiting the quasi-experimental outcomes in 18 to 24 months.

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Executive Summary

The District of Columbia has experienced dramatic growth in population, economic activity, and urban development over the past decade. In this dynamic context, while the city has experienced a general decrease in violent crime, it has also experienced an increase in homicides. Additionally, Washington, DC has had a gradual and substantial increase in the proportion of homicides, assaults with a dangerous weapon (ADW), and robberies that involved guns from 2012 to 2018.

One of the core challenges in combating gun violence in DC is the availability of guns in surrounding jurisdictions, limiting what DC can do on its own to reduce the number of guns put into circulation. Instead, DC must make efforts to improve its ability to track guns, and the individuals that use them to commit crimes, through partnerships with local and federal law enforcement partners. Through a U.S. Department of Justice (DOJ) Office of Justice Programs (OJP) Bureau of Justice Assistance (BJA) grant (Award Number: 2016-DG-BX-0010), the Metropolitan Police Department (MPD) was able to enhance the capabilities of Washington, DC's Crime Gun Intelligence Center (CGIC), originally launched in 2015. The grant, awarded in fall 2016, also funded an evaluation of the effect of these enhancements, which is the subject of this report.

The CGIC employs the Bureau of Alcohol, Tobacco, Firearms and Explosives' (ATF's) National Integrated Ballistic Information Network (NIBIN) to link ballistic evidence across cases where the same gun is used multiple times, with the goal of identifying, detaining, and prosecuting the most active shooters in the District. In doing so, the CGIC's aim is to reduce gun crime in Washington, DC. The grant from BJA supports collective efforts to improve the speed with which NIBIN ballistic evidence is processed and distributed to MPD's detectives, and to enhance the capacity of MPD, DFS, and the CGIC to use NIBIN output. The underlying logic of these efforts is that the timely processing of ballistic evidence will allow law enforcement officials to more effectively investigate, arrest, and prosecute perpetrators of gun crime and remove illegitimate firearms from circulation, thereby reducing violent crime.

Before deciding on which specific improvements to the CGIC would be made under this grant, agency partners and the evaluation team conducted a process evaluation of the existing CGIC protocols and implementation. This process evaluation took place from late fall 2016 through summer 2017, and involved site visits with all agency partners, interviews with operators from the relevant units, site visits to other CGIC locations, a focus group with detectives, and a discussion-based exercise to help map existing processes and procedures.

From that experience, agency partners developed a series of programmatic and policy changes related to personnel capacity, communication, and processes, detailed in the table below, with the goal of streamlining and improving the NIBIN process.

CGIC 2.0 Improvements piloted from November 2017 - April 2019.

Personnel	● The DFS Firearms Examination Unit (FEU) expanded its capacity to include two additional firearms technicians and two contracted firearms examiners. ● MPD temporarily reassigned a second detective to the CGIC for 11 months between 2017 and 2018. ● From January 2018 onwards, MPD detailed an analyst to the CGIC to conduct data analyses and streamline the data- and information-sharing process between MPD and CGIC.
Communication	● USAO, ATF & DFS provided multiple trainings for detectives who were likely to use NIBIN in their investigations. ● Starting in early 2019, the USAO and ATF have facilitated a joint 30-minute training session for all MPD officers as part of MPD's annual professional development training. ● CGIC personnel and leadership have been integrated into numerous District-wide criminal justice meetings to discuss gun crime and violence prevention both on strategic and tactical levels.
Process	● Expedited delivery of lower-priority casings (e.g. those not involved in a reported violent crime) from MPD district station offices to DFS for NIBIN processing, with the goal of district-recovered casings to be delivered to DFS within 48 hours or 2 business days of initial recovery (whereas previously, lower-priority casings were transported to DFS when it was convenient to do so). ● DFS prioritized entry of 7D casings into NIBIN.

In November 2017, a pilot of these CGIC 2.0 enhancements was initiated in MPD's Seventh District (7D), with data collection for the pilot period concluding at the end of April 2019. Project partners selected 7D, which consists of the southeasternmost portion of DC, as the pilot site for the CGIC 2.0 initiative because it consistently experiences the highest rates of gun crime in the city, and nearly half of all ShotSpotter alerts (activated when the sounds of gunshots are detected) come from 7D.

Following this decision, The Lab @ DC — a team of applied researchers based in the Office of the City Administrator of the District of Columbia — worked with CGIC agency partners to develop a multi-method approach to measure the effects of CGIC 2.0 enhancements on gun-related and violent crime outcomes. We conducted descriptive analyses of case clearance rates and prosecutorial outcomes, and fielded a multi-wave survey of detectives to gauge their perceptions of the utility of CGIC and NIBIN products. The Lab @ DC also developed a quasi-experimental approach to assess the causal effect of the CGIC 2.0 intervention on violent crime outcomes — calls for service for the sounds of gunshots, ShotSpotter alerts, violent crime rates, and arrests for gun-related crimes. We applied two methods: a synthetic control approach that allows us to estimate the effect of the CGIC 2.0 intervention at the police service area (PSA) level; and a difference-in-differences method that provides an estimate of the treatment effect for all of 7D.

In addition to our analyses of the effects of CGIC 2.0 enhancements, we examine the relationship between ShotSpotter alerts (generated by sensors) and calls for service for sounds of gunshots, matching them. We conduct this analysis to better understand whether District residents call 9-1-1 when they hear sounds of gunshots. Additionally, we want to understand if there are any geographic patterns in these calls and what those patterns might suggest about trust in criminal justice and government institutions broadly.

Our key findings from these analyses are presented below:

- **Case Clearance Rates.** There is some evidence that NIBIN information may be useful in advancing the investigative process.
- **Prosecutorial Outcomes.** We report descriptive information on prosecution outcomes for cases with NIBIN hits and cases with any ballistics evidence. Based on data collected during the study period, we do not observe any notable differences between outcomes when NIBIN information is available.
- **Detectives' Perceptions.** Survey responses and participant feedback suggest that detectives view CGIC and NIBIN positively and find it useful in their investigations.
- **Causal Effect on Violent Crime Outcomes.** We find that the implementation of CGIC 2.0 enhancements had no statistically discernible effect on violent crime outcomes *as measured during the study period*. Due to the pace of law enforcement, prosecutorial, and court activities, our analyses of these outcomes may not capture the full effects of CGIC 2.0 in an 18-month period, if effects exist.
- **ShotSpotter Dashboard.** 6D and 7D experience the most ShotSpotter alerts — by an order of magnitude — and have lower match rates to calls for service.

The descriptive analyses offer initial insights on the potential effects of CGIC 2.0 on outcomes of interest, including case clearance rates and prosecutorial outcomes. We find that cases with NIBIN hits are cleared at a slightly higher rate than cases without such evidence. Though there are admittedly other confounding factors we are unable to account for in our descriptive analysis, the direction of the effect, paired with survey data indicating that detectives not only perceive the CGIC and NIBIN information to be useful but are actually using this evidence in legal settings, suggest the utility of the CGIC and NIBIN for law enforcement investigations.

When we examine the causal effects of CGIC 2.0 through the quasi-experimental component of our evaluation, we find that the implementation of CGIC 2.0 enhancements had *no discernible effect* on violent crime outcomes as measured during the study period. As documented in the pre-registered pre-analysis plan,[3] we anticipated that it may be difficult to observe the full effects of CGIC 2.0 in an 18-month period, if effects exist. This limitation is due to the pace of law enforcement, prosecutorial, and court activities, which means that cases may take well over a year from the point of crime to arrest, trial, and sentencing. Thus, our analyses of some of these outcomes may not capture the full effect of CGIC 2.0. Because this evaluation must be completed within the grant period of performance, we accept this as an unavoidable limitation and interpret our results as a preliminary window into the possible impacts of CGIC 2.0.

[3] See The Lab @ DC. Pre-Analysis Plan: Crime Gun Intelligence Center (CGIC) Evaluation. 2019. Available https://osf.io/q8r5m/, and The Lab @ DC. Pre-Analysis Plan Addendum: Crime Gun Intelligence Center (CGIC) Evaluation. 2019. Available https://osf.io/vztxe/.

We also anticipated the statistical difficulty of estimating causal effects for 7D, the district with the highest rates of gun crime in the city. The unique nature of this district within Washington, DC presented a challenge for constructing a well-matched comparison group.

In addition, we note that, while the fullest implementation of CGIC 2.0 processes took place in 7D (e.g., MPD expedited the delivery of shell casings recovered in 7D to DFS within 2 business days, and DFS prioritized entry into NIBIN of those 7D shell casings), CGIC activities (and CGIC 2.0 enhancements) were not constrained to 7D. For example, detectives from other police districts also received CGIC/NIBIN training; personnel assigned to CGIC worked on cases in other districts; and cases that originated in 7D may have had connections to cases in other districts. Further, ATF activities at the CGIC did not treat investigative leads from 7D differently than leads from the rest of the city. Thus, there may be some spillover effects that affect our ability to detect an effect of the full CGIC implementation in 7D through the quasi-experimental approach applied.

The findings presented here — from one of the first ever formal assessments of CGIC process improvements — offer preliminary insights on the effectiveness of this approach to improving the comprehensiveness and timeliness of NIBIN information, and more broadly, to reducing gun crime. Though we do not find an effect of CGIC 2.0 enhancements on violent crime outcomes during the study period, our descriptive analyses are suggestive of the value of CGIC and NIBIN information to advancing the investigatory process.

Additional feedback from CGIC partners suggests other mechanisms — not assessed here due to data limitations — through which the CGIC might help reduce violent crime outcomes long-term. For example, NIBIN information has been used to inform MPD’s patrol deployment throughout the city, and NIBIN information from DC has been used by ATF in interstate firearms trafficking investigations leading to arrests in other jurisdictions. Partners also report improvements in coordination and collaboration with one another in responding to high profile shooting incidents. Though we cannot systematically measure these outcomes at this time, this anecdotal evidence suggests directions for future evaluations of the CGIC model.

Taken together, our recommendation is to continue the CGIC 2.0 implementation and for CGIC partner agencies to track outcomes of interest through an additional 18- to 24-month period. This recommendation aligns to findings reported from the evaluation of Milwaukee, WI’s CGIC program as well.[4] Extending the evaluation time frame would allow for further data collection, especially on law enforcement and prosecutorial processes that did not yet have final outcomes at the time this report was written. This evaluation also suggests that continuing efforts to expand detectives’ use of NIBIN and CGIC products may help advance investigations, and in so doing, help reduce gun crime in Washington, DC.

[4] Koper, C., Vovak, H., and B. Cowell. Evaluation of the Milwaukee Police Department’s crime gun intelligence center. Washington, DC: National Police Foundation (2019).

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Introduction

The District of Columbia has experienced dramatic growth in population, economic activity, and urban development over the past decade. The U.S. Census Bureau estimates the District's population at over 700,000 people in 2018, an increase of more than 100,000 people since 2010.[5] In this dynamic context, while the city has experienced a general decrease in violent crime, it has also experienced an increase in homicides, as demonstrated in the upward trend shown in the graph below. Additionally, Washington, DC has had a gradual and significant increase in the proportion of homicides, assaults with a dangerous weapon (ADW), and robberies that involved guns from 2012 to 2018.

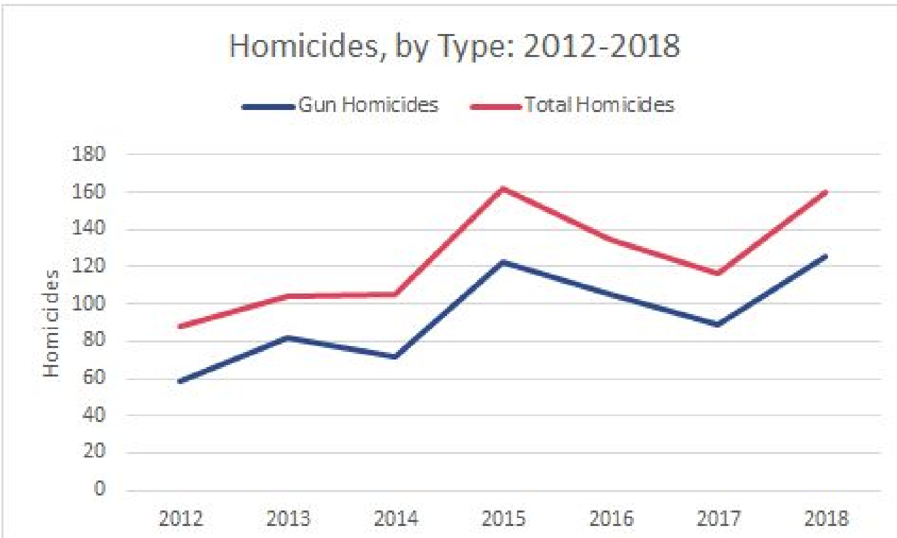

Figure 1: Homicide trends in DC from 2012-2018 (Source: MPD Homicide Branch)

One of the core challenges in combating gun violence in DC is the availability of guns in surrounding jurisdictions. A Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) report on firearms[6] recovered and traced in Washington, DC suggests that roughly 50 percent of the guns in the District with known source states were traced back to surrounding states. According to the report, 2,095 guns were traced and recovered in 2018 and a source state for the gun was identified in 1,454. Of those, 599 came from the state of Virginia, while 179 came from Maryland. In fact, of the gun traces with known source states, only 43 guns (less than 3 percent) actually came from Washington, DC. These findings demonstrate that DC has limited ability on its own to reduce the number of guns put into circulation. Instead, law enforcement in DC has focused on improving its ability to track guns, and the individuals that use them to commit crimes, through partnerships with local and federal law enforcement partners. Through a U.S. Department of Justice (DOJ) Office of Justice Programs (OJP) Bureau of Justice Assistance (BJA) grant (Award Number: 2016-DG-BX-0010), the Metropolitan Police Department (MPD) was able to enhance the capabilities of Washington, DC's Crime Gun Intelligence

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[5] U.S. Census Bureau. "Quick Facts - District of Columbia." 2018. Available https://www.census.gov/quickfacts/DC.
[6] Office of Strategic Intelligence and Information. *Firearms Trace Data: District of Columbia - January 1, 2018 - December 31, 2018.* Bureau of Alcohol, Tobacco, Firearms and Explosives. 2019. Available https://www.atf.gov/file/137076/download.

Center (CGIC). The grant, awarded in fall 2016, also funded an evaluation of the effect of these enhancements, which is the subject of this report.

The CGIC employs ATF's National Integrated Ballistic Information Network (NIBIN) to link ballistic evidence across cases where the same gun is used multiple times, with the goal of identifying, detaining, and prosecuting the most active shooters in the District. In doing so, the CGIC's aim is to reduce gun crime in Washington, DC. The grant from BJA supports collective efforts to improve the speed with which NIBIN ballistic evidence is processed and distributed to MPD's detectives, and to enhance the capacity of MPD, DFS, and the CGIC to use NIBIN output. The underlying logic of these efforts is that the timely processing of ballistic evidence will allow law enforcement officials to more effectively investigate, arrest, and prosecute perpetrators of gun crime and remove illegal firearms from circulation, thereby reducing violent crime.

Before deciding on which specific improvements to the CGIC would be made under this grant, agency partners and the evaluation team conducted a process evaluation of the existing CGIC protocols and implementation.[7] From that experience, agency partners developed a series of programmatic and policy changes related to personnel capacity, communication, and processes, with the goal of streamlining and improving the NIBIN process (detailed in the following section). In November 2017, a pilot of these "CGIC 2.0" process enhancements was initiated in MPD's Seventh District (7D), with data collection for the pilot period concluding at the end of April 2019. Project partners selected 7D, which consists of the southeasternmost portion of DC, as the pilot site for the CGIC 2.0 initiative because it consistently experiences the highest rates of gun crime in the city, and nearly half of all ShotSpotter alerts (activated when the sounds of gunshots are detected) come from 7D. As the CGIC 2.0 process changes focus on recovered shell casings, 7D was determined to be the optimal pilot site as it would be the area where such an intervention would have the greatest potential to have the hoped-for effects.

Following this decision, the evaluation team, led by The Lab @ DC,[8] developed a quasi-experimental study design to measure the effects of CGIC 2.0 on gun-related and violent crime outcomes. The Lab and MPD also conducted descriptive analyses of case clearance rates and prosecutorial outcomes, and fielded a multi-wave survey of detectives to gauge their perceptions of the utility of CGIC and NIBIN products. The findings presented here — from one of the first ever formal assessments of CGIC activities — offer preliminary insights on the effectiveness of this approach to reducing gun crime. Though we do not find an effect of CGIC 2.0 on violent crime outcomes during the study period, we find preliminary evidence suggesting the value of CGIC and NIBIN information to advancing the investigatory process.[9]

[7] This process evaluation took place from late fall 2016 through summer 2017.
[8] The Lab @ DC is a team of applied researchers based in the Office of the City Administrator. For more information, see https://thelab.dc.gov/.
[9] As pre-registered in the pre-analysis plan for this evaluation, we had anticipated that it may be difficult to observe the full effects of CGIC 2.0 in an 18-month period, if effects truly exist. This limitation is due to the pace of law enforcement, prosecutorial, and court activities, which means that cases may take well over a year from the point of crime to arrest, trial, and sentencing. Thus, our analyses of some of these outcomes may not capture the full effect of CGIC 2.0. Because this evaluation must be completed within the grant period of performance, we accept this as an unavoidable limitation and interpret our results as a preliminary window into the possible impacts of CGIC 2.0. Also, there were statistical reasons we

Designing CGIC 2.0

There has been little formal research to date on the precise mechanisms underpinning the CGIC model nationally. MPD has anecdotal evidence that a small number of individuals are involved in a large proportion of gun crimes, and that the same firearms are often used in multiple violent crimes. The CGIC model, which entails the rapid processing of all ballistic evidence, entry of that information into an integrated information network (NIBIN), and coordination of law enforcement and prosecution efforts, may allow criminal justice agencies to more effectively investigate cases (e.g., allowing detectives to connect the dots across multiple related cases, and to do so much more quickly), apprehend suspects, and prosecute them on the basis of more robust evidence.

The CGIC model itself remains relatively new — Washington, DC, along with Milwaukee, WI and Los Angeles, CA, are among the first sites to conduct formal evaluations — and therefore there are variations in each jurisdiction's approach. To understand the implementation of the CGIC in DC, specifically, the research team undertook qualitative research efforts, working alongside agency partners to:

1. Sketch existing processes and procedures related to NIBIN;
2. Identify areas for improvement;
3. Propose solutions to address those issue areas; and
4. Develop a methodology for evaluating the effects of implementing CGIC 2.0.

These efforts included site visits with all involved agency partners and in-person or phone interviews with individuals from the following units:

Table 1: Site visits and interviews conducted as part of the process evaluation.

Agency	Unit
MPD	Criminal Investigations Division (CID) Investigative Services Bureau (ISB) Crime Scene Investigation Division (CSID) Evidence Control Branch (ECB) Seventh District property
DFS	Firearms Examination Unit (FEU) Crime Scene Sciences Unit (CSSU) Central Evidence Unit (CEU) Forensic Technology Unit (FTU)
Other	DC U.S. Attorney's Office (USAO) DC CGIC

expected difficulty with estimating causal effects for 7D — the district with the highest rates of gun crime in the city. The unique nature of this district within Washington, DC presented a challenge for constructing a well-matched comparison group.

The Lab, along with agency partners, also traveled to Philadelphia, PA and Denver, CO to observe CGIC- and NIBIN-related processes employed in those jurisdictions and to interview local staff.

In addition, we conducted a discussion-based, or “tabletop,” exercise on July 20, 2017 that included operators from MPD, including CID, ISB, CSID, and Seventh District property units; from DFS, including FEU, CEU, and CSSU; and operators from the DC CGIC. During the tabletop exercise, CGIC operators were asked to simulate their responses to scenarios provided by the research team, including an incident with sounds of gunshots and a homicide. This allowed us to observe participants’ stated responses to how they would react to an incident and the specific processes they go through, and provided an opportunity to discuss process pain points and areas for potential improvement. The event helped to clarify some of the NIBIN process points raised in previous interviews and guide the team’s thinking about the design of potential changes to existing procedures.

We also conducted a focus group with six MPD detectives in late November 2017 as part of our process evaluation. This was intended as an opportunity to hear the views of detectives — the primary end-users of NIBIN information — regarding NIBIN, CGIC, and the benefits and drawbacks of the kinds of intelligence products they receive.

In addition to this qualitative work, we drew on insights from psychology, user-centered design, and behavioral science to inform many of the policy and procedural changes made by the agency partners to achieve CGIC 2.0. Research on cognitive load,[10] good design,[11] and work on performance feedback [12] were particularly relevant to our efforts.

Based on this process evaluation, agency partners identified the improvements detailed in Table 2 below to be piloted in the Seventh District beginning in November 2017. Collectively, we refer to this set of changes as “CGIC 2.0.”

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[10] Sweller, John. "Cognitive load theory." *Psychology of learning and motivation*. Vol. 55. Academic Press, 2011. 37-76.
[11] Norman, Don. *The design of everyday things: Revised and expanded edition*. Constellation, 2013.
[12] O'Reilly III, Charles A., and John C. Anderson. "Trust and the communication of performance appraisal information: The effect of feedback on performance and job satisfaction." *Human Communication Research* 6.4 (1980): 290-298; Kim, Jay S., and W. Clay Hamner. "Effect of performance feedback and goal setting on productivity and satisfaction in an organizational setting." *Journal of Applied Psychology* 61.1 (1976); Pritchard, Robert D., et al. "Effects of group feedback, goal setting, and incentives on organizational productivity." *Journal of Applied Psychology* 73.2 (1988).

Table 2: CGIC 2.0 improvements piloted from November 2017 - April 2019.

Personnel	● The DFS Firearms Examination Unit (FEU) expanded its capacity to include two additional firearms technicians and two contracted firearms examiners. ● MPD temporarily reassigned a second detective to the CGIC for 11 months between 2017 and 2018. ● From January 2018 onwards, MPD detailed an analyst to the CGIC to conduct data analyses and streamline the data- and information-sharing process between MPD and CGIC.
Communication	● USAO, ATF & DFS provided multiple trainings for detectives who were likely to use NIBIN in their investigations. ● Starting in early 2019, the USAO and ATF have facilitated a joint 30-minute training session for all MPD officers as part of MPD's annual professional development training. ● CGIC personnel and leadership have been integrated into numerous District-wide criminal justice meetings to discuss gun crime and violence prevention both on strategic and tactical levels.
Process	● Expedite delivery of lower-priority casings (e.g. those not involved in a reported violent crime) from MPD 7D station offices to DFS for NIBIN processing, with the goal of delivering 7D-recovered casings to DFS within 48 hours or 2 business days of initial recovery, whereas previously, lower-priority casings were transported to DFS when it was convenient to do so. ● DFS prioritizes entry of 7D casings into NIBIN.

We note that the fullest implementation of the CGIC 2.0 pilot took place in 7D. While the process changes were implemented in 7D only, the personnel and communication changes were not constrained to 7D — e.g., detectives from other districts also received CGIC/NIBIN training; personnel assigned to CGIC worked on cases in other districts; and cases that originated in 7D may have had connections to cases in other districts.

Compliance with CGIC 2.0 Improvements

Throughout the study period, we conducted periodic compliance checks to ensure all MPD parties in 7D adhere to the protocol requiring that shell casings be delivered to DFS within two business days of being recovered.[13] We find there is relatively high compliance with the protocol in 7D. The chart below depicts the number of shell casings delivered to DFS within (and outside of) the required two-day window in 7D. For the study period we find that on average, 80% of shell casings were delivered within the required window.

[13] We define business days as Sunday - Thursday, as the majority of shooting incidents occur in the evening hours, after any delivery on Friday would occur.

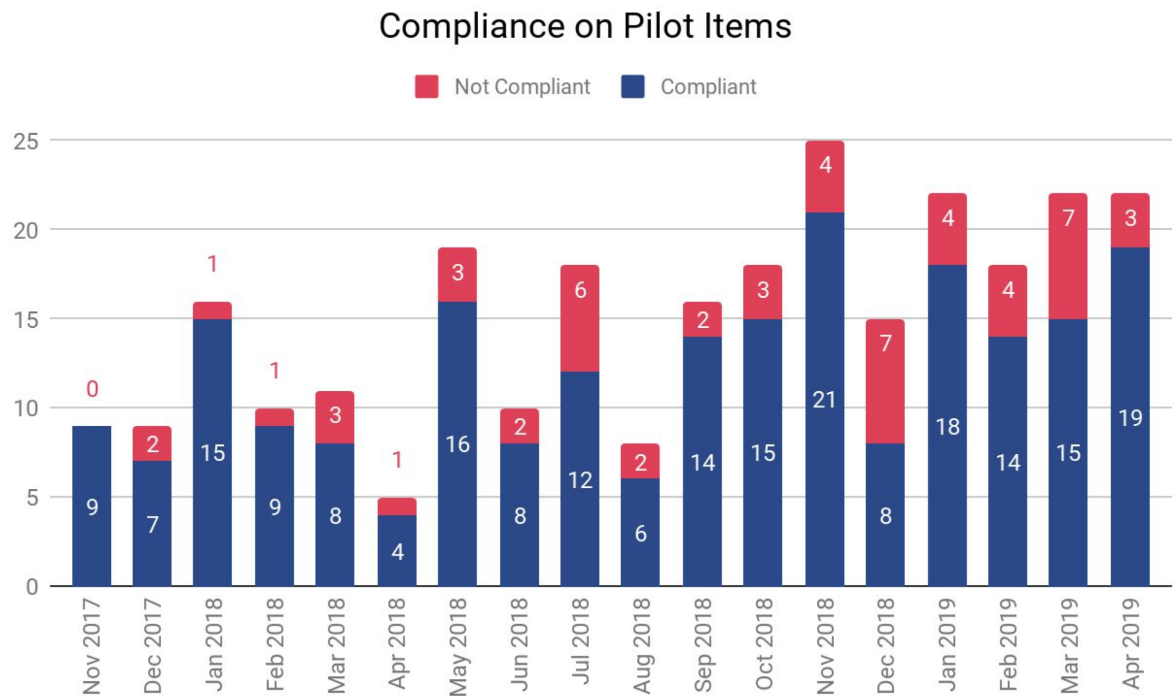

Figure 2: Number of shell casings delivered to DFS within (and outside of) the required two-day window in 7D

We also examine the median time to delivery for shell casings which are part of the CGIC 2.0 pilot (blue) and those which are not (red) in the chart below for 7D — where CGIC 2.0 was implemented — compared to the other six police districts. Specifically, we examine district-recovered casings only (e.g., those casings from sounds of gunshots and destruction of property incidents recovered on scene by MPD; casings from violent crime incidents such as homicides or assaults with a deadly weapon are recovered on scene by DFS and are not included here). In Figure 3, we see clearly that MPD transferred casings recovered in 7D to DFS substantially faster during CGIC 2.0 implementation, but unfortunately cannot know if that difference (or a difference of lesser magnitude) existed previously as the data were not reported at the district level prior to the study period.[14]

[14] We are unable to plot 7D-recovered casings prior to the implementation of CGIC 2.0, as that labeling was not implemented until the pilot began and earlier data does not indicate the district in which the shell casing was recovered. 7D shell casings recovered in the pre-treatment period are thus included in the plotted red line along with the rest of the city.

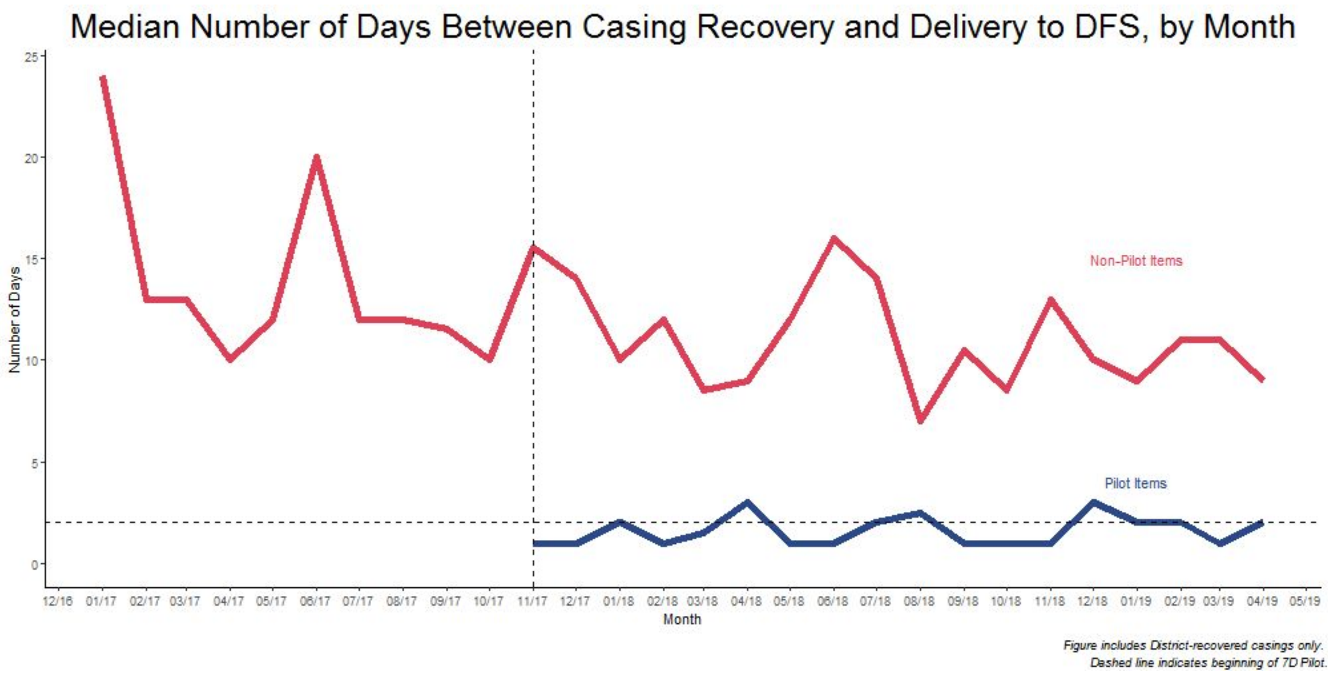

Figure 3: Median number of days between casing recovery and delivery to DFS by month. The dashed vertical line indicates the beginning of the pilot; the dashed horizontal line shows where 2 days, the compliance target, falls on the y-axis. The blue line depicts the median delivery time for shell casings in 7D. The red line depicts the median recovery time for the *entire* District before the CGIC 2.0 implementation; after the CGIC 2.0 implementation, the red line represents the median delivery time for *non-7D* casings. We were unable to plot 7D casings prior to the implementation of CGIC 2.0, as the breakout by police district for these types of casings was not implemented until the pilot began.

In addition, after two examiners were assigned to DFS NIBIN Operations in FY2018, the number of NIBIN hits reported increased by 147% compared to previous years, increasing from 347 and 338 in FY2016 and FY2017, respectively, to 834 hits in FY2018.

Taken together, these metrics suggest that the CGIC 2.0 process changes were implemented as intended in 7D during the study period. But did the overall intervention — comprised of the personnel, communication, and process changes detailed in Table 2 above — have any effects on violent crime? The remainder of this report focuses on the impact of CGIC 2.0 on outcomes of interest as measured during the study period.

Research Design

Given the nature of the CGIC 2.0 implementation — the intervention was restricted to one intentionally selected police district in Washington, DC — it was not feasible to conduct a randomized evaluation to assess the effects of this program. Instead, we apply multiple methods to evaluate CGIC 2.0 across several dimensions:

1. We use descriptive analyses to measure if CGIC 2.0 was associated with improvements in case clearance rates and prosecutions.
2. We employ a multi-wave survey to gauge how this intervention affects detectives' perceptions of the utility of the CGIC and NIBIN products.
3. We use the synthetic control[15] method to evaluate the impact of CGIC 2.0 on violent crime, measured at the police service area (PSA) level.[16]
4. We use difference-in-differences[17] method to evaluate the effects of CGIC 2.0 on violent crime, measured at the district-level.[18]

Each of these approaches was detailed in our Pre-Analysis Plan and Addendum to our Pre-Analysis plan on the Open Science Framework at https://osf.io/459wt/. Both were registered and time-stamped to promote scientific transparency and accuracy.

Descriptive Analyses

Case Clearance Rates and Prosecutorial Outcomes

We undertake descriptive analyses to shed light on the potential effect of CGIC 2.0 on case clearance rates and prosecutions. For these analyses we focus on cases that have ballistics evidence and cases that have NIBIN hits. We consider cases that have any firearms and cartridge casings evidence acquired and entered into NIBIN as having *ballistics evidence.* Some of this ballistics evidence can potentially have a NIBIN *lead*. A NIBIN lead is made when a casing is acquired into NIBIN and the NIBIN database identifies a possible match with a previously acquired casing. When an examiner takes the physical cartridges from the lead and confirms the lead, it is called a NIBIN *hit*. In DC, over 99% of the leads that are examined are confirmed as hits.

We use data from the Department of Forensic Science (DFS) to identify those cases with NIBIN hits and MPD arrest data to calculate MPD's case clearance rate. In this analysis, a case is considered "cleared" when an arrest is made. We focus our analyses on violent crimes in which a gun was used.[19] We also take a descriptive look at prosecutorial outcomes for gun cases with ballistics evidence during the study period, examining data that was provided by the US Attorney's Office (USAO).[20]

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[15] For more information and examples of the application of the synthetic control approach, see (1) Abadie, Alberto, Alexis Diamond, and Jens Hainmueller. "Synthetic control methods for comparative case studies: Estimating the effect of California's tobacco control program." *Journal of the American statistical Association* 105.490 (2010): 493-505; (2) Abadie, Alberto, and Javier Gardeazabal. "The economic costs of conflict: A case study of the Basque Country." *American Economic Review 93.1 (2003)*: 113-132; and (3) Saunders, Jessica, et al. "A synthetic control approach to evaluating place-based crime interventions." *Journal of Quantitative Criminology* 31.3 (2015): 413-434.

[16] The decision to analyze the results of CGIC 2.0 at the PSA-level using the synthetic control method was updated in the addendum to the pre-analysis plan. For further detail, see Appendix A.

[17] For more information and examples of the application of this approach, see Angrist, Joshua D., and Jörn-Steffen Pischke. *Mostly harmless econometrics: An empiricist's companion.* Princeton University Press, 2008, pp. 221-247, and Card, David., and Alan B. Krueger. "Minimum wages and employment: A case study of the fast food industry in New Jersey and Pennsylvania." *American Economic Review* 84.4 (1994): 772–793.

[18] The decision to analyze the results of CGIC 2.0 at the District-level using the difference-in-differences method was updated in the addendum to the pre-analysis plan. For further detail, see Appendix A.

[19] We break out these cases by offense category, not the category of crime that the defendant was charged with.

[20] The USAO was unable to provide outcomes for four of the arrests because of data discrepancy issues.

Due to the pace of law enforcement, prosecutorial, and court activities, cases may take well over a year from the point of crime to arrest, trial, and sentencing. Thus, our analyses of some of these outcomes, which is restricted to data collected from November 2017 through April 2019, likely do not capture the full effect of CGIC 2.0, particularly on prosecutorial outcomes, where any effect may only emerge over several years as cases are concluded.

Detective Perceptions of NIBIN/CGIC

Increasing awareness and use of CGIC and NIBIN products among detectives (and officers) was a key objective of CGIC 2.0. Through a multi-wave survey of MPD's detectives, we measure change in their perceptions and use of CGIC and NIBIN products over time.[21] Survey questions ask about awareness of NIBIN and CGIC; the utility and timeliness of NIBIN and CGIC products to investigations; and areas for improvement with the design and content of these products. We present the topline results from each wave.[22]

Quasi-Experimental Research Design: Measuring the Effect of CGIC 2.0 on Violent Crime

We apply two distinct but related quasi-experimental approaches — synthetic control and difference-in-differences — to measure the effects of CGIC 2.0 on the following outcomes of interest:

- **Violent crime**. We use MPD's crime data to measure the monthly crime rate. We calculate two versions of this outcome: 1) the rate of violent crimes, which includes all incidents with an offense category of robbery, assault with a dangerous weapon, sex abuse, or homicide; and 2) the rate of incidents in which a gun was explictly reported to be used in the course of the event, or gun crime rate.
- **ShotSpotter alerts**. We use MPD's ShotSpotter data to measure the rate of alerts per coverage area. The process for cleaning the ShotSpotter data is detailed in Appendix D.
- **Calls for Service for sounds of gunshots**. We measure the rate of calls for service for sounds of gunshots using data from the Office of Unified Communications (OUC). We focus our analysis on events that were called into OUC (e.g., we exclude events that were self-initiated by officers).
- **Arrests for gun-related crimes**. We use MPD's arrest data to calculate the rate of daily gun-related arrests aggregated by month. We use three different definitions of "gun-related arrests" to measure this outcome:

[21] The survey instrument is included in Appendix E.

[22] Not all detectives participated (or were part of the sample population) for each wave — the initial wave of the survey was sent to the detectives who attended the training provided in December 2018 (primarily detectives assigned to 7D, as well as a few Homicide detectives and detectives assigned to other police districts). Later rounds of the survey added on detectives assigned to the Homicide Branch and detectives in police districts assigned primarily to shooting cases.

- Arrests for weapons violations in which a gun was involved and/or violent crimes (these include assault with a dangerous weapon, homicide, robbery, and sex abuse) in which a gun was used (broadest definition)
- Arrests for weapons violations involving a gun.
- Arrests for violent crimes involving a gun.

Both the synthetic control and difference-in-differences methods are used to evaluate the impact of an intervention in the absence of random assignment, and involve constructing counterfactual outcomes for treated areas (i.e., estimating what would have happened if the treatment was not implemented) using information on untreated units. The approaches differ in that the synthetic control method attempts to construct comparison groups as a weighted combination of the untreated regions explicitly to be equal on pre-treatment outcomes. A difference-in-differences design assumes that treated and untreated regions are not necessarily equal on pre-treatment outcomes, but—absent the treatment—that they would follow a parallel trend over time, even if their outcomes differ in absolute levels systematically due to unobserved factors.[23] Where both methods allow for unobserved confounders, the synthetic control model allows for those factors to vary over time, while difference-in-differences "restricts the effect of those confounders to be constant in time."[24]

In this evaluation, 7D was selected as the pilot district for the CGIC 2.0 due to its higher rates of gun-related and violent crime — it is our "treated" unit. As this police district is an outlier within DC, it is not reasonable to directly compare outcomes in 7D to other non-treated districts. Instead, we apply the synthetic control method at the police service area (PSA) level to allow us to build a more balanced comparison to the treated unit. While there are only seven districts in DC, each district is further divided into police service areas, of which there are 57 total. For each treated PSA in 7D, we construct a synthetic control using the *30-day rolling means of the number of incidents* from a combination of the other untreated PSAs in DC. This "donor pool" is constructed using data from November 1, 2016 to October 31, 2017.[25] If we are able to construct a viable synthetic control to each PSA in 7D, the method allows us to approximate *what would have happened* in 7D (at the PSA level) if the intervention did not take place during the study period. We used rolling means to account for the fact that shootings, and crime in general, are usually rare occurrences. There may be a shooting one day and no shootings for several days after that, which can make our data clustered in time. To correctly identify for trends in crime, we use rolling means to smooth out data over time.[26]

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[23] More simply, in difference-in-differences, the implicit weight on the single control unit is 1, and the weight on all other potential donor units is 0.
[24] Abadie et al (2010), p. 495.
[25] A more detailed description of how the synthetic controls were constructed is provided in Appendix B.
[26] This component of the analysis, along with *t*-tests to inform statistical inference, was pre-registered in the pre-analysis plan for the Crime Gun Intelligence Center (CGIC) Evaluation Version 1.0. In an addendum to the pre-analysis plan that has also been pre-registered, we update our methodology, shifting from *t*-tests to placebo tests for statistical inference. The latter is more commonly performed in synthetic control analyses, and so we follow established best practices. The results of the *t*-test analyses, however, are still reported in Appendix C as specified in the original pre-analysis plan. We caution against further interpretation of these results as tests of this type are not typically used with the synthetic control method.

We then compare outcomes for the treated PSAs and their synthetic matches, examining the corresponding plots visually and conducting placebo tests to infer whether differences between the treated PSAs and synthetic controls are statistically significant.[27] In placebo tests, we run the synthetic control method on each PSA in the donor pool (i.e., all PSAs not in 7D) as if it was a treated PSA in 7D. These placebo PSAs are then compared with their synthetic counterparts; any deviations between a placebo PSA and its synthetic match would not be due to the implementation of CGIC 2.0 since the placebo PSAs were not treated.[28] By then comparing the difference between the treated PSAs and their corresponding synthetic controls to the difference between placebo PSAs and their controls, we can evaluate whether the deviation between the outcomes in treated PSAs and their synthetic counterparts are likely to reflect the impacts of CGIC 2.0 rather than random chance.[29,30] Specifically, we follow a similar approach to Abadie et al. (2010) to assess this difference:

1. Visually display the difference between the 7D PSAs and the placebo PSAs;
2. Calculate the ratio of the pre-intervention and post-intervention mean squared prediction errors (MPSE); and
3. Calculate the permutation inference *p*-value — the proportion of placebo PSAs where the ratio of the pre/post-CGIC 2.0 MPSE equals or exceeds that of the 7D PSAs for each outcome.

We perform this analysis for each violent crime outcome, and obtain results at the PSA level.

To provide more insight into the *overall changes in outcomes* across all treated PSAs relative to the PSAs in the six other police districts during the CGIC 2.0 implementation, we pair the synthetic control analysis with a difference-in-differences analysis for each outcome of interest. This method allows us to interpret the effect of CGIC 2.0 at the police district level — the level at which the treatment was applied — and allows for baseline differences between 7D and the rest of the District. Specifically, we measure the change in each of our outcomes before and after CGIC 2.0 implementation in 7D (our first "difference") and subtract that from the change in each outcome in the other six districts (our second "difference"). We perform this calculation for the four quarters prior to the implementation of CGIC 2.0 and for the six quarters after the implementation. As described above, a key assumption of difference-in-differences design is that the treated and untreated units would follow a similar trend during the treatment period (i.e. the implementation of CGIC 2.0). While that assumption cannot be

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[27] This element of the analysis was pre-registered in an addendum to the pre-analysis plan for this evaluation. For further detail, see Appendix A.

[28] We might still find systematic differences between placebos and their synthetic matches if, for example, some other change occurred at the same time as CGIC 2.0. Our hypothesis is that CGIC 2.0 implementation drives deviation between the treated PSAs and their synthetic controls. The placebo test tells us whether that is actually the case — if it is *not*, we would expect to see a *similar deviation* between treated PSAs and their synthetic counterparts and placebo PSAs and their synthetic matches *regardless of CGIC exposure*. This might be either due to chance because the measure is noisy, or because there are changes but they are driven by something other than CGIC.

[29] This element of the analysis was pre-registered in an addendum to the pre-analysis plan for this evaluation. For further detail, see Appendix A.

[30] Abadie, Alberto, Alexis Diamond, and Jens Hainmueller. "Synthetic control methods for comparative case studies: Estimating the effect of California's tobacco control program." *Journal of the American Statistical Association* 105.490 (2010): 493-505; Abadie, Alberto, Alexis Diamond, and Jens Hainmueller. "Comparative Politics and the Synthetic Control Method." *American Journal of Political Science* 59.2. (2015): 495–510; McClelland, R., S. Gault. The synthetic control method as a tool to understand state policy. *Washington, DC: Urban-Brookings Tax Policy Center* (2017).

measured, one important check is to examine the trends for the treated and untreated units prior to implementation. Based on visual inspection of pre-treatment trends for 7D compared to the other police districts, the assumption of parallel trends across treated and untreated PSAs during the treatment period may not hold for at least some of our outcomes of interest. Therefore, the estimates generated using the difference-in-differences design may deviate from the true impact of CGIC 2.0.

That said, we estimate the following model as the best available method to understand the overall effects of CGIC 2.0 on the outcomes of interest:

$$Y_{jt} = \alpha_j + \beta_q + \eta CGIC_j + \sum_q (\gamma_q * \beta_q * CGIC_j) + \varepsilon_{jt}$$

where Y_{jt} is the value of the outcome of interest in PSA *j* on day *t*, α_j and β_q are PSA and quarter fixed effects respectively, $CGIC_j$ is an indicator variable that takes a value of one for PSAs in which CGIC 2.0 was implemented (i.e., the PSAs in 7D), and ε_{jt} is the error term. ε_{jt} will be clustered at the PSA level for estimation. γ_q are the estimates of interest and, under the assumptions of the difference-in-differences design, correspond to quarterly estimates of the average treatment effect of CGIC 2.0.

Exploratory Analyses

In addition to our analyses of the effects of CGIC 2.0, we examine the relationship between ShotSpotter alerts (generated by sensors) and calls for service for sounds of gunshots, matching them. We conduct this analysis to better understand whether District residents call 9-1-1 when they hear sounds of gunshots. Additionally, we want to understand if there are any geographic patterns in these calls and what those patterns might suggest about trust in criminal justice and government institutions broadly. Appendix D provides an overview of the methods used to clean the ShotSpotter data and determine what constitutes a “match” between an alert and a call for service.

The multi-method research design outlined above aims to inform a preliminary understanding of the overall impact of CGIC 2.0 on the outcomes of interest. Each method provides useful, if imperfect, information towards building an evidentiary basis for this type of intervention, accounting for the many different dimensions that may be affected in a multi-agency partnership of this kind. We present the results of our analyses in the next section.

Results

Summary

This section presents results from both descriptive and quasi-experimental analyses of data collected during the study period.

The descriptive analyses offer preliminary insights on the potential effects of CGIC 2.0 on additional outcomes of interest, including case clearance rates and prosecutorial outcomes. We find that cases with NIBIN information are cleared at a slightly higher rate than cases without such evidence. Though there are admittedly other confounding factors we are unable to account for in our descriptive analysis, the direction of the effect, paired with survey data indicating that detectives not only perceive the CGIC and NIBIN information to be useful but are actually using this evidence in legal settings, suggest the utility of CGIC and NIBIN for law enforcement investigations.

Our quasi-experimental analysis, which seeks to estimate the *causal* effect of the CGIC 2.0 implementation, focuses on outcomes related to violent crime — violent crime rates, ShotSpotter alerts, calls for service for the sounds of gunshots, and arrests for gun-related crimes.

Overall, we find that the implementation of CGIC 2.0 had no statistically detectable effect on violent crime outcomes as measured during the study period. While we did observe changes (in both a positive and negative direction) in some PSAs, we do not measure any nonzero treatment effects of the CGIC 2.0 when we examine outcomes at the police district level.

As documented in the pre-registered pre-analysis plan, we anticipated that it may be difficult to observe the full effects of CGIC 2.0 in an 18-month period, if effects truly exist. This limitation is due to the pace of law enforcement, prosecutorial, and court activities, which means that cases may take well over a year from the point of crime to arrest, trial, and sentencing. Thus, our analyses of some of these outcomes may not capture the full effect of CGIC 2.0. Because this evaluation must be completed within the grant period of performance, we accept this as an unavoidable limitation and interpret our results as a preliminary window into the possible impacts of CGIC 2.0.

We present our findings below, with more detailed results in Appendix C to this report.

Descriptive Analyses

Comparison of clearance rates for cases with NIBIN information in 7D

In these descriptive analyses, we calculate whether cases with NIBIN hits are cleared at higher rates than cases without this information. Cases are considered "cleared" when an arrest is made. We focus our analyses on all violent crimes in which a gun was involved in 7D between November 1, 2017 and April 30, 2019. *Overall, clearance rates for violent offenses with NIBIN hits*[31] *in 7D (28.4%) are higher than clearance rates for cases without any ballistics evidence (20.8%) during our study period.*

Figure 4 below plots the clearance rates for all 524 violent gun offenses in 7D, broken out by cases with no ballistics evidence (N = 274), by cases with any ballistics evidence (N = 250), and by cases

[31] We consider any firearms and cartridge casings evidence acquired and entered into NIBIN as having *ballistics evidence*. Some of this ballistics evidence can have a NIBIN *lead.* A NIBIN lead is made when the NIBIN database identifies a possible match with a previously acquired casing. When an examiner takes the physical cartridges from the lead and confirms the lead, it is called a NIBIN hit. In DC, >99% of the leads that are examined are confirmed as hits. While we have information on NIBIN information and hits, we do not have information on NIBIN leads at this time.

with NIBIN hits (N = 81), during our study period of interest. We include cases with any ballistics evidence to show that regardless of whether there is a NIBIN hit, violent crimes with this type of evidence had a higher clearance rate during this study period. For all types of violent crime offenses (homicides, assault with a dangerous weapon, sex abuse, and robberies), the clearance rates for cases without ballistics evidence is 20.8%. The clearance rate is 25.6% for cases that contain *any* type of ballistics information, which include firearms and/or cartridge casings acquired and entered into NIBIN. The clearance rate is higher (28.4%) for cases that have a NIBIN *hit.*

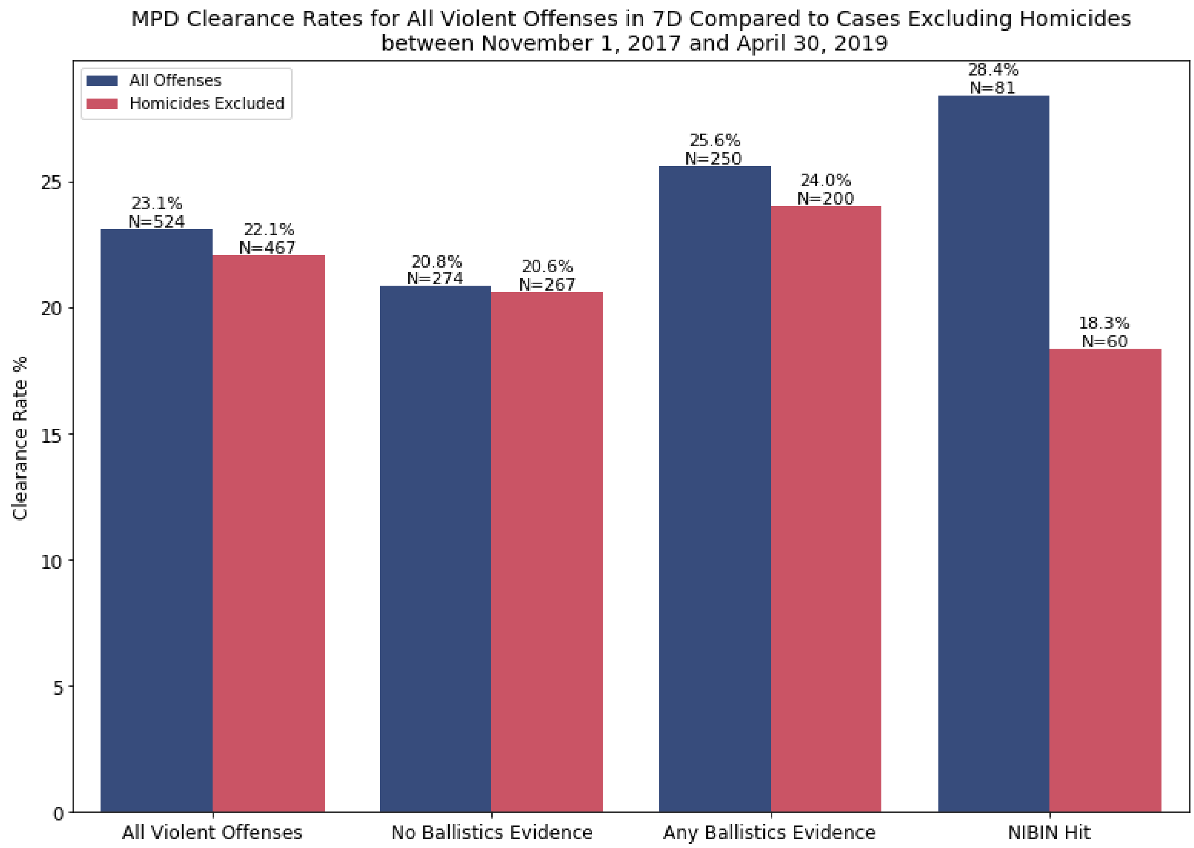

Figure 4: MPD's 7D clearance rates for all violent offenses involving a gun, broken out by cases with and without ballistics evidence, and cases that have a NIBIN hit. Clearance rates for non-homicide violent offense cases involving a gun are also presented, as homicide cases may differ from an investigation standpoint from the average shooting case in DC.

In Figure 4, we also examine the outcomes for violent gun crimes *excluding* homicides, as homicide cases may differ substantially from the average shooting case in DC. When we remove the cases involving homicides (the red bars in Figure 4), clearance rates are lower overall and substantially lower for those cases with NIBIN hits. This difference is largely to be expected, as homicides are substantially different from other shooting cases in that they receive more investigative resources (including larger monetary rewards for information leading to an arrest) and have higher community participation in investigations.

Figure 5 below disaggregates clearance rates by the type of violent crime for cases without ballistics evidence, cases with any ballistics evidence, and cases with NIBIN hits. This breakdown allows us to see that clearance rates across the types of violent offenses are not uniform and explains why clearance rates in Figure 4 change substantially when homicides are excluded. For example, there are a greater number of assault with a dangerous weapon (ADW) cases (N = 266 cases overall) than other types of violent crime, but the clearance rate appears to decrease with the level of NIBIN information provided. Conversely, we see that the greater the level of information, the higher the clearance rate for homicides.[32]

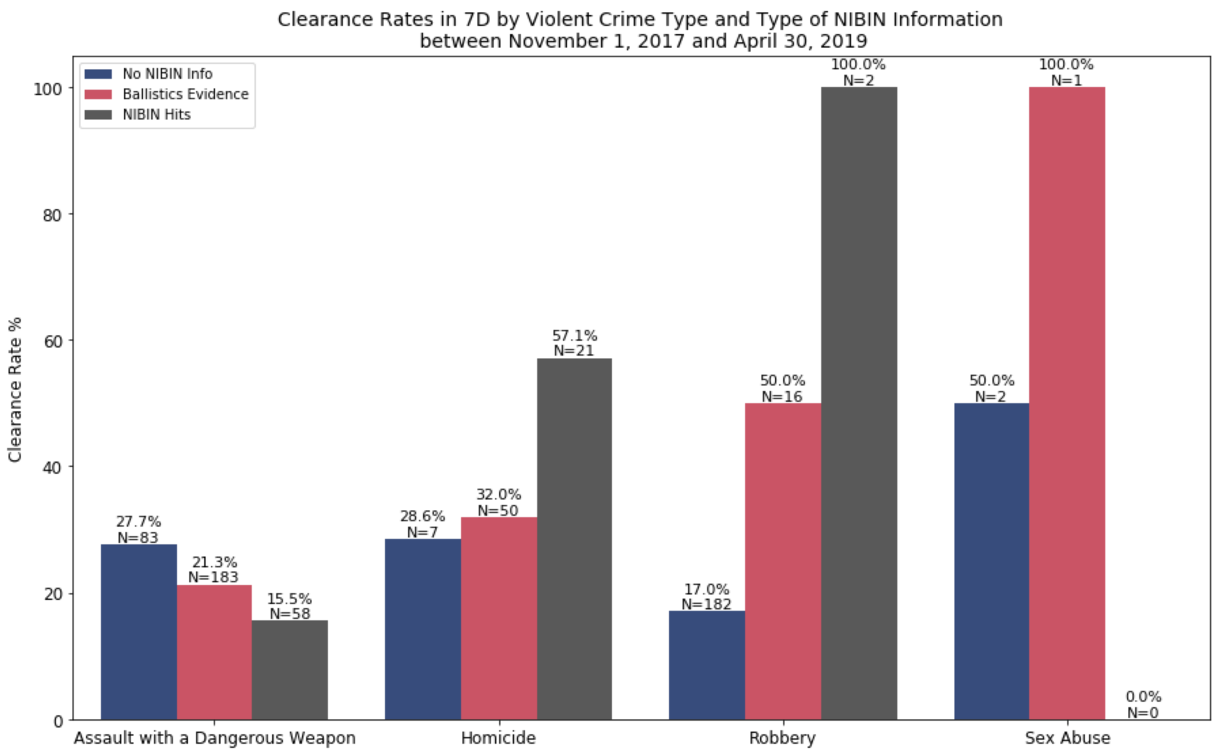

Figure 5: MPD clearance rates for all violent offenses involving a gun in 7D for cases with and without ballistics evidence, and with NIBIN hits, broken out by offense type.

Based on this disaggregation, we can see that the decrease in clearance rates when homicides are excluded is driven by the prevalence of ADW cases and the negative correlation between NIBIN hits and ADW case closures. We do not know why NIBIN hits would be associated with higher clearance rates for homicide, but lower clearance rates for ADW cases. This ambiguity illustrates that clearance rate differences may be confounded by the fact that cases with ballistics evidence may be substantially different from cases without in ways that are distinct from the availability of NIBIN information (i.e. crimes involving a gun that is used multiple times are different from those that do not and may receive more attention or generally be easier to clear).

[32] We do not consider the 100% clearance rate for cases with NIBIN hits for robbery cases or the cases with ballistics evidence for sex abuse cases, because the number of cases is too small for us to consider these to be meaningful results.

Analysis of Prosecutorial Outcomes

Using data that was provided by the US Attorney's Office (USAO), we also take a descriptive look at prosecutorial outcomes for arrests for gun cases with NIBIN hits compared to cases with any ballistics evidence during the study period.[33] *Overall, we do not observe substantial differences in prosecutorial outcomes when we compare cases with NIBIN hits to those without NIBIN hits.*

To conduct this analysis, we focused on arrests for violent crimes[34] in which a gun was involved and arrests for weapons violations in which a gun was involved that had any ballistics evidence entered into NIBIN.[35] We narrowed this list to cases that occurred in DC during our pilot period between November 1, 2017 and April 30, 2019.

In total, we sent a list of 1,633 arrests of 1,534 unique individuals related to 1,368 cases to the USAO. They reviewed the cases in late June to early August 2019 and determined the status of each of the cases at that time. Of the arrests sent to USAO, 252 (15.4%) had at least one NIBIN hit. At the time the data was reviewed in August 2019, we knew the prosecution outcomes for 1,002 of the 1,633 arrests, representing 62% of the cases sent to the USAO. A majority of these arrests (N = 604) resulted in a guilty outcome, either by plea or the result of a trial (approximately 18 were found guilty by trial). Fifteen defendants were found not guilty at trial and 265 defendants had their cases dismissed. In Table 3, the cases are tabulated by police district and violent offense category:

Table 3: Distribution of offense categories by police district where defendant was arrested.

District	Weapon Violations	Assault with a Dangerous Weapon	Homicide	Robbery	Sex Abuse	Total
1D	144	22	27	5	0	**198**
2D	50	6	0	0	0	**56**
3D	112	8	1	18	0	**139**
4D	113	17	4	15	0	**149**
5D	181	15	5	9	0	**210**
6D	304	48	10	17	0	**379**
7D	412	34	9	11	2	**468**
NA	7	9	18	0	0	**34**
Total	**1,323**	**159**	**74**	**75**	**2**	**1,633**

33 The USAO was unable to provide outcomes for four of the arrests because of data discrepancy issues.
34 Violent crimes include homicides, robberies, sex abuse, and assault with a dangerous weapon.
35 "Ballistics evidence" can include both firearms and cartridge casing evidence.

We first present summary statistics for prosecution outcomes citywide, followed by outcomes for 7D specifically.

Citywide Prosecution Outcomes

Figure 6 below plots the outcomes for arrests citywide in cases with any ballistics evidence (N = 1,002 arrests). For the 137 arrests that had at least one NIBIN hit (shown in red), approximately 61%resulted in a guilty plea.[36] For the arrests that had ballistics evidence but no NIBIN hit (labeled "No Hit" in blue), the percent of guilty pleas is slightly lower, at approximately 58%. Similarly, we see no meaningful difference in outcomes between cases with a NIBIN hit and those without for other prosecutorial outcomes measured.

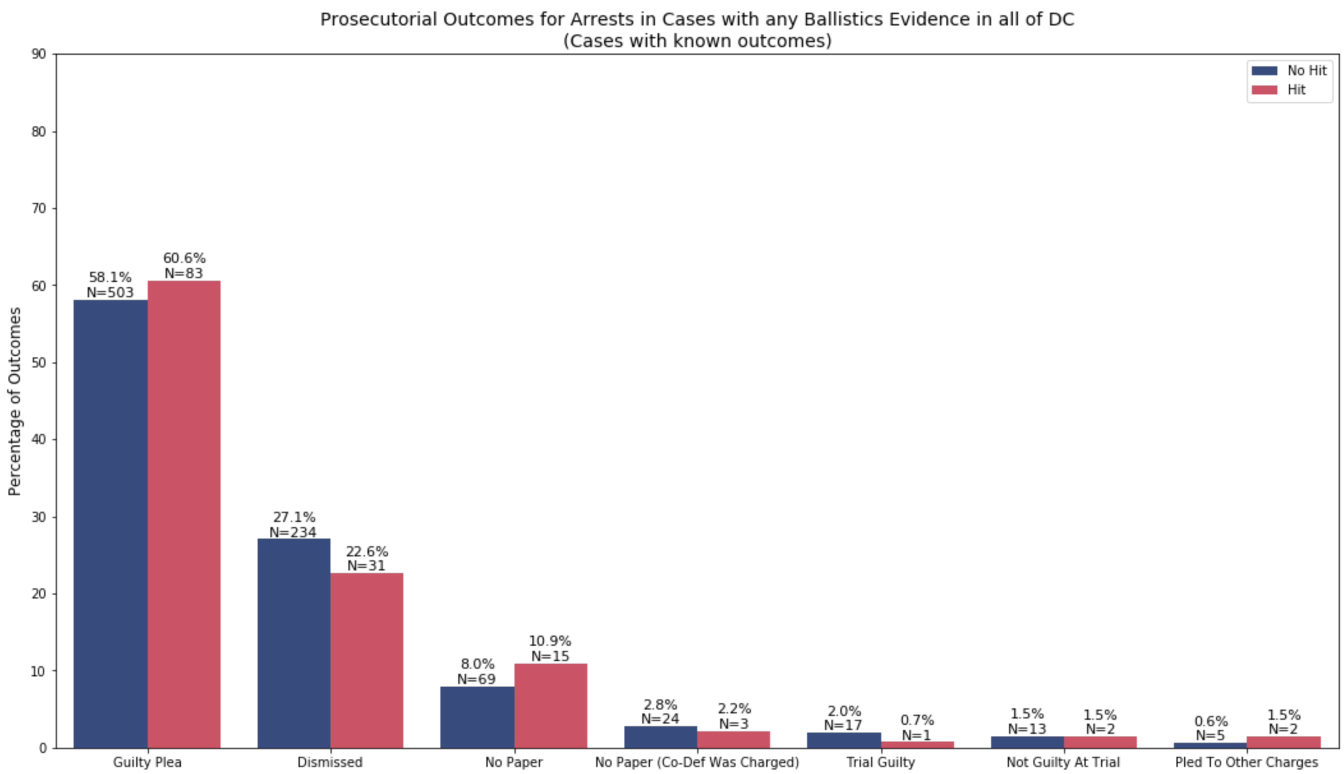

Figure 6: Prosecutorial outcomes for adjudicated cases that had any ballistics evidence (N = 1,002 arrests). The red bars represent the subset cases which had a NIBIN hit.

Figure 7 below plots the current known status of 627 arrests citywide in cases with any ballistics evidence that had *not* yet been adjudicated at the time the data was provided in August 2019 (or otherwise had an unknown status). The rate at which these cases have been "papered" — the prosecutorial term for filing charges against an individual — is the exact same (45.6%) for cases with a NIBIN hit and those without.

[36] The rate of guilty pleas (~60%) aligns to trends typically observed by USAO. Per USAO, we note that the general dismissal category can include a range of possible outcomes (e.g., due to evidentiary issues, witness issues, dismissal if another case involving the same defendant is resolved with a plea).

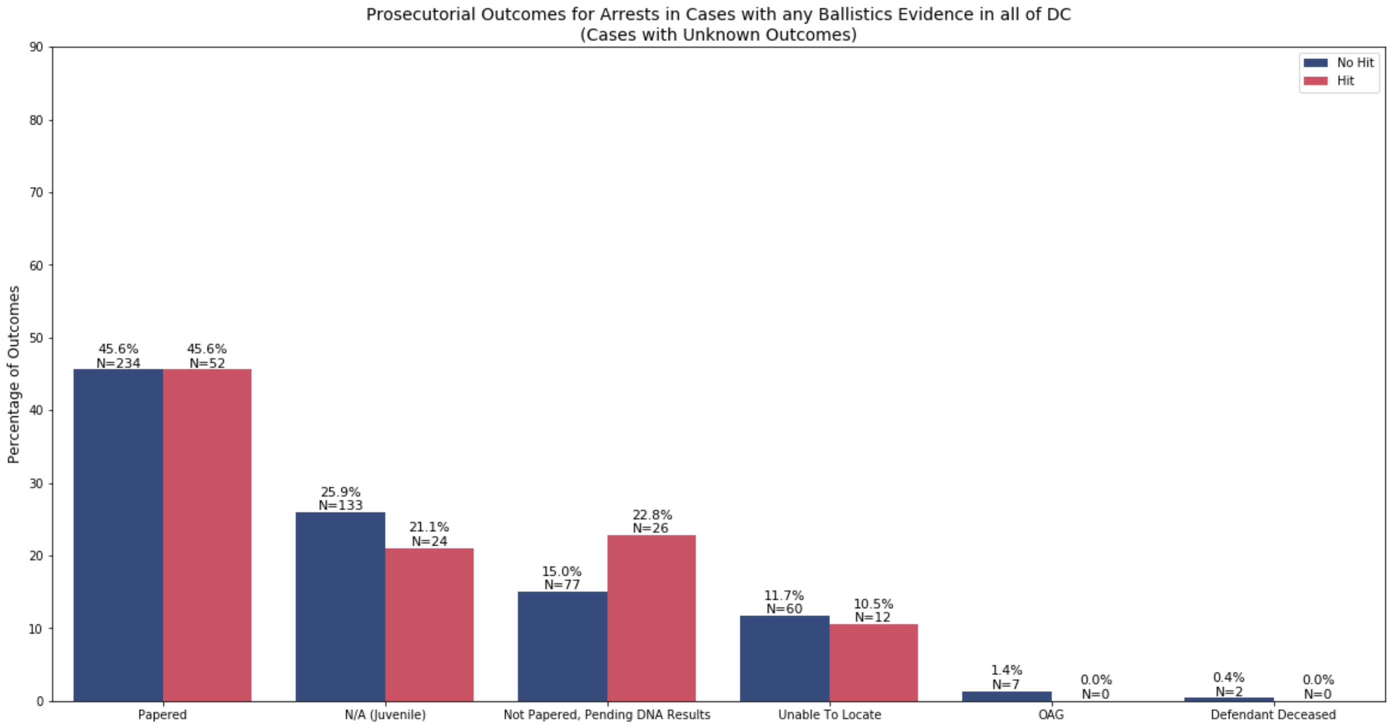

Figure 7: Prosecutorial outcomes for cases not yet adjudicated (or with otherwise unknown status), that had *any* ballistics evidence. The red bars represent the subset cases which had a NIBIN hit.

Prosecution Outcomes in 7D

We further examine prosecutorial outcomes at the district level. Table 4 below reports the number of arrests sent to the USAO by police district, where the district assignment is based on where the arrest took place.[37] The table also reports the number of NIBIN hits associated with these cases. *Overall, 15.4% of arrests sent to USAO had at least one NIBIN hit.* At the district level, 25% of the arrests that took place in 7D had at least one hit.

[37] We use arrest location as this is the location that is available for almost all cases in our data (e.g., instead of incident location).The majority of the arrests examined in this section (1,323 out of 1,633) involve weapons violations, which do not have incident locations separate from the arrest location.

Table 4: Number of arrests sent to the USAO with NIBIN hits, broken out by police district.

District	Number of Arrests	Number of Hits	Percentage of Arrests with a Hit
1D	198	26	13.1%
2D	56	6	10.7%
3D	139	14	10.1%
4D	149	11	7.4%
5D	210	24	11.4%
6D	379	44	11.6%
7D	468	117	25.0%
No Information	34	10	29.4%
Total	**1,633**	**252**	**15.4%**

We focus on cases that occurred in 7D in the next two figures. In Figure 8, we see that there is no meaningful difference in how cases with and without NIBIN hits are adjudicated. For example, 58.7% of cases with hits conclude with a guilty plea, while 54.2% of cases without a hit conclude with a guilty plea.

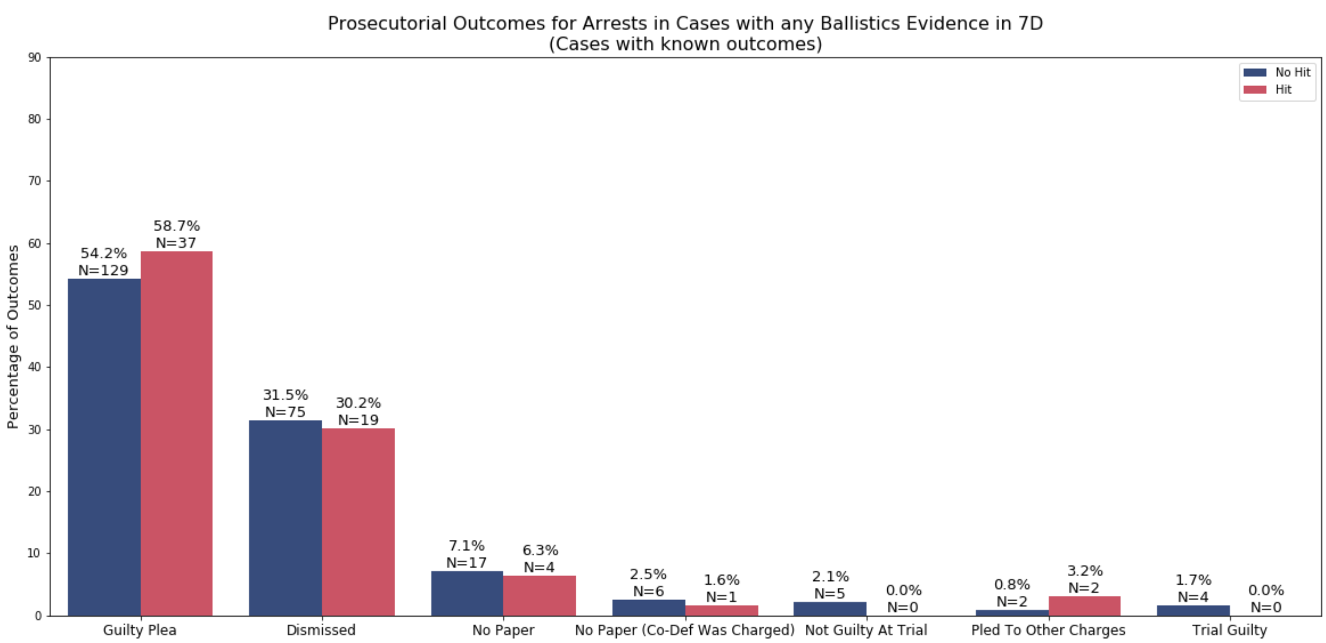

Figure 8: Prosecutorial outcomes for adjudicated cases that had *any* ballistics evidence. The red bars represent the subset cases which had a NIBIN hit.

In Figure 9 below, which shows the current status of cases that have not yet been adjudicated (or with otherwise unknown status), we see that a higher proportion of the arrests with hits in 7D were papered (62%), compared to 47% for those without NIBIN hits.

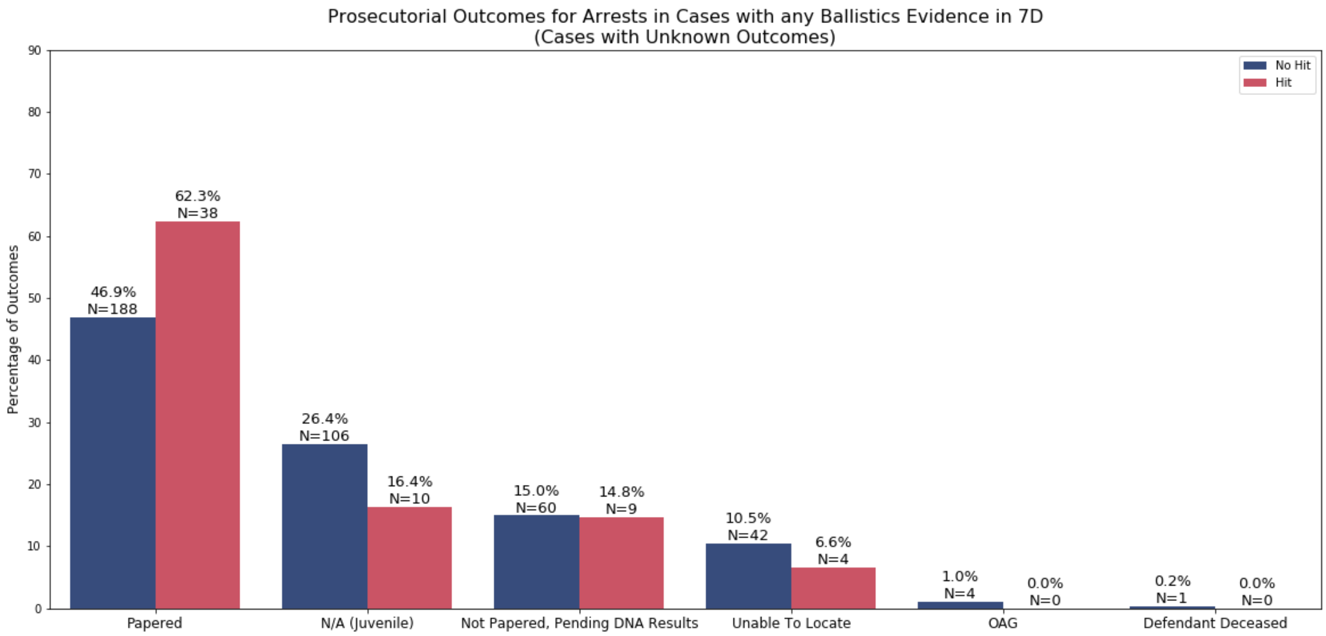

Figure 9: Prosecutorial outcomes for 7D cases not yet adjudicated (or with otherwise unknown status), that had *any* ballistics evidence. The red bars represent the subset cases which had a NIBIN hit.

Overall, we do not observe substantial differences in outcomes when we compare cases with NIBIN hits to those without NIBIN hits. In 7D, NIBIN hits appear to be associated with the decision to paper a case.

Detective Perceptions of NIBIN/CGIC

The CGIC 2.0 efforts aimed to increase awareness and use of CGIC and NIBIN products among detectives (and officers) through two primary mechanisms: 1) providing training to detectives who were likely to use NIBIN in their investigations, and 2) through the assignment of MPD detectives and an analyst to the CGIC to help improve information flow and general coordination among involved personnel. As a window into the effectiveness of these efforts, we fielded three surveys between December 2018 and July 2019 to measure detectives' perceptions about the utility of NIBIN and CGIC products. *Survey responses and participant feedback suggest that detectives view CGIC and NIBIN positively and find it useful in their investigations.*

The CGIC, along with the USAO and DFS, offered three trainings for detectives about how to use NIBIN information in investigations and warrants. Participants in the training were selected based on their location in the pilot site (all detectives assigned to 7D), and their likelihood of using NIBIN and CGIC information in their work (detectives assigned to the Homicide Branch in MPD's Investigative

Services Bureau and detectives assigned to other police districts who work primarily on shooting investigations).

The first training was provided to 7D detectives who work on shooting cases, and was conducted in October 2017. Two additional rounds of training were provided in April 2018 and December 2018. The training audience for both of these later sessions was expanded to include all 7D detectives, detectives assigned to the Homicide Branch, and detectives assigned to the other police districts who primarily handle shooting investigations.

The survey was designed to measure detectives' knowledge of the CGIC and NIBIN after the training they received and to collect detectives' feedback on the utility, clarity, and timeliness of CGIC and NIBIN products. We fielded the survey in three waves, at four-month intervals, as shown in Table 5 below.

Table 5: Timing and Population Sampled for Survey of Detective Perceptions of CGIC/NIBIN

Survey Wave	Time Period Conducted	Detectives Surveyed	Number of Completed Responses/Number Surveyed
Wave 1	December 2018	● Homicide Branch detectives and district detectives (including 7D) assigned to shooting investigations who *attended the Dec 2018 training session.*	31/37
Wave 2	March 2019	● Wave 1 survey recipients ● All Homicide Branch detectives ● All district detectives assigned to shooting investigations	66/70
Wave 3	July 2019	● Wave 1 survey recipients ● Wave 2 survey recipients	51/70

The population sampled changed after the first wave — we surveyed *only* those detectives who attended the December 2018 training in Wave 1, while in Waves 2 and 3 we surveyed the Wave 1 survey recipients as well as all Homicide Branch detectives and detectives assigned to other police districts who work primarily on shooting investigations.[38] We do not track individual respondents over time (e.g., how did Detective X respond in Waves 1, 2, and 3) and instead present the topline results from each wave as a window into detectives' perceptions. With data collected at multiple time points, we also look for any indication of shifts over time in the overall distribution of responses (e.g., are

[38] Wave 1 respondents received the survey three times, while Wave 2 respondents received the survey two times. For Wave 1, recipients included a mix of detectives assigned to the Homicide Branch as well as those detectives assigned to District Detective Units who investigate shooting cases, all of whom attended the December 2018 training. For waves 2 and 3, we expanded the survey to include all Homicide Branch detectives and district detectives who work shooting cases, regardless of whether they attended the December 2018 training.

detectives' perceptions noticeably different once they have some time to use these products in their work, between waves 2 and 3?).

Based on a descriptive analysis of the surveys, it appears that detectives find the information provided by the CGIC to be timely and relatively useful to their investigations, particularly with developing new leads. Notably, the majority of survey respondents report their perception that CGIC products have improved over the preceding year (in waves 2 and 3). Detectives also report using CGIC and NIBIN information in their affidavits for search and arrest warrants.

Detectives' Exposure to and Use of NIBIN Information

The detectives who took these surveys were relatively familiar with NIBIN at the outset, with over 75% of these detectives having worked a case in the past two years with a NIBIN lead or hit

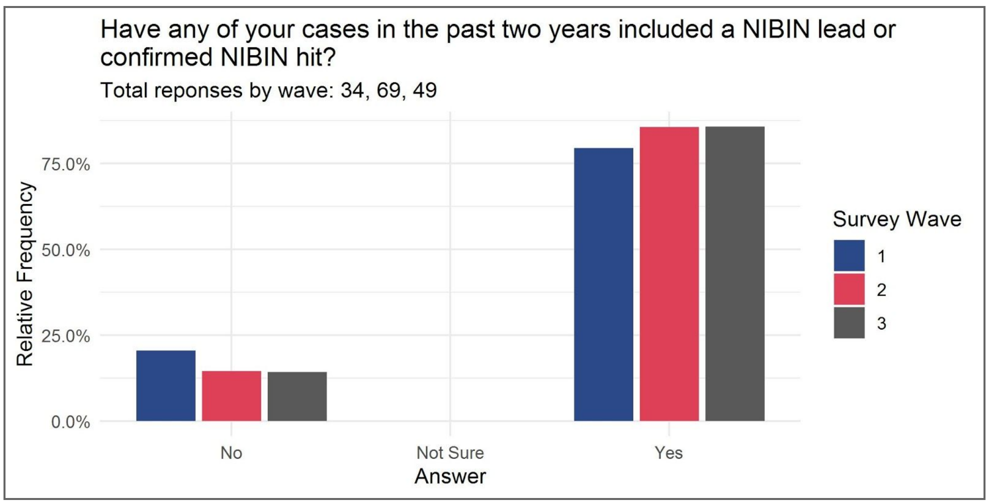

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Figure 10: Survey responses by wave: "Have any of your cases in the past two years included a NIBIN lead or confirmed NIBIN hit?"

The detectives also indicated that they worked cases involving NIBIN leads with some frequency. The later two waves, which included more detectives who work homicides, reported they have cases involving NIBIN more frequently than the original survey sample.

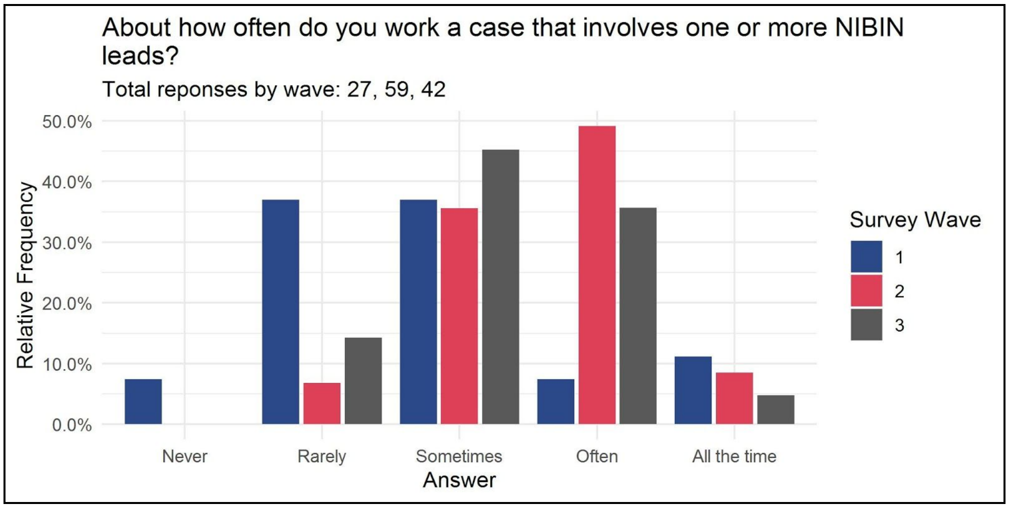


Figure 11: Survey responses by wave: “About how often do you work a case that involves one or more NIBIN leads?”

In each successive wave, an increasing proportion of respondents reported using NIBIN in affidavits and warrants, with 65% reporting doing so in Wave 3.

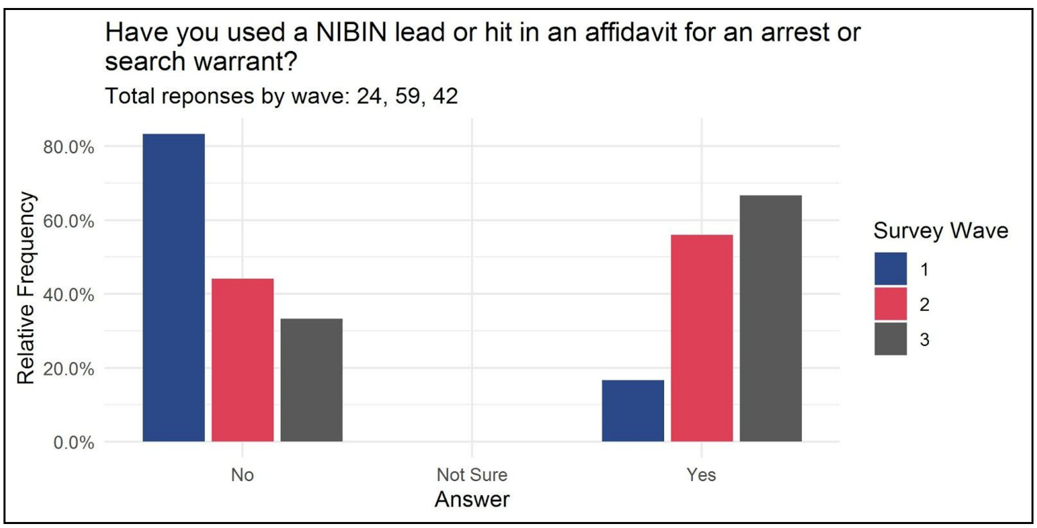


Figure 12: Survey responses by wave: “Have you used a NIBIN lead or hit in an affidavit for an arrest or a search warrant?”

Detectives’ Perceptions of Utility of NIBIN

The next three questions pertain to how useful detectives perceive NIBIN to be in different parts of investigations:

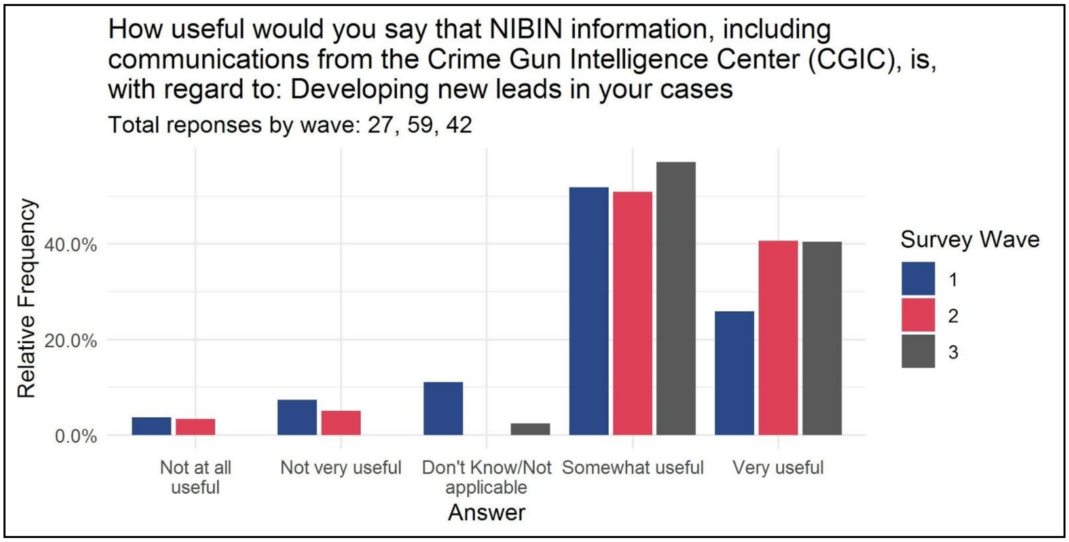


Figure 13: Survey responses by wave: “How useful would you say that NIBIN information, including communications from the Crime Gun Intelligence Center (CGIC), is, with regard to developing new leads in your cases?”

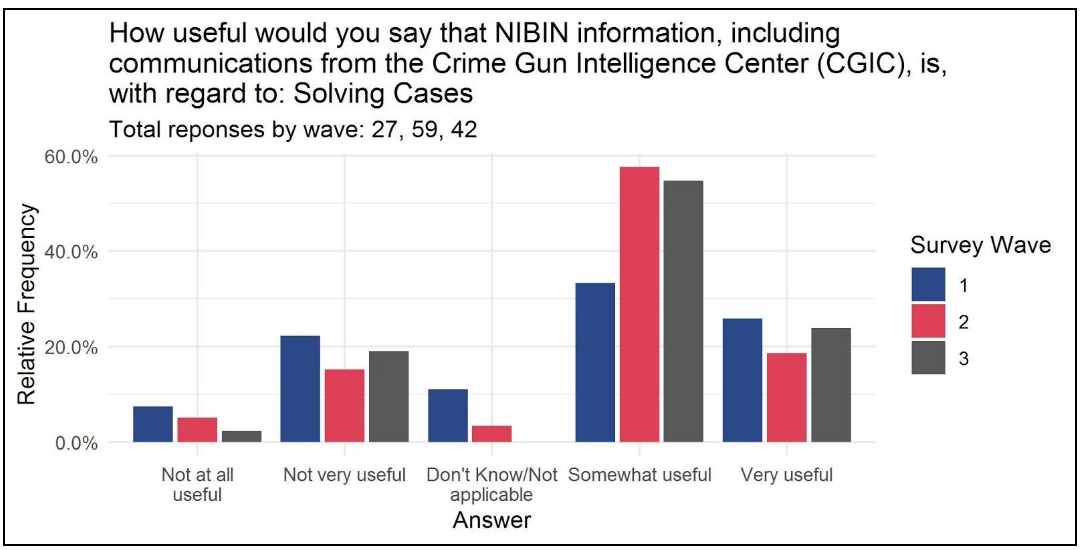


Figure 14: Survey responses by wave: “How useful would you say that NIBIN information, including communications from the Crime Gun Intelligence Center (CGIC), is, with regard to solving crimes?”

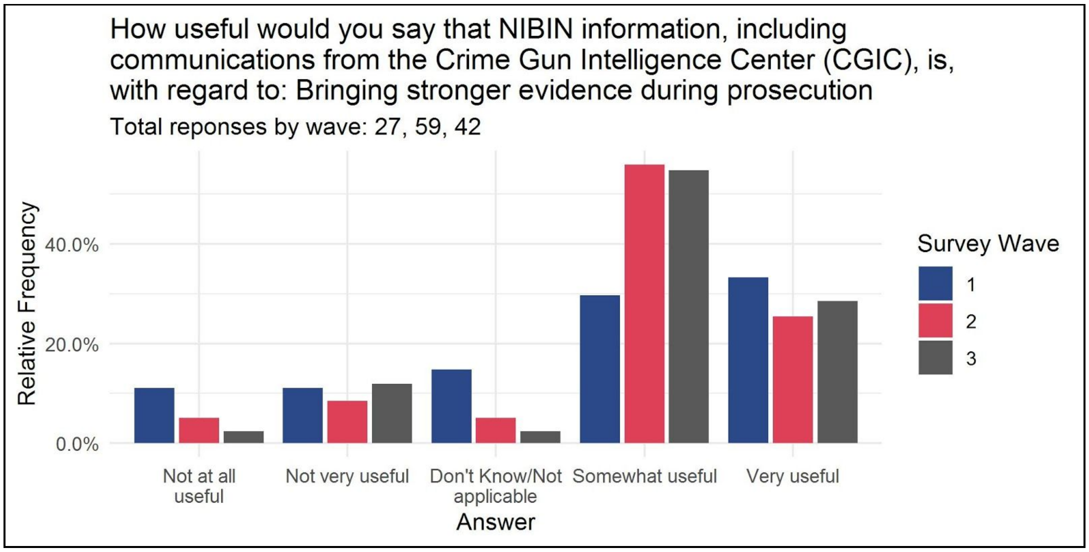


Figure 15: Survey responses by wave: “How useful would you say that NIBIN information, including communications from the Crime Gun Intelligence Center (CGIC), is, with regard to bringing stronger evidence during prosecution?”

Detectives found NIBIN to be most useful for developing leads in their cases, and slightly less useful for solving cases and bringing stronger evidence during prosecution. We heard similar assessments anecdotally from detectives, who noted that NIBIN alone will not close a case, but it can open new lines of investigation.

Detectives’ Perceptions of Timeliness and Value of CGIC Products

Finally, detectives found that NIBN leads were distributed quickly and reported that the value of products produced by the CGIC had improved over the past year. Notably, between the second and third waves of the survey, we observe a clear shift from tepid agreement with the statement that CGIC products have improved over the past year, to strong agreement with that statement: in wave 2, almost 60% of respondents indicated that they “somewhat agree,” with about 35% reporting strong agreement; in wave 3, those numbers reverse.

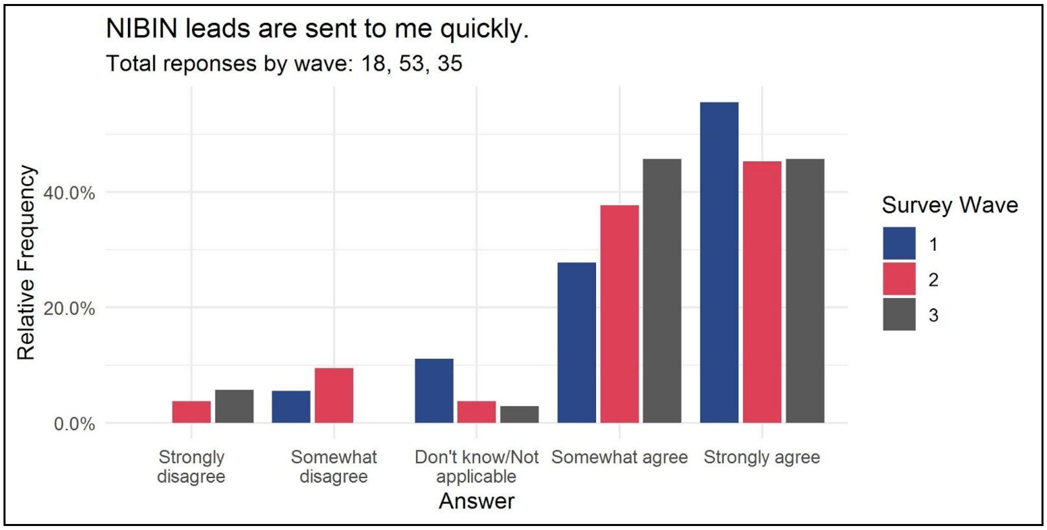


Figure 16: Survey responses by wave: “NIBIN leads are sent to me quickly.”

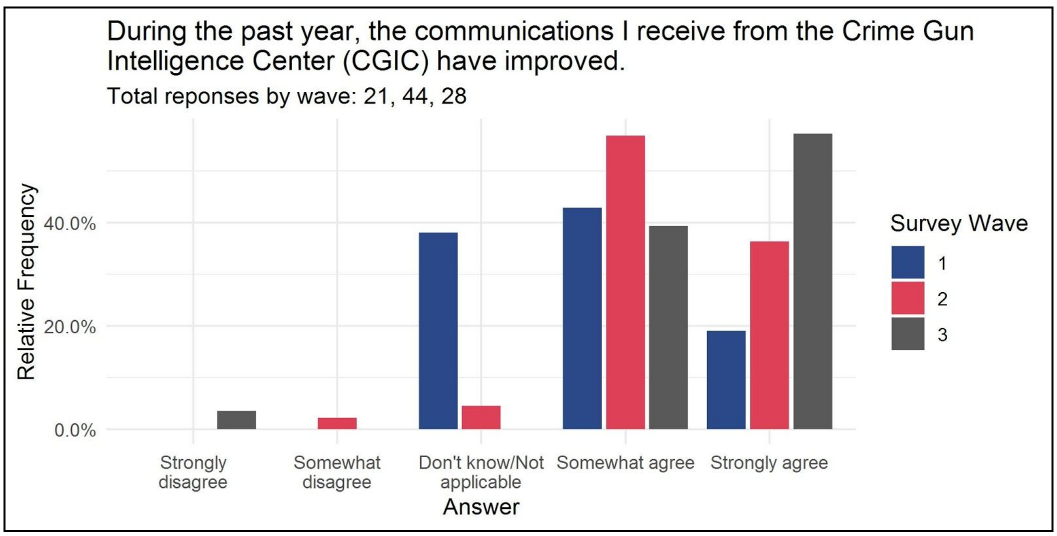


Figure 17: Survey responses by wave: “During the past year, the communications I receive from the Crime Gun Intelligence Center (CGIC) have improved.”

Quasi-Experimental Analyses

Overall, we find that the implementation of CGIC 2.0 had no effect on violent crime outcomes as measured during the study period. Though we did observe changes in some treated PSAs in 7D, as shown below in the results from our synthetic control analyses, the PSA-level differences were mixed. We do not observe a meaningful effect of the CGIC 2.0 when we examine these effects across 7D, as shown in the difference-in-differences analyses.

For each outcome, we first present findings at the PSA-level, generated using the synthetic control method, and then at the district level, generated using the difference-in-differences approach.

1. *Have violent crime rates changed significantly in treated PSAs?*

Using MPD's crime data, we calculate two versions of the violent crime rate:[39] 1) the rate of violent crimes, which includes all incidents with an offense category of robbery, assault with a dangerous weapon, sex abuse, or homicide; and 2) the rate of incidents in which a gun was explicitly reported to be used in the course of the event, or gun crime rate.[40]

We do not observe a meaningful effect of CGIC 2.0 on the rate of violent crimes. The figure below plots the difference in the true violent crime rate for each treated PSA and the crime rate for the constructed synthetic control.[41] A visual inspection of this graph suggests that, for the most part, there is no clear trend in the line plotted for each PSA; instead, we see the daily differences in the violent crime rate shifting back and forth between positive and negative values throughout the study period. Over the course of the study period, the difference between the treated PSA and its synthetic counterpart averages out to a very small effect, indistinguishable from zero.

[39] We also set out to compare *events*, i.e., CCNs, at which a violent crime occurred and individual violent crimes. However, only 6 of the over 50,000 CCNs we received from MPD had more than one crime attached to them. Thus, we did not distinguish between these in this analysis.
[40] This appears in the "DCR Weapon" column of the data.
[41] Specifically, in each of these plots, the difference shown is the outcome for the treated PSA minus the outcome for the synthetic control.

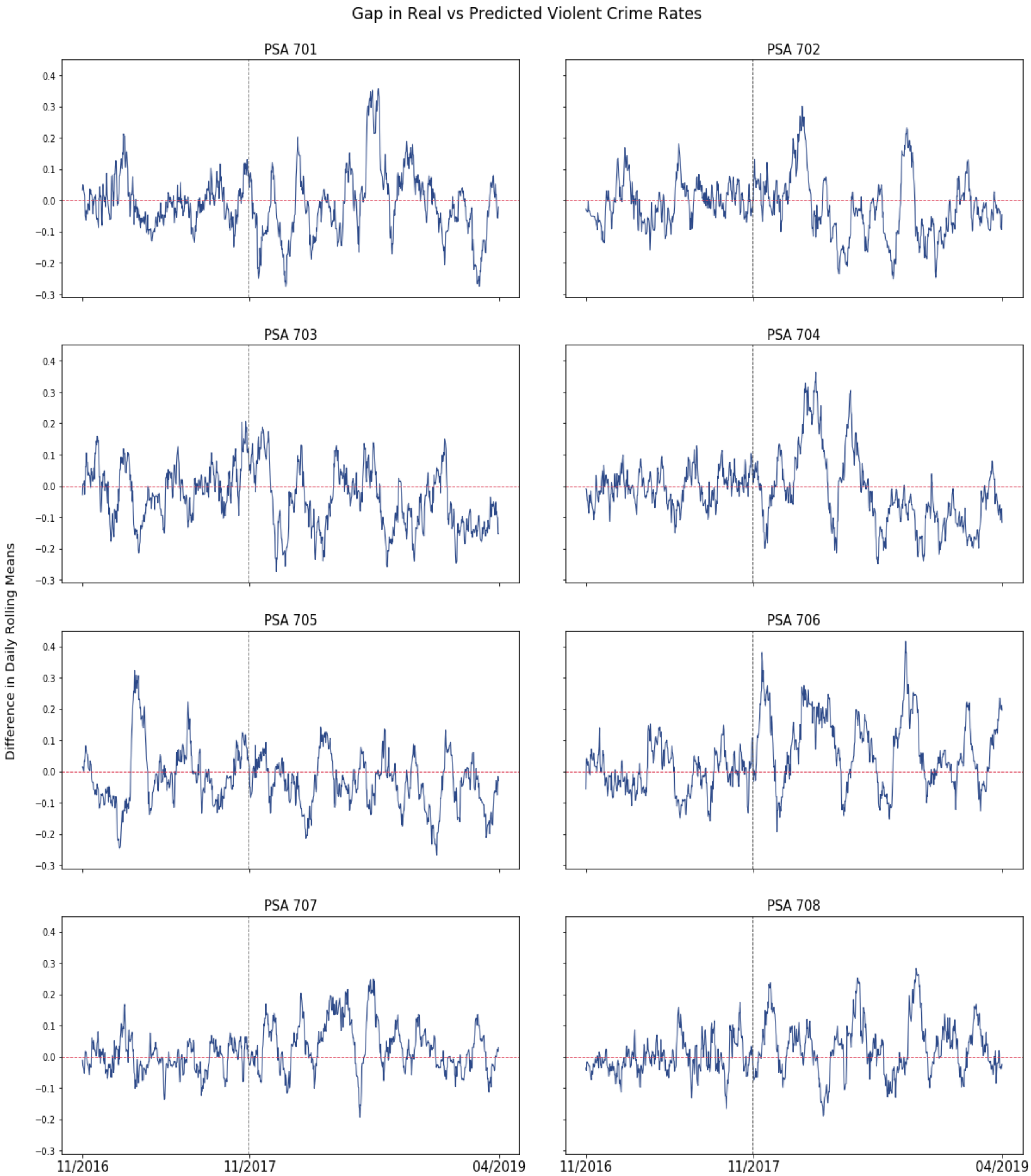


Figure 18: Difference in daily rolling means of violent crime rates between the real PSAs within 7D and the synthetic PSAs within 7D from November 1, 2016 to April 30, 2019. The dashed vertical line represents the start of the intervention period. The horizontal dashed line represents zero. Differences above zero indicate that actual crime rates were higher than predicted, and differences below zero indicate that actual crime rates were lower than predicted.

This interpretation is confirmed through the permutation placebo test shown in Figure 19 below. If the CGIC 2.0 intervention had an effect on violent crime in the treated PSAs, we would expect to see the plotted lines for those 7D PSAs (blue) to *deviate clearly* from the placebo PSAs (red) in the post-treatment period. Instead, we see that, while the synthetic control method appears to generate reasonably good matches between the real 7D PSAs and their synthetic counterparts — with some exceptions, the plotted lines are clustered closely together — the lines continue to track closely together in the post-treatment period.[42]

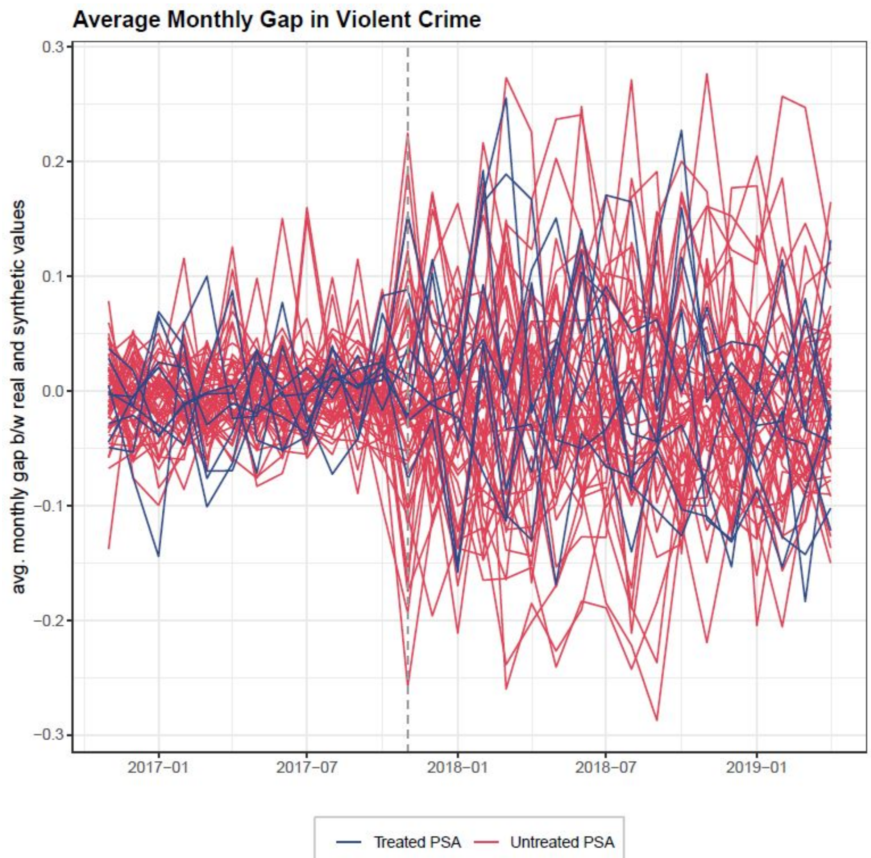


Figure 19: Average monthly gaps in rolling means for the PSAs within 7D (in blue) and placebo gaps for the non-treated PSAs (in red) for violent crime rates. Since the blue lines are not clearly differentiated from the red lines, we cannot say that CGIC 2.0 had a detectable effect on violent crime in the treated PSAs.

Turning to Figure 20 below, the difference, or lack thereof, between treated and synthetic PSAs is shown more clearly. This figure plots the *mean squared prediction error (MSPE)*, defined as the average of the squared discrepancies between violent crime rates in 7D PSAs and their synthetic matches. More specifically, we plot the ratio of the MSPE for the post-treatment period to the pre-treatment MSPE. If the implementation of CGIC 2.0 had an effect, we would expect to see the 7D PSAs as outliers on the plot, with a much higher ratio of post-treatment MSPE to pre-treatment MSPE

[42] The mean squared prediction error (MSPE) plotted in Figure 19 increases noticeably for all units in the post-treatment period. This is largely due to the increased error that comes with predicting out of sample.

— we would expect to see them towards the bottom right corner of the chart. Instead, we see the 7D PSAs with a wide range of Post/Pre MSPEs ratio values.

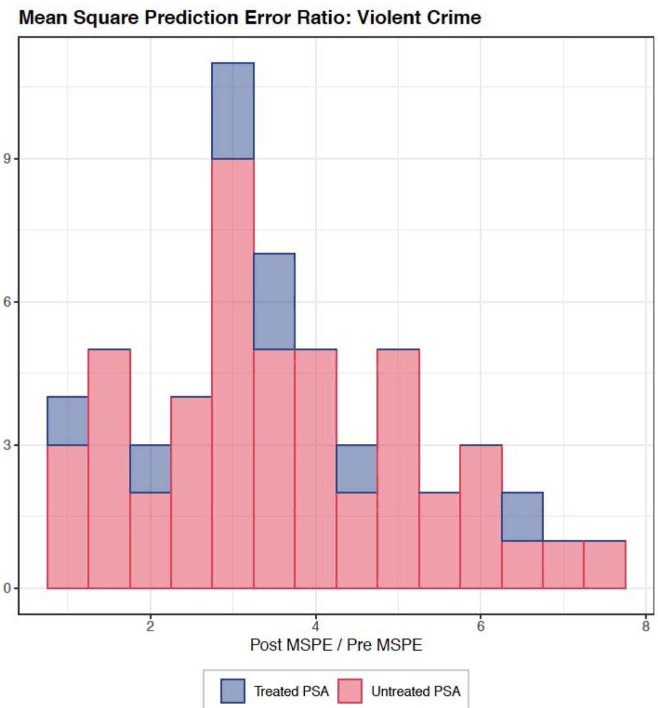


Figure 20: The ratio of the post-treatment MSPE to pre-treatment MSPE. If CGIC 2.0 had an effect, we should expect to see the treated PSAs within 7D with a higher ratio (i.e. blue bars clustered to the right), however, we do not observe this.

The consistency of these three measures — the synthetic control plots shown previously in Figure 18, the placebo test shown in Figure 19, and the Post/Pre MSPE plotted in Figure 20 — reinforce our findings that the CGIC 2.0 had no measurable effect at the PSA level on the violent crime rate.

Similarly, when we apply the difference-in-differences method to assess treatment effects across 7D, we find no discernible effect of CGIC 2.0 on this outcome. The table below depicts our best estimates of the daily rate of violent crime incidents by quarter (90-day period), beginning one year prior to the implementation of the CGIC 2.0 intervention and concluding in April 2019, along with the confidence interval for that estimate.[43,44,45] For example, our best estimate of the effect of CGIC 2.0 in the fourth quarter after implementation — at the one year mark — is a small reduction in violent crime, with 0.5 fewer violent crime incidents per day in 7D. However, our data is consistent with the real effect ranging anywhere from 1.72 fewer violent crime incidents per day to 0.73 *more* incidents per day in 7D. As the range of estimates includes 0, we interpret this as a null result — we do not measure an effect of CGIC 2.0 on the violent crime rate. Further, examining the estimates over time, we do not observe a notable

[43] The "estimates" listed for all pre-treatment quarters are not estimates, but rather the true difference in violent crime rates between 7D and the other six police districts.
[44] Post-Treatment Q0 is the quarter in which treatment began.
[45] Post-Treatment Q6 only includes the last 6 days of the study period.

difference between the pre-treatment and post-treatment periods, reinforcing our interpretation that CGIC 2.0 had no measurable effect on violent crime rates during the study period.

Table 6: Difference-in-differences estimates for violent crime rates in 7D

Violent Crime	Estimate	Lower Bound	Upper Bound
Pre-Treatment Q4	-0.06	-1.42	1.30
Pre-Treatment Q3	-0.51	-1.79	0.76
Pre-Treatment Q2	-0.32	-1.79	1.16
Pre-Treatment Q1	-0.09	-1.34	1.16
Post-Treatment Q0	-0.09	-1.37	1.20
Post-Treatment Q1	-0.07	-1.45	1.30
Post-Treatment Q2	-0.22	-1.46	1.02
Post-Treatment Q3	-0.35	-1.55	0.86
Post-Treatment Q4	-0.50	-1.72	0.73
Post-Treatment Q5	-0.57	-1.87	0.72
Post-Treatment Q6	-1.21	-2.61	0.20

Turning to our second measure of violent crime rates — the rate of incidents in which a gun was explicitly reported to be used in the course of the event, we find similar results. *The CGIC 2.0 implementation does not appear to have had a detectable effect on gun crime rates as measured during the study period.*

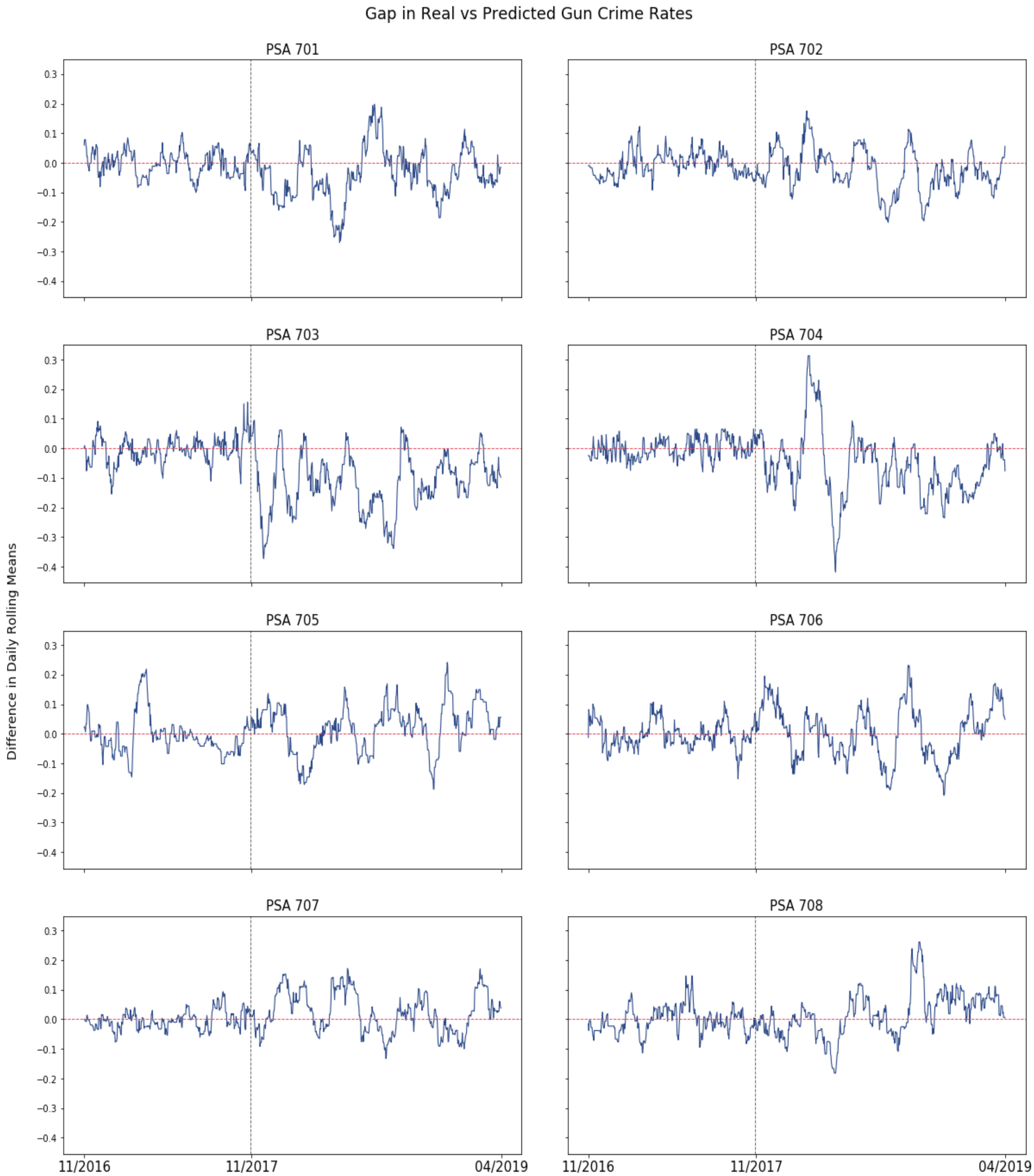


Figure 21: Difference in daily rolling means of gun crime rates between the real 7D PSAs and the synthetic 7D PSAs from November 1, 2016 to April 30, 2019. The dashed vertical line represents the start of the intervention period.The horizontal dashed line represents zero. Differences above zero indicate that actual gun crime rates were higher than predicted, and differences below zero indicate that the actual gun crime rates were lower than predicted.

Again, the placebo test plot and plot of post/pre MSPE ratios for each PSA in Figure 22 below confirm this interpretation: we do not find any clear deviation between real and synthetic PSAs. Similarly, we can see from the MSPE plot that none of the treated PSAs are outliers, which is what we would expect if the CGIC 2.0 had an effect. Instead, the treated PSAs have a wide range of Post/Pre MSPE ratio values.

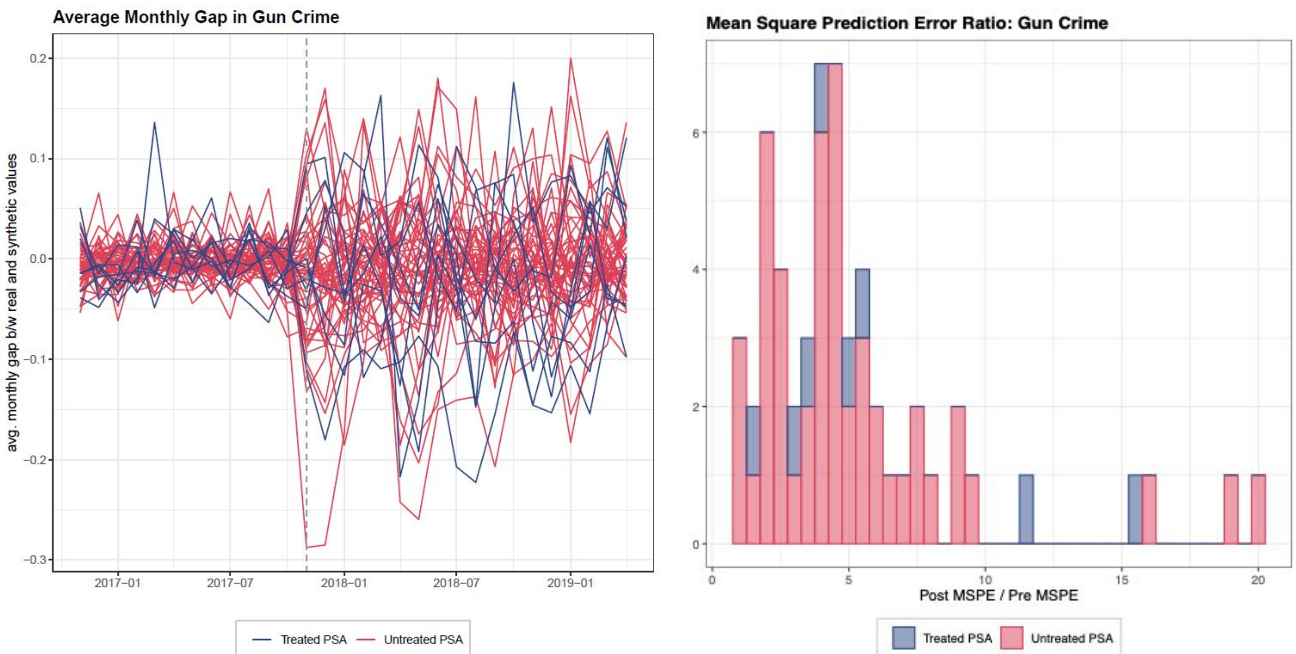


Figure 22: Average monthly gaps in rolling means for the PSAs within 7D (in blue) and placebo gaps for the non-treated PSAs (in red) to the left, and the ratio of the post-treatment MSPE to pre-treatment MSPE to the right, for gun crime rates. For the plot on the left, we see that the blue lines are not clearly differentiated from the red lines, so we cannot conclude that CGIC 2.0 had a detectable effect on gun crime in the treated PSAs. For the plot on the right, we should expect to see the treated 7D PSAs with a higher ratio (i.e. blue bars clustered to the right) if CGIC 2.0 had an effect; we do not observe this.

Examining the difference-in-differences results, shown in Table 7 below, we similarly find no discernible effect of CGIC 2.0 on this outcome. Our best estimate of the effect of CGIC 2.0 in the fourth quarter after implementation — at the one year mark — is a small reduction in gun crime, with about one less incident per day in 7D. However, our data is consistent with the real effect ranging anywhere from 2.58 fewer violent crime incidents per day to 0.09 more incidents per day in 7D. As the range of estimates again includes 0, we interpret this as a null result — we do not measure an effect of CGIC 2.0 on the gun crime rate. In examining the estimates over time, we do not observe a substantial difference between the pre-treatment and post-treatment periods, reinforcing our interpretation that CGIC 2.0 had no measurable effect on gun crime rates during the study period.

Table 7: Difference-in-differences estimates for gun crime rates in 7D

Gun Crime	Estimate	Lower Bound	Upper Bound
Pre-Treatment Q4	-1.03	-2.41	0.34
Pre-Treatment Q3	-1.21	-2.53	0.12
Pre-Treatment Q2	-1.10	-2.56	0.36
Pre-Treatment Q1	-0.89	-2.33	0.55
Post-Treatment Q0	-1.02	-2.40	0.36
Post-Treatment Q1	-1.02	-2.46	0.41
Post-Treatment Q2	-1.07	-2.36	0.22
Post-Treatment Q3	-1.07	-2.32	0.18
Post-Treatment Q4	-1.24	-2.58	0.09
Post-Treatment Q5	-1.11	-2.40	0.18
Post-Treatment Q6	-1.29	-2.76	0.18

2. *Have ShotSpotter alerts changed significantly in 7D?*

Using MPD's ShotSpotter data, we compare the rate of alerts per coverage area in each 7D PSA to a synthetic control constructed from 37 PSAs with ShotSpotter coverage.[46] Comparing monthly ShotSpotter alert rates in each of the 8 PSAs in 7D during the study period, *we do not find a discernible effect of CGIC 2.0 on the rate of ShotSpotter alerts.*

Figure 23 below displays the difference in daily rolling means for ShotSpotter alerts for the real and the synthetic 7D for the study period of interest; Figure 24 shows the results of the placebo test and the post-treatment MSPE/pre-treatment MSPE ratio for each PSA for this outcome. Both figures point to the same conclusion: for most PSAs, we again do not discern any effect of CGIC 2.0 on the rate of alerts. For PSAs 706 and 708, however, there appears to be a more substantive difference between real and predicted ShotSpotter alerts: in PSA 706, the rate of ShotSpotter alerts was lower than predicted, while in PSA 708, we observe a higher rate of alerts. The same two treated PSAs are outliers in the placebo test and post/pre MSPE ratio plots. Though the effects do appear to be meaningful, that they move in opposite directions is suggestive of the confounding effect of some other unobserved factor. It is not clear that the changes we measure in these two PSAs are due to a causal effect of the CGIC intervention.

[46] None of the PSAs contained within the Second Police District were included as part of the donor pool as MPD does not have any ShotSpotter coverage in 2D. After cleaning (see Appendix D for further details) there were no ShotSpotter events in PSAs 101, 102, and 401 during the pre-intervention period, so they were also not included in the donor pool.

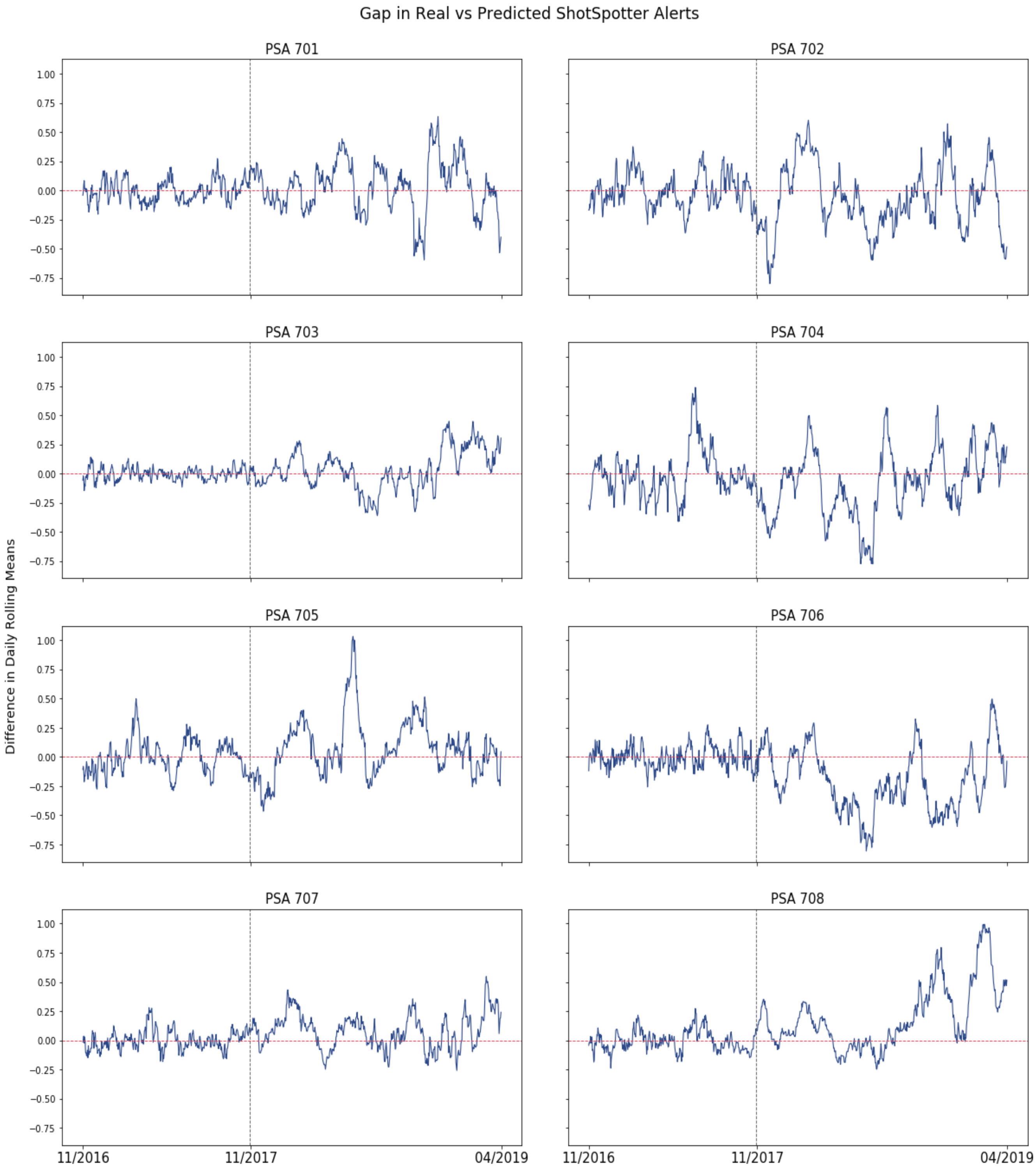
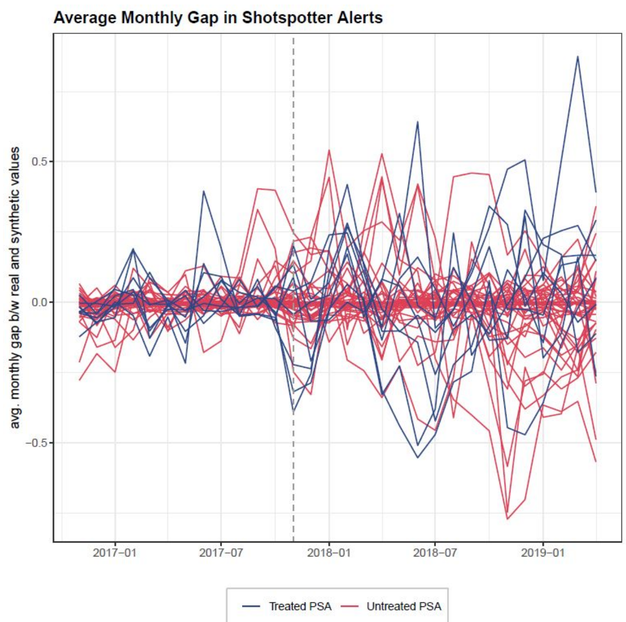


Figure 23: Difference in daily rolling means of ShotSpotter alert rates between real 7D PSAs and synthetic 7D PSAs from November 1, 2016 to April 30, 2019. The dashed vertical line represents the start of the intervention period. The horizontal dashed line represents zero. Differences above zero indicate that actual ShotSpotter rates were higher than predicted, and differences below zero indicate that the actual ShotSpotter rates were lower than predicted.



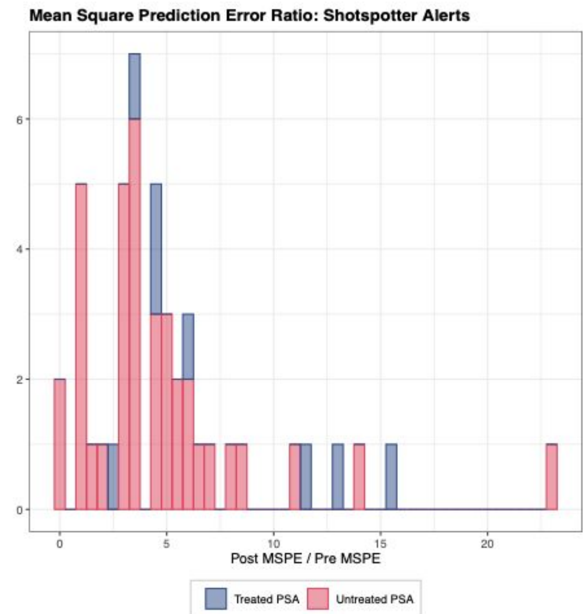


Figure 24: Average monthly gaps in rolling means for the PSAs within 7D (in blue) and placebo gaps for the non-treated PSAs (in red) to the left, and the ratio of the post-treatment MSPE to pre-treatment MSPE to the right, for ShotSpotter alert rates. For the plot on the left, we see that the blue lines are not clearly differentiated from the red lines, so we cannot conclude that CGIC 2.0 had a detectable effect on ShotSpotter alerts in the treated PSAs. For the plot on the right, we should expect to see the treated PSAs within 7D with a higher ratio (i.e. blue bars clustered to the right) if CGIC 2.0 had an effect. While two of the blue bars cluster closer to the right in the post/pre MSPE ratio plots, the fact that these PSAs (706 and 708) move in opposite directions in Figure 23 is suggestive of the confounding effect of some other unobserved factor.

When we apply the difference-in-differences method to assess treatment effects across 7D, we find no discernible effect of CGIC 2.0 on ShotSpotter alerts. For all estimates in the periods after the start of the intervention, the range of estimates includes 0, which we interpret as a null result — we do not measure an effect of CGIC 2.0 on ShotSpotter alert rates. This interpretation is consistent with our visual inspections of the plots in Figures 23-24 above. Though we did measure significant change in PSAs 706 and 708, as those shifts were in opposite directions, their respective effects wash out when we examine the CGIC 2.0’s effect across all of 7D.

Table 8: Difference-in-differences estimates for ShotSpotter alerts in 7D

ShotSpotter Alerts	Estimate	Lower Bound	Upper Bound
Pre-Treatment Q4	-0.06	-1.63	1.50
Pre-Treatment Q3	-0.94	-2.48	0.61
Pre-Treatment Q2	-0.28	-2.08	1.52
Pre-Treatment Q1	-0.74	-2.17	0.69
Post-Treatment Q0	-1.47	-2.99	0.04
Post-Treatment Q1	-1.11	-2.73	0.51
Post-Treatment Q2	-0.89	-2.96	1.18
Post-Treatment Q3	-0.68	-2.02	0.67
Post-Treatment Q4	0.73	-1.27	2.74
Post-Treatment Q5	0.68	-0.79	2.15
Post-Treatment Q6	-0.25	-2.32	1.83

3. *Have calls for service for the sounds of gunshots changed significantly in 7D?*

We measure the rate of calls for service for sounds of gunshots using data from the Office of Unified Communications (OUC). We focus our analysis on events that were called into OUC — that is, we *exclude* ShotSpotter events and events that were self-initiated by officers.

Overall, we do not observe a meaningful effect of CGIC 2.0 on the rate of calls for service for the sounds of gunshots in the real 7D. Figure 25 below plots the differences in the true calls for service rates for each treated PSA and the calls for service rates for the constructed synthetic control. A visual inspection of these graphs suggests that, with the exception of PSA 701, there is no clear trend in the line plotted for each PSA, with the daily differences in the calls for service rate shifting back and forth between positive and negative values throughout the study period. PSA 701 did see higher calls for service rates, explained in part by an increase in criminal activity in PSA 701 during our study period.

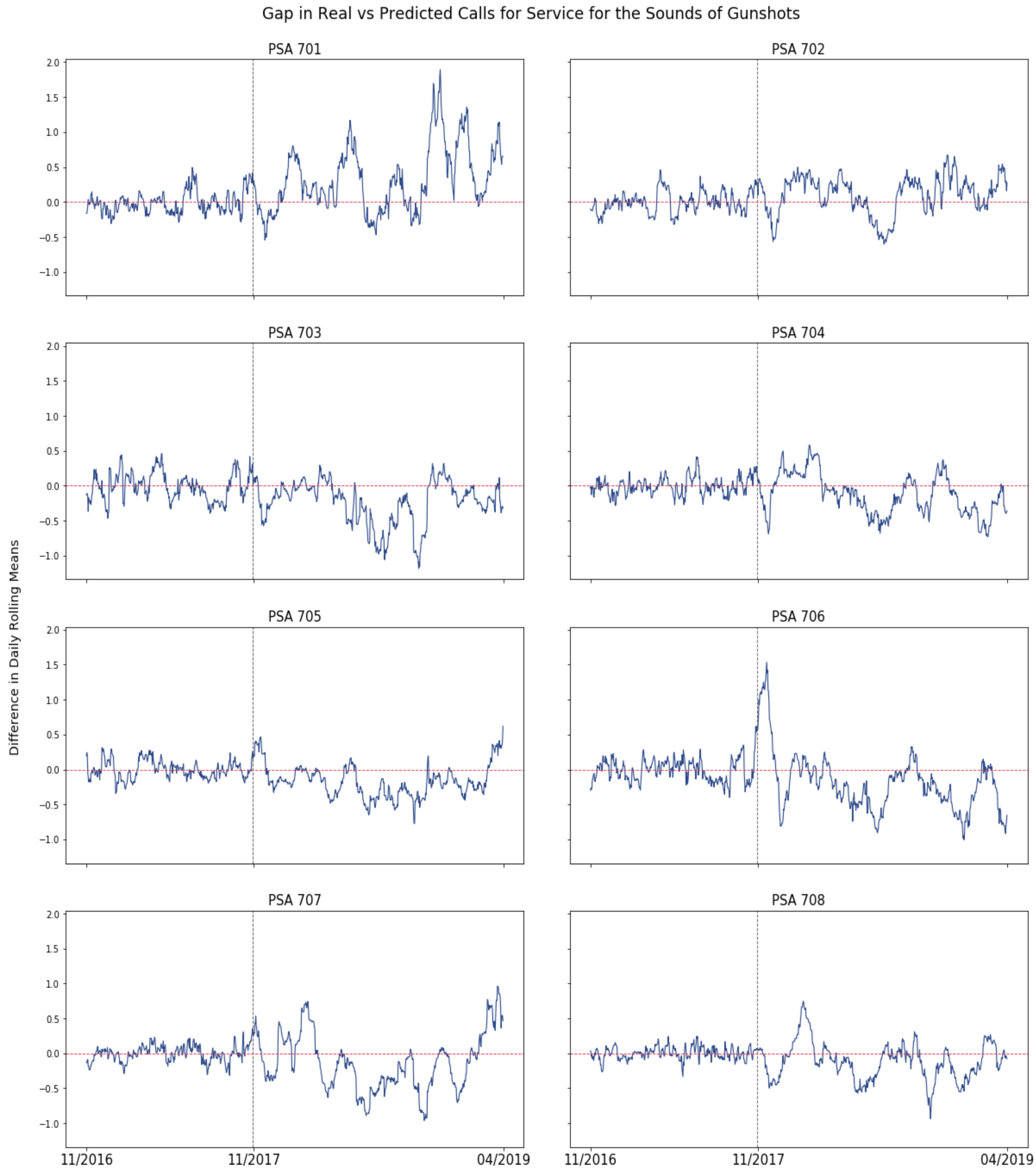


Figure 25: Difference in daily rolling means for the calls for service rates for the sounds of gunshots between the real 7D PSAs and synthetic 7D PSAs from November 1, 2016 to April 30, 2019. The dashed vertical line represents the start of the intervention period. The horizontal dashed line represents zero. Differences above zero indicate that actual calls for service rates were higher than predicted, and differences below zero indicate that the actual calls for service rates were lower than predicted.

This slight increase in the calls for service rates for the sounds of gunshots for PSA 701, however, is not very meaningful. In the placebo tests plotted below in Figure 26, we can see that the monthly difference in rolling means for calls for service rates do not deviate significantly from the placebo PSAs. Similarly, in the MSPE plots, none of the treated PSAs stand out as outliers. This leads us to believe that CGIC 2.0 had no measurable effect at the PSA level on the rate of calls for service for the sounds of gunshots.

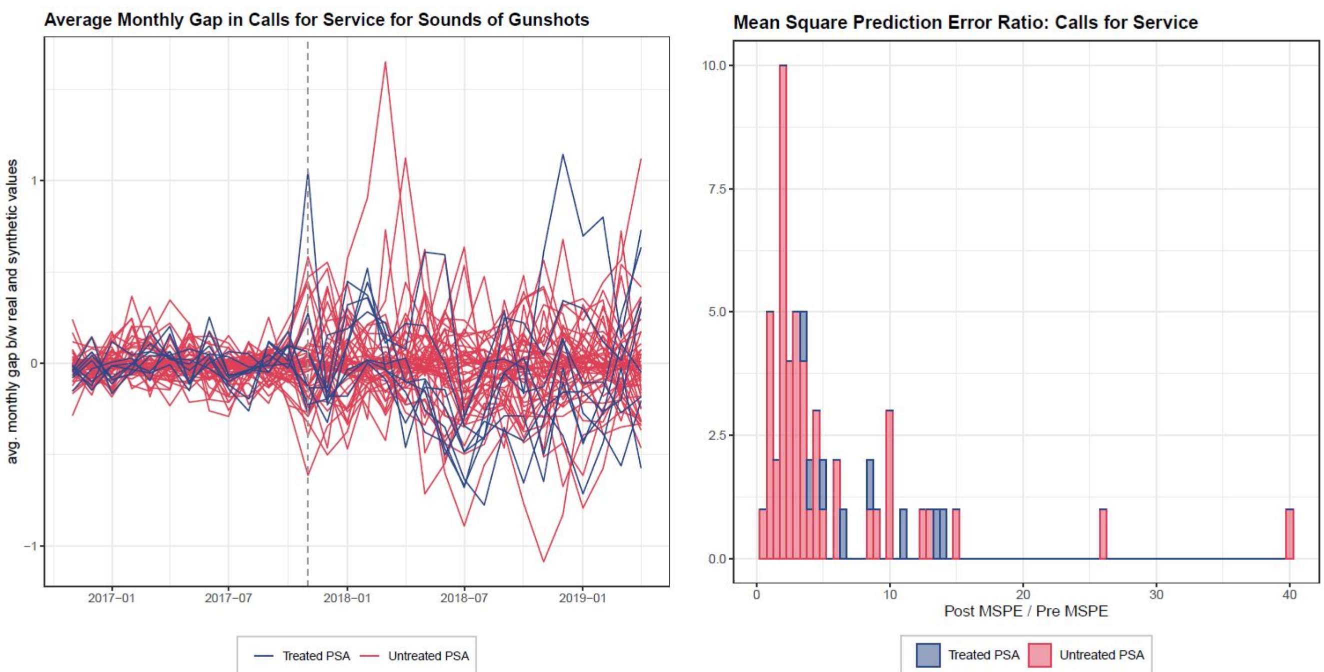


Figure 26: Average monthly gaps in rolling means for the PSAs within 7D (in blue) and placebo gaps for the non-treated PSAs (in red) to the left, and the ratio of the post-treatment MSPE to pre-treatment MSPE to the right, for calls for service rates. For the plot on the left, we see that the blue lines are not clearly differentiated from the red lines, so we cannot conclude that CGIC 2.0 had a detectable effect on calls for service rates in the treated PSAs. For the plot on the right, we should expect to see the treated PSAs within 7D with a higher ratio (i.e. blue bars clustered to the right) if CGIC 2.0 had an effect; instead we observe the blue bars distributed across the plot.

When we apply the difference-in-differences method to assess treatment effects across 7D, we find no discernible effect of CGIC 2.0 on the rate of calls for service for the sounds of gunshots. Similar to the results for our other outcomes, the range of our estimates encompass 0, which we interpret as a null result — we do not measure an effect of CGIC 2.0 on the rate of calls for service.

Table 9: Difference-in-differences estimates for the rate of calls for service for the sounds of gunshots in 7D

Calls for Service	Estimate	Lower Bound	Upper Bound
Pre-Treatment Q4	0.64	-2.45	3.72
Pre-Treatment Q3	0.87	-2.24	3.98
Pre-Treatment Q2	1.69	-1.31	4.70
Pre-Treatment Q1	1.69	-1.20	4.59
Post-Treatment Q0	0.91	-1.93	3.76
Post-Treatment Q1	0.45	-2.60	3.50
Post-Treatment Q2	0.48	-2.28	3.23
Post-Treatment Q3	0.71	-2.17	3.59
Post-Treatment Q4	1.29	-1.67	4.25
Post-Treatment Q5	1.11	-1.68	3.91
Post-Treatment Q6	1.14	-2.74	5.03

4. Have arrests for gun-related crimes changed significantly in 7D?

We use MPD's arrest data to calculate the rate of daily gun-related arrests aggregated by month. We use three different definitions of "gun-related arrests" to measure this outcome. First, we considered the broadest category of gun-related arrests, which included both charges categorized as a weapons violations in which a gun was involved,[47] and violent crimes (these include assault with a dangerous weapon, homicide, robbery, and sex abuse) in which a gun was used.[48] Next, we looked at each of these separately — gun-related arrests defined as charges for weapons violations that were firearm-related, and gun-related arrests defined as a violent crime where a gun was used.

We did not observe a meaningful effect of CGIC 2.0 on any of the three definitions of arrests for gun-related crimes. The results for each definition are presented in detail below.

Broadest category of gun-related arrests

We do not measure an effect of CGIC 2.0 on the rate of arrests for the broadest definition of arrests for gun crimes. Figure 27 below displays the difference in daily rolling means for arrests for the broadest definition of gun-crimes for the real and the synthetic 7D for the study period of interest. Similar to the other outcomes, visual inspection of these graphs suggests that there is no clear trend in the line plotted for each PSA. Daily differences in the arrests shift back and forth between positive and negative values throughout the study period, which essentially net out to a very small effect, indistinguishable from zero. The arrests in the real 704 was slightly lower than predicted, driven by fewer arrests than expected in December 2018. However, we do not measure any treatment effects of the CGIC 2.0 when examining the results at the police district level (see Table 10 below).

[47] Some examples of what these charges can include are: carrying a pistol without a license, unlawful discharge of a firearm, altering the serial number of a firearm, interstate transportation of a firearm, among others.
[48] Our definition of "used" here means that a gun was involved in the commission of the crime, either by using the gun or threatening with the gun.

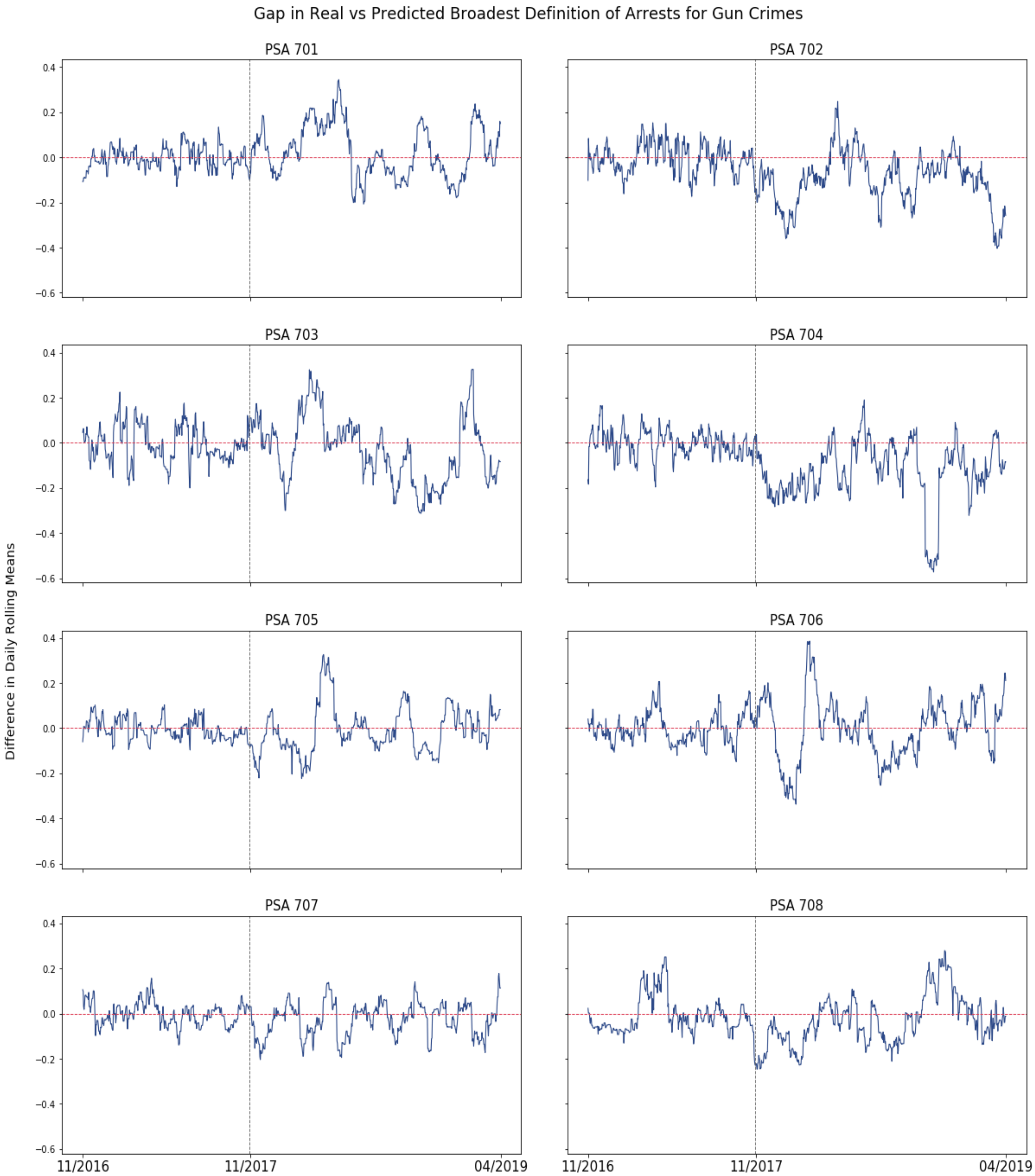


Figure 27: Difference in daily rolling means for the broadest definition of arrests between the real 7D PSAs and synthetic 7D PSAs from November 1, 2016 to April 30, 2019. The dashed vertical line represents the start of the intervention period. The horizontal dashed line represents zero. Differences above zero indicate that actual arrest rates were higher than predicted, and differences below zero indicate that actual arrest rates were lower than predicted.

Figure 28 shows the results of the placebo test and the post-treatment MSPE/pre-treatment MSPE ratio for each PSA for this outcome. These figures point to the same conclusion: for most PSAs, we again do not discern a clear effect of CGIC 2.0 on the rate of this broad definition of arrests for gun crimes. In the placebo test, however, we can see that large difference between the number of arrests in the synthetic 704 and the real 704 in the fall of 2018.

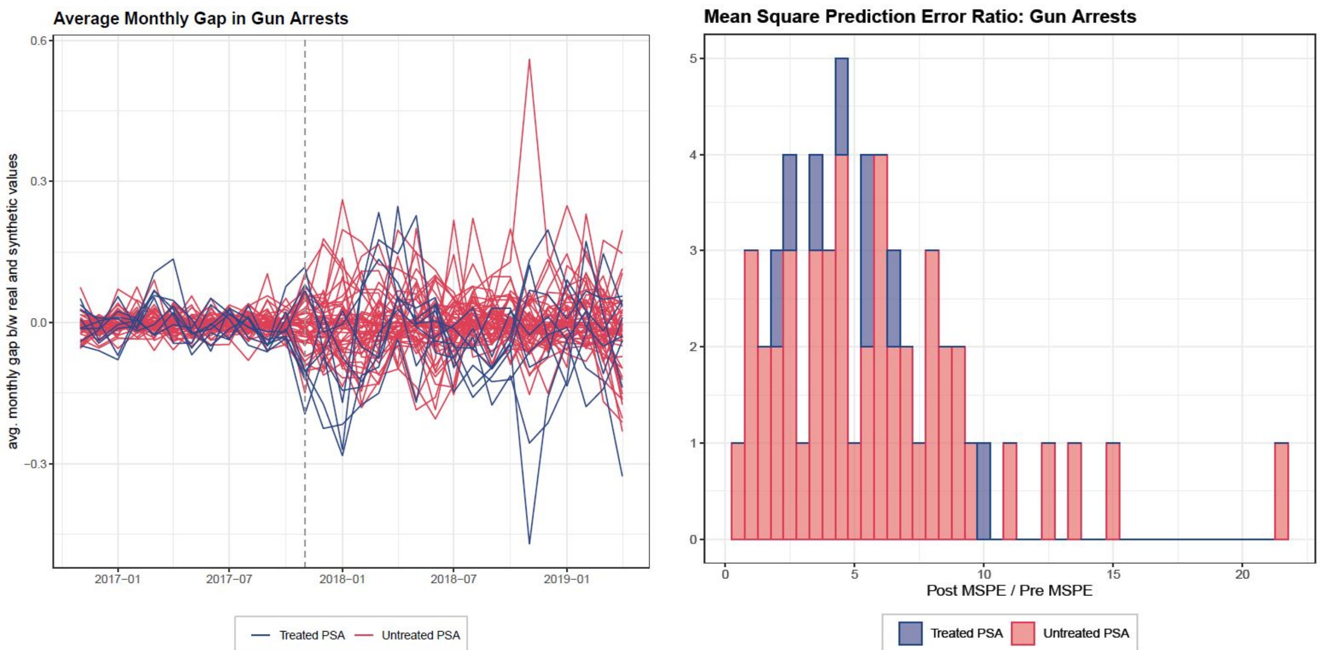


Figure 28: Average monthly gaps in rolling means for the PSAs within 7D (in blue) and placebo gaps for the non-treated PSAs (in red) to the left, and the ratio of the post-treatment MSPE to pre-treatment MSPE to the right, for arrests for the broadest definition of crimes. For the plot on the left, we see that the blue lines are not clearly differentiated from the red lines, so we cannot conclude that CGIC 2.0 had a detectable effect on arrest rates in the treated PSAs. For the plot on the right, we should expect to see the treated PSAs within 7D with a higher ratio (i.e. blue bars clustered to the right) if CGIC 2.0 had an effect; instead we observe the blue bars distributed across the plot.

When we apply the difference-in-differences method to assess treatment effects across 7D, we find no discernible effect of CGIC 2.0 on this broad definition of arrests. Similar to the results for our other outcomes, the range of our estimates encompass 0, which we interpret as a null result — we do not measure an effect of CGIC 2.0 on this broad definition of arrests. We do not observe a notable difference between the pre-treatment and post-treatment periods, reinforcing our interpretation that CGIC 2.0 had no measurable effect on this broad definition of arrest rates during the study period.

Table 10: Difference-in-differences estimates for arrests for the broadest definition of gun crime in 7D

Arrests for the Broadest Defintion of Gun Crime	Estimate	Lower Bound	Upper Bound
Pre-Treatment Q4	-0.56	-2.21	1.09
Pre-Treatment Q3	-0.26	-2.19	1.66
Pre-Treatment Q2	-0.30	-2.21	1.61
Pre-Treatment Q1	-0.64	-2.51	1.23
Post-Treatment Q0	-0.83	-2.70	1.05
Post-Treatment Q1	-0.21	-2.06	1.64
Post-Treatment Q2	-0.74	-2.55	1.06
Post-Treatment Q3	-0.73	-2.50	1.04
Post-Treatment Q4	-0.78	-2.66	1.10
Post-Treatment Q5	-0.44	-2.22	1.34
Post-Treatment Q6	-0.21	-2.55	2.13

Arrests for Gun-Related Weapons Violations

We do not measure an effect of CGIC 2.0 on the rate of arrests for gun-related weapons violations. Figure 29 below displays the difference in daily rolling means for arrests for gun-related weapons violations for the real and the synthetic 7D for the study period of interest. Visual inspection of these graphs suggest that for PSAs 701 through 704, arrests were slightly lower than predicted, but for PSAs 705 through 708, there that there is no clear trend in the line plotted for each PSA. When we run placebo tests, however, we do not see a distinguishable treatment effect.

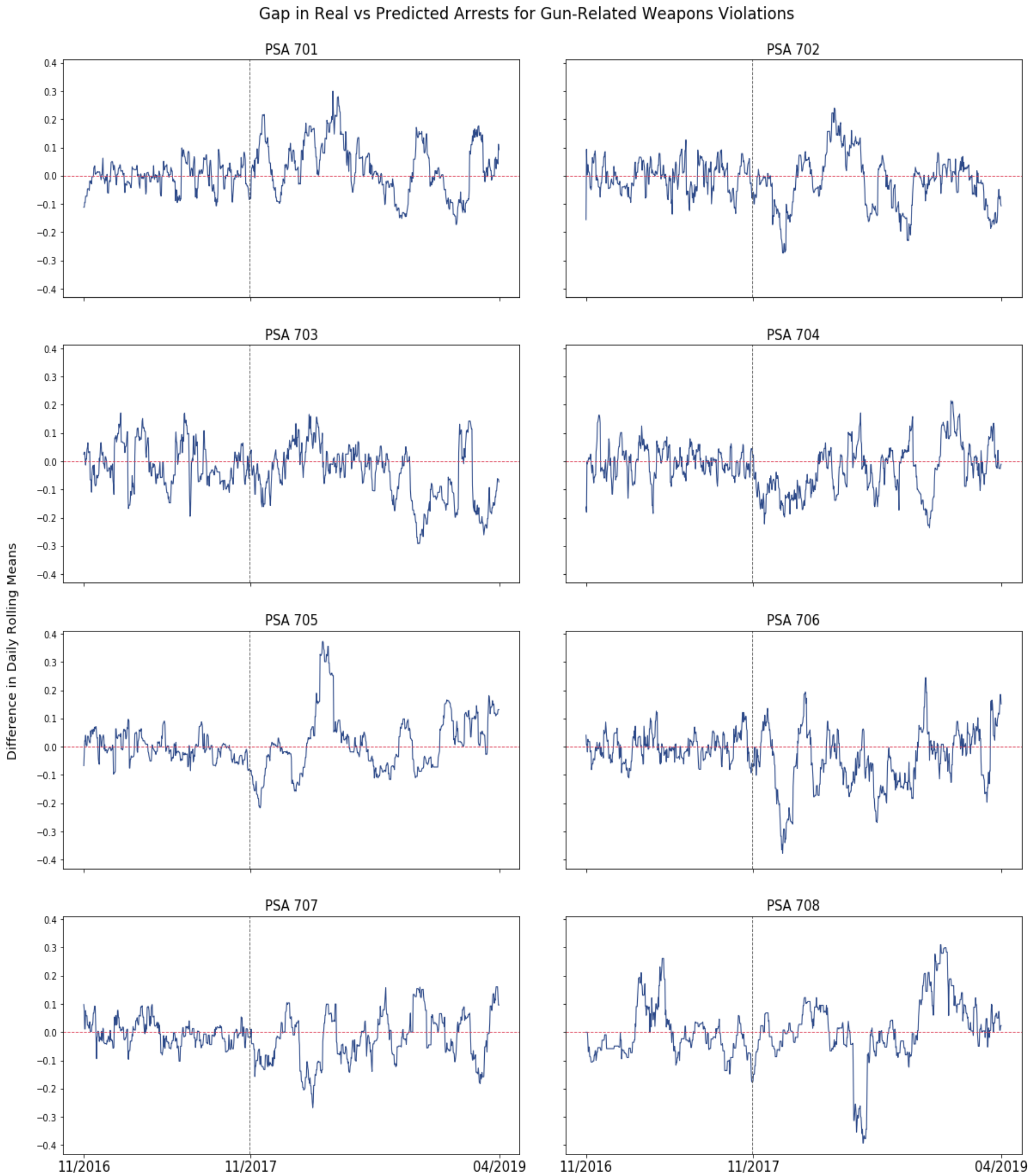


Figure 29: Difference in daily rolling means for arrests for gun-related weapons violations between the real 7D PSAs and synthetic 7D PSAs from November 1, 2016 to April 30, 2019. The dashed vertical line represents the start of the intervention period. The horizontal dashed line represents zero. Differences above zero indicate that actual arrest rates were higher than predicted, and differences below zero indicate that actual arrest rates were lower than predicted.

When we look at the results from the placebo test, shown in Figure 30 below, we can see that the plotted lines for the treated 7D PSAs (blue) do not deviate clearly from the placebo PSAs (red) in the post-treatment period. Similarly, the MSPE plot confirms that none of the 7D PSAs are outliers. This reinforces our finding that the CGIC 2.0 had no measurable effect at the PSA level for arrests for gun-related weapons violations.

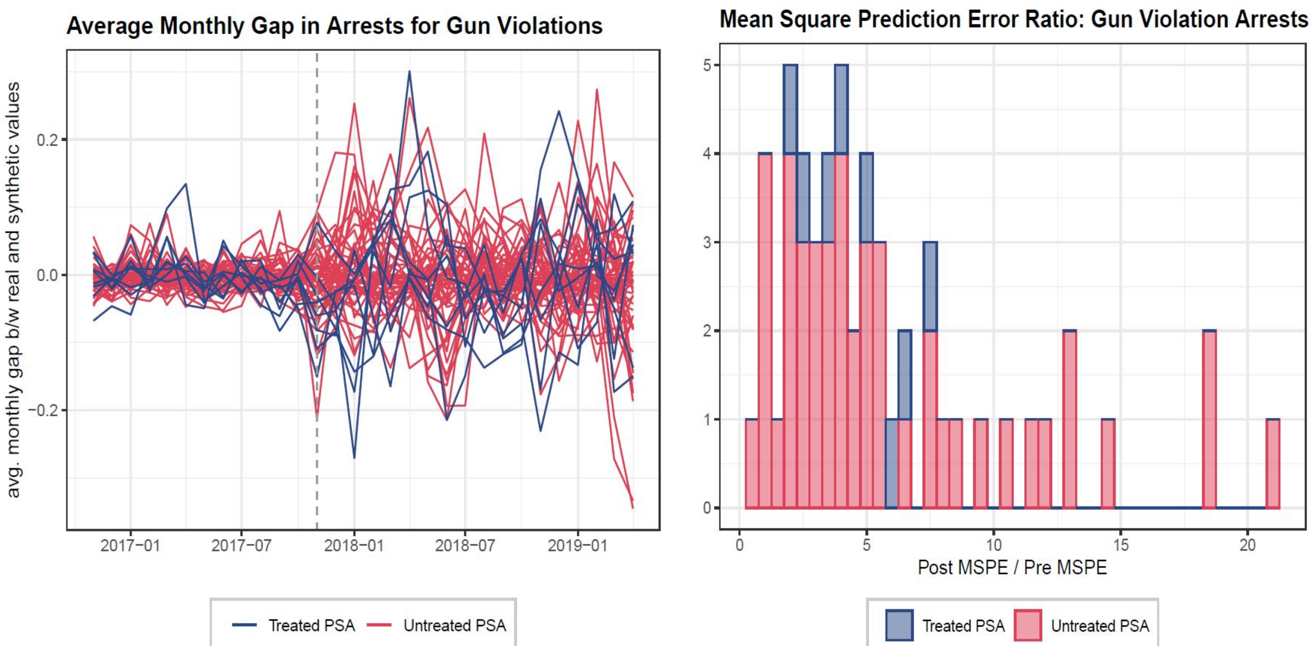


Figure 30: Average monthly gaps in rolling means for the PSAs within 7D (in blue) and placebo gaps for the non-treated PSAs (in red) to the left, and the ratio of the post-treatment MSPE to pre-treatment MSPE to the right, for arrests for gun-related weapons violations. For the plot on the left, we see that the blue lines are not clearly differentiated from the red lines, so we cannot conclude that CGIC 2.0 had a detectable effect on arrest rates in the treated PSAs. For the plot on the right, we should expect to see the treated 7D PSAs with a higher ratio (i.e. blue bars clustered to the right) if CGIC 2.0 had an effect; instead we observe the blue bars closer to the left.

Examining the results from our difference-in-differences analyses, seen in Table 11 below, all of our estimates for the periods after the start of the intervention encompass 0, which we interpret as a null result.

Table 11: Difference-in-differences estimates for arrests for gun-related weapon violations in 7D

Arrests for Gun-Related Weapon Violations	Estimate	Lower Bound	Upper Bound
Pre-Treatment Q4	-0.76	-2.38	0.86
Pre-Treatment Q3	-0.40	-2.21	1.41
Pre-Treatment Q2	-0.49	-2.38	1.39
Pre-Treatment Q1	-0.81	-2.61	1.00
Post-Treatment Q0	-0.87	-2.76	1.01
Post-Treatment Q1	-0.44	-2.24	1.35
Post-Treatment Q2	-0.79	-2.59	1.02
Post-Treatment Q3	-0.83	-2.58	0.93
Post-Treatment Q4	-0.67	-2.51	1.17
Post-Treatment Q5	-0.50	-2.23	1.22
Post-Treatment Q6	-0.62	-2.77	1.53

Arrests for Violent Gun Crimes

We do not measure an effect of CGIC 2.0 on the rate of arrests for violent crimes in which a gun was used. Figure 31 below displays the difference in daily rolling means for arrests for violent gun crimes for the real and the synthetic 7D PSAs for the study period of interest. A visual inspection of these graphs suggest that there is no clear trend in the line plotted for each PSA; instead, we see the daily differences in the arrest rate shifting back and forth between positive and negative values throughout the study period.

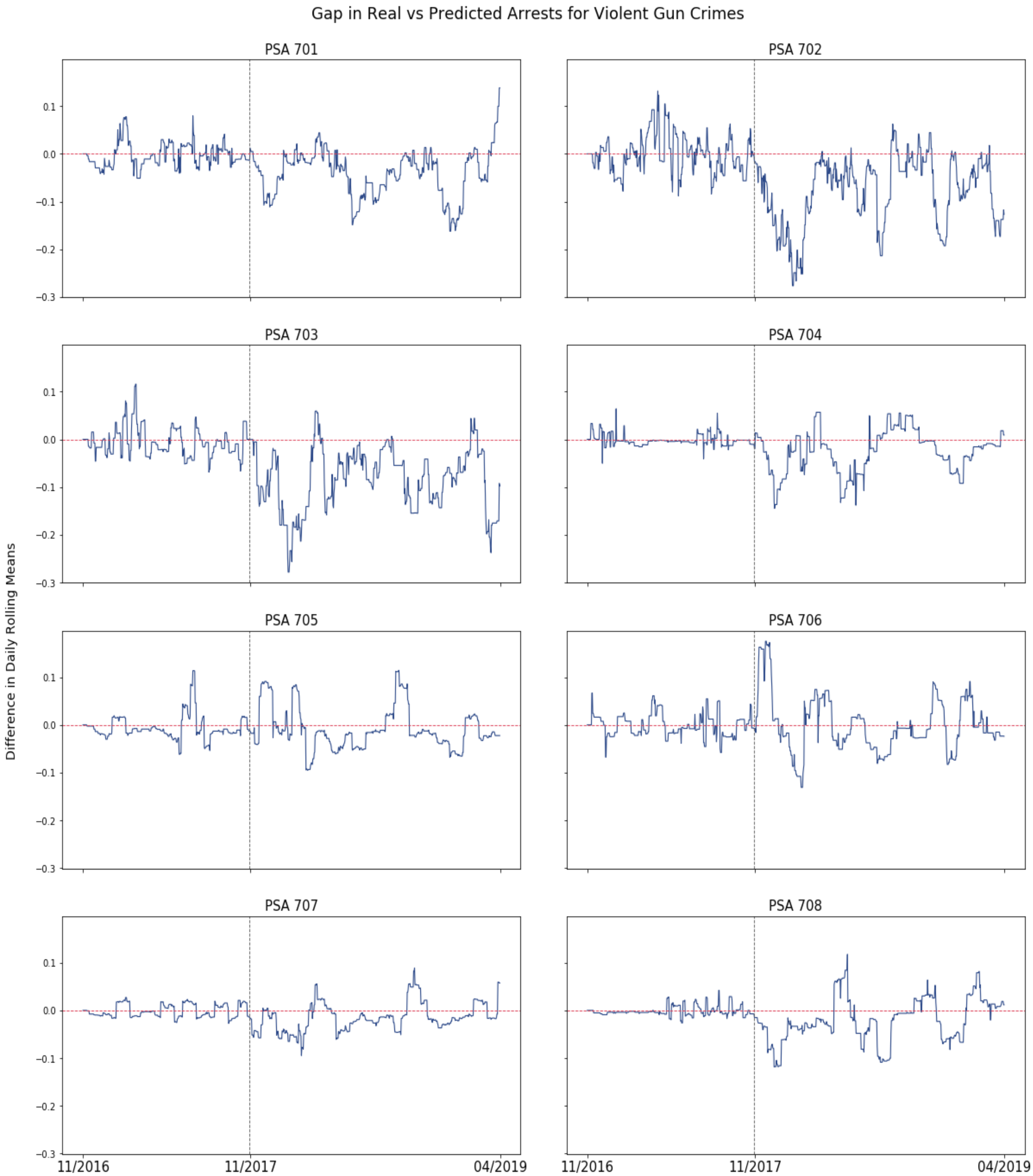


Figure 31: Difference in daily rolling means for arrests for violent gun crimes between the real 7D PSAs and synthetic 7D PSAs from November 1, 2016 to April 30, 2019. The dashed vertical line represents the start of the intervention period. The horizontal dashed line represents zero. Differences above zero indicate that actual arrest rates were higher than predicted, and differences below zero indicate that actual arrest rates were lower than predicted.

Similarly, when we examine the results from the placebo test, shown in Figure 32 below, we can see that the plotted lines for the treated 7D PSAs (blue) do not deviate clearly from the placebo PSAs (red) in the post-treatment period. The MSPE plot in confirms this as well -- none of the 7D PSAs are outliers. This reinforces our finding that the CGIC 2.0 had no measurable effect at the PSA level on arrests for violent crimes in which a gun was used.

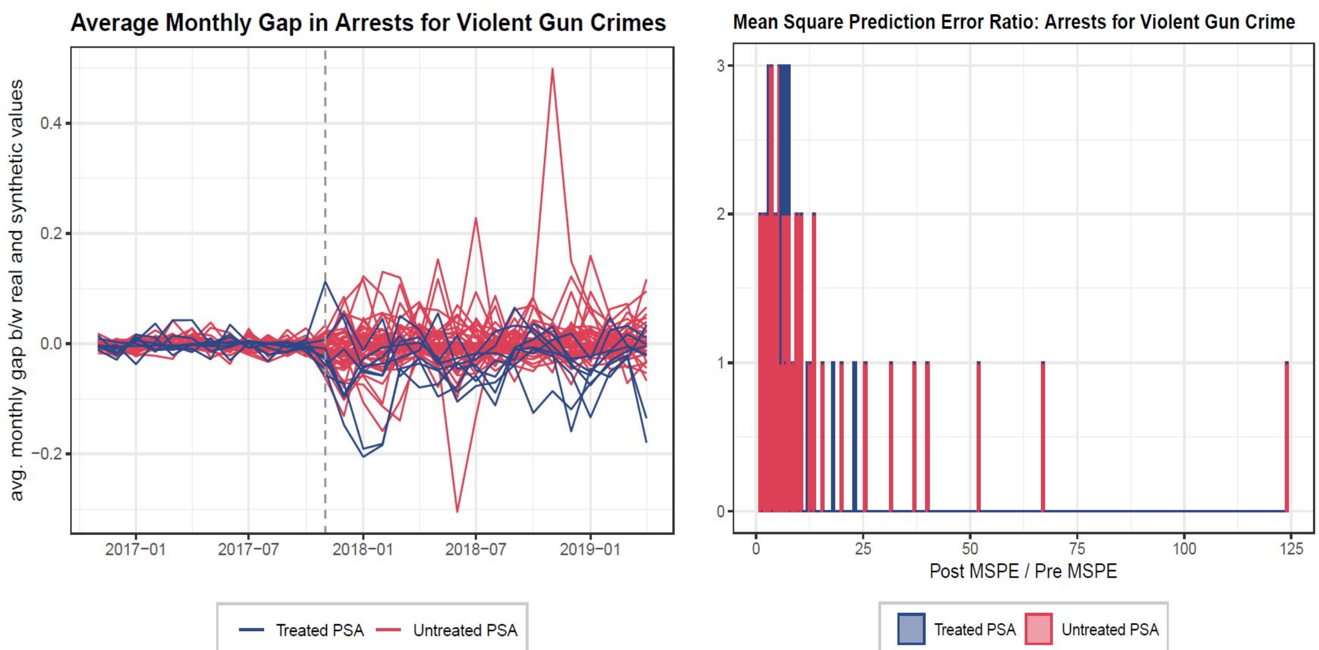


Figure 32: Average monthly gaps in rolling means for the PSAs within 7D (in blue) and placebo gaps for the non-treated PSAs (in red) to the left, and the ratio of the post-treatment MSPE to pre-treatment MSPE to the right, for arrests for violent gun crimes. For the plot on the left, for the most part, we see that the blue lines are not clearly differentiated from the red lines, so we cannot conclude that CGIC 2.0 had a detectable effect on arrest rates in the treated PSAs. For the plot on the right, we should expect to see the treated PSAs within 7D with a higher ratio (i.e. blue bars clustered to the right) if CGIC 2.0 had an effect; instead we observe the 7D PSAs closer to the left side of the plot.

Looking at the results of the difference-in-differences analyses, almost all of the post-treatment quarterly estimates encompass zero, indicating a null effect. We do measure a small, statistically significant *increase* in arrests for violent gun crimes in a single post-treatment quarter (in the first quarter after treatment was initiated, beginning February 2018). There are, however, a number of reasons to believe this effect may not be due to the implementation of the CGIC 2.0:

1. The change measured is very early on in the treatment period. As we know, the time elapsed from the point of a crime to arrest is often much longer than a few months, so it would be highly unlikely that CGIC 2.0 interventions had a causal effect so early on in their implementation.
2. We observe similarly small increases in arrests for violent gun crimes in the pre-treatment period, prior to the implementation of CGIC 2.0.

3. We observe this increase in arrests in only one of six quarters of the post-treatment period.

As such, we interpret the difference-in-differences results for this outcome as inconclusive. We do not discern a meaningful effect of the CGIC 2.0 intervention on arrests for violent gun crimes during the study period.

Table 12: Difference-in-difference estimates for arrests for violent gun crimes in 7D

Arrests for Violent Gun Crimes	Estimate	Lower Bound	Upper Bound
Pre-Treatment Q4	0.19	0.02	0.36
Pre-Treatment Q3	0.19	-0.04	0.42
Pre-Treatment Q2	0.23	0.09	0.36
Pre-Treatment Q1	0.18	0.05	0.30
Post-Treatment Q0	0.07	-0.09	0.22
Post-Treatment Q1	0.26	0.12	0.40
Post-Treatment Q2	0.02	-0.11	0.15
Post-Treatment Q3	0.12	-0.02	0.27
Post-Treatment Q4	-0.09	-0.24	0.06
Post-Treatment Q5	0.09	-0.02	0.20
Post-Treatment Q6	0.53	-0.29	1.34

Exploratory Analysis: Matching ShotSpotter Alerts and Calls for Service

In addition to our analyses of the effects of CGIC 2.0, we examined the relationship between ShotSpotter alerts (generated by sensors) and calls for service for sounds of gunshots, matching them in order to understand the rates at which District residents call 9-1-1 when they hear sounds of gunshots. At this time, this matching effort offers preliminary insights into patterns and trends in the distribution of ShotSpotter alerts and calls for service. Though this analysis does not inform this assessment of the impact of the CGIC 2.0 enhancements, we note the potential value of this measure for future program evaluations.

The dashboard we built to visualize this data contains information for ShotSpotter alerts and calls for service from 2014 through 2017. We note that MPD does not have complete ShotSpotter coverage for the entire city; sensors are concentrated in areas that experience the most violence. 6D and 7D have near complete coverage, while 1D, 4D, and 5D have much less coverage as a proportion of their area. MPD does not have any ShotSpotter coverage in 2D.

In 2017, there were 4,476 ShotSpotter alerts, 1,891 of which occured in 7D. Of the 4,476 alerts citywide, 1,574 were matched to a call for service for “Sound of Gunshots” for an overall match rate of 35%. Within individual PSAs across the District, the match rates varied from 23.6% to 73.3% for PSAs with at least 20 alerts. As shown in the table and map below, which presents a view of the dashboard for 2017, match rates are notably lower in the First, Sixth, and Seventh police districts.

Table 13: 2017 Match Rates for Shotspotter Alerts and Citizen Calls for Service, by District

2017 Match Rates for ShotSpotter Alerts and Citizen Calls for Sounds of Gunshots			
DISTRICT	Unmatched Alerts	Matched Alerts	Match Rate
1D	125	61	33%
3D	52	72	58%
4D	82	81	50%
5D	200	225	53%
6D	1099	485	31%
7D	1251	640	34%
Outside of DC	93	10	10%
Total	**2902**	**1574**	**35%**

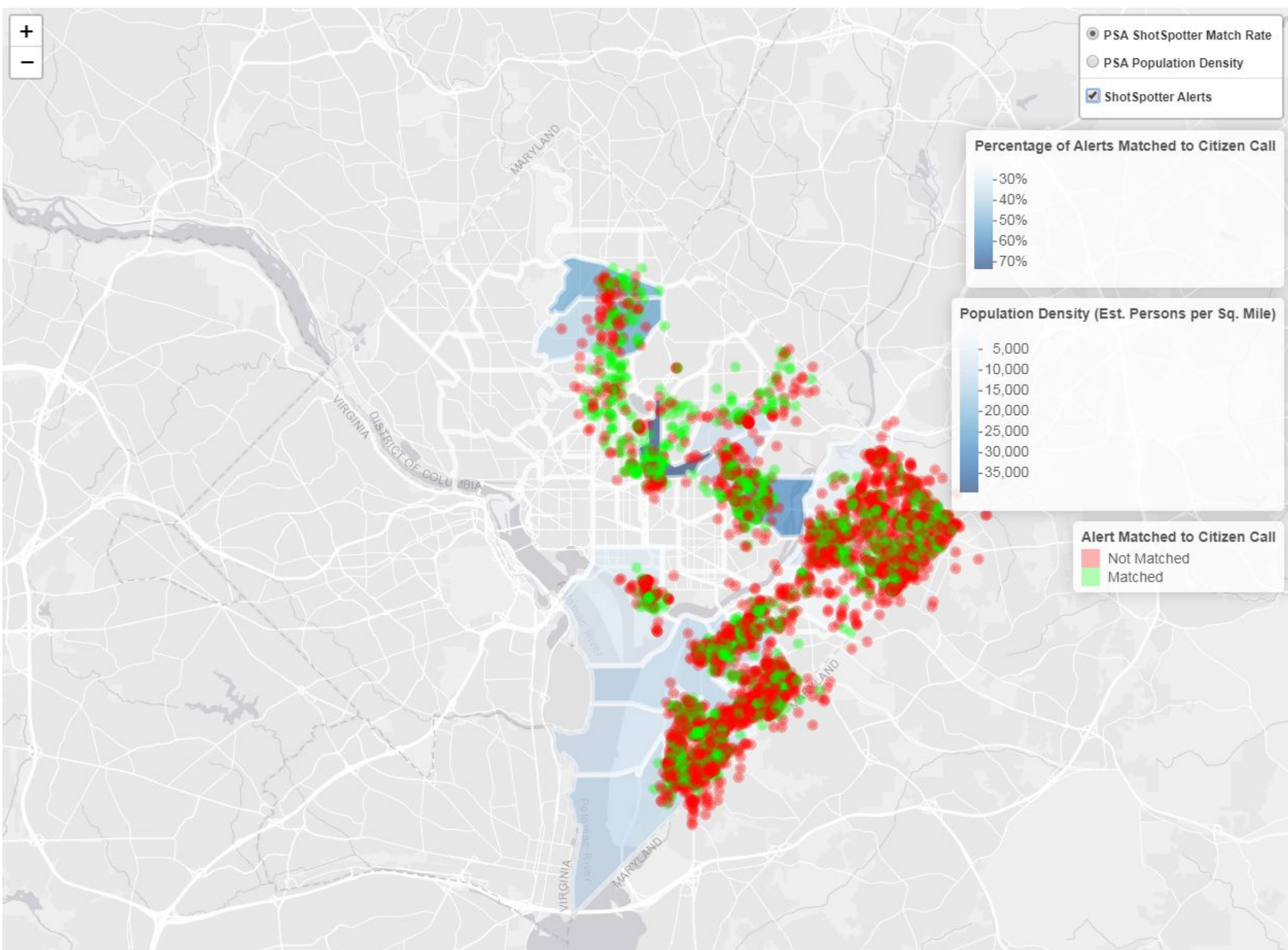


Figure 33: A screenshot of the dashboard showing match rates and ShotSpotter alerts for 2017.

There are a number of possible explanations for differences in rates, all of which merit further investigation. To the extent that calls for service can be interpreted as a measure of trust in the police (and government institutions more broadly), the lower match rates in 1D, 6D, and 7D may signal a more complicated relationship between police and communities in these districts.[49] 6D and 7D also experience higher rates of gun crime, and so there may be some degree of desensitization within the resident population to the sounds of gunshots. The lower match rates may be partly due to differing population densities, as both 6D and 7D are less dense on average compared to the other districts so there may be more people who are able to hear any given gunshot in the other districts.

Limitations

There are several limitations to our analyses, some of which were anticipated and pre-registered, and others of which were identified over the course of the study:

1. **We are evaluating the *enhancements to the CGIC,* not just the CGIC itself.**

While anecdotal evidence and results from our descriptive analyses suggest that the CGIC and NIBIN are useful to detectives and the investigative process in general, our quasi-experimental analyses only focus on the *enhancements* to the CGIC, not the CGIC itself. Over the course of the study period, these enhancements primarily affected fewer than 300 non-violent cases with cartridge casing evidence in 7D. In the absence of CGIC 2.0, these pilot items would have still been processed by DFS, but not as quickly. This component of the evaluation thus measures the effects of an important, but small, aspect of the overall CGIC effort.

Further, we are evaluating a process that is designed to provide better evidence and information leading to the *resolution* and *closure* of cases. The effect we are measuring is mediated through several intermediate steps — such as the decision to prosecute, whether an individual is out on bail while awaiting trial, court proceedings, sentencing, etc. Thus, we may not observe a change in ShotSpotter alerts or violent crime during the study period, as the individuals who might be our frequent shooters have not yet been removed from the street as they are still in the law enforcement process at the time of our evaluation.

2. **Spillover Effects**

While the CGIC 2.0 process improvements were piloted in 7D, we see that actual CGIC 2.0 implementation, and CGIC activities more broadly, are not constrained to 7D. For example, NIBIN information from a 7D case could be linked to cases in untreated areas. New trainings that were implemented as part of the process improvements were not restricted to detectives in 7D, but also offered to detectives who work in other police districts in DC. Further, ATF activities at the CGIC did not treat investigative leads from 7D differently than leads from the rest of the city. Thus, there may be

[49] 1D has fewer ShotSpotter coverage areas than 6D and 7D, and relatedly, many fewer alerts than 6D and 7D; the pattern of crime in 1D is also different from 6D and 7D.Thus, the matching rates observed in this district may be due to different factors than those in 6D and 7D.

some spillover effects that affect our ability to detect an effect of the full CGIC implementation in 7D through the quasi-experimental approach applied.[50]

3. 7D is unlike any other district within Washington DC.

As noted in our pre-registered pre-analysis plan, 7D is unlike any other district within Washington, DC in many ways, but most specifically in that it has the highest rates of gun-related and violent crimes. Though there are more similarities at the PSA level between this district and others throughout the city (hence the synthetic control approach we use for our analyses), the “treated” unit is unique relative to other districts. This fact affects our analysis because the synthetic control method typically requires that the donor pool be restricted to the units that have characteristics similar to the treated unit to avoid overfitting. Because 7D is so unique compared to other districts in terms of crime rates, and the fact that we only use the outcome itself to construct our synthetic 7D (e.g., rate of ShotSpotter alerts alone to construct the synthetic control for 7D), we suspect that the other PSAs in DC are not optimal matches for 7D. As a result, we likely overfitted our data. Overfitting occurs when the “characteristics of the unit affected by the intervention or event of interest are artificially matched by combining idiosyncratic variations in a large sample of unaffected units.”[51] This means that while the trends in the synthetically-matched 7D appear to align closely to the trends in the real 7D during the pre-intervention period, we know that because the non-treated PSAs were likely to be subpar matches for 7D, that this model would not be generalizable to unseen data (i.e., rolling means of incidents after CGIC 2.0 was implemented).

This limitation, foreseen in the pre-analysis plan, suggests that we should be cautious about the results. Further analyses of CGIC effects might explore what additional variables — other than the outcomes themselves — might improve the synthetic controls. Those variables might include measures of changes in demographic, social, or policing variables in the pre- and post-treatment periods.

4. Changes within 7D during the study period

During the study period, a number of important changes took effect in 7D. The effects of these events/initiatives may confound our measurement of the effects of CGIC 2.0, particularly as they undermine the parallel trends assumption that is a condition of difference-in-difference analyses, as described in the Research Design section of this report.

- Barry Farm, a major public housing community in 7D, was demolished in early 2019 after its residents were relocated over the period of April 2018 - January 2019. Barry Farm was located in PSA 703, and was a hot spot for violent crime. While the residents were relocated all over the city, a large proportion of them were relocated to newly refurbished housing in Washington Highlands, PSA 706. This significant population change may explain some of the changes observed in PSA 703 during the study period.
- The Office of Neighborhood Safety and Engagement (ONSE) began a violence interruption program in 7D and other parts of the District in mid-2018.

[50] Abadie, et al. (2015).
[51] Abadie, et al. (2015).

- The Office of the Attorney General (OAG) also started a violence interruption program with a presence in Washington Highlands (PSA 706) in mid-2018.
- 7D contained 3 focus areas for the 2016, 2017, and 2018 Summer Crime Initiatives (SCIs). MPD chose 6 SCI areas in each of those years and half were in 7D. The areas are chosen based on violent crime rates, with a specific interest in targeting gun violence. The SCI areas receive extra officers, resources, and attention from May through August.

5. Length of control period

This analysis only uses one year's worth of data from the control period to construct the synthetic control. This decision was informed by our power calculations (conducted in the pre-analysis phase), which indicated a year's worth of data was more than sufficient to detect a change. However, typical synthetic control studies suggest that a greater number of pre-intervention data is necessary to control for unobservable factors that might impact our outcomes of interest. In particular, "The applicability of the method requires a sizable number of pre-intervention periods. The reason is that the credibility of a synthetic control depends upon how well it tracks the treated unit's characteristics and outcomes over an extended period of time prior to the treatment."[52]

We also noted in the pre-analysis plan to this study our concerns about the ability to assess the full effects of CGIC 2.0 within an 18-month period due to the pace of law enforcement, prosecutorial, and court activities.[53] Because our expectation then was that the effects of the intervention might not be captured right away, this suggests that our control period needs to be longer. In addition, there were notably more homicides in 2018 (during our study period of interest) than in other recent years.[54] It is possible that we needed several more years of data both pre- and post- intervention to construct a synthetic 7D that more accurately and precisely captures the base rate of events.

6. 2019 Police Boundary Realignment

There may be reason to believe that the results from our analysis might not hold true for the entirety of the study period because MPD realigned police district boundaries towards the end of the study period, effective January 10, 2019.[55] This change affects the generation of our synthetic controls, as many of the PSAs in the 7D and the rest of the PSAs in the donor pool had changes to their boundaries as a result of this realignment. We ran our main analyses for the entirety of the pilot period through April 30, 2019 using the 2018 police boundaries, simply because there was a greater number of months of our study period that took place when the 2018 police boundaries were still in effect.

As a robustness check, we also ran our analyses using (1) the 2019 updated police boundaries and (2) the 2018 police boundaries, but only running the analyses up until January 10, 2019, excluding the remainder of the pilot period. We found that although there were slight variations in the daily rolling means at the PSA levels, the results reported at the District level do not change with either of these specifications.

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[52] Abadie, Alberto, Alexis Diamond, and Jens Hainmueller. "Comparative Politics and the Synthetic Control Method." American Journal of Political Science, 59.2 (2015): 495–510.
[53] Pre-Analysis Plan: Crime Gun Intelligence Center (CGIC) Evaluation. https://osf.io/q8r5m/
[54] Metropolitan Police Department. District Crime Data at a Glance. https://mpdc.dc.gov/page/district-crime-data-glance
[55] Metropolitan Police Department. Police Boundary Update. https://mpdc.dc.gov/realignment2019

Conclusion

The findings presented here — from one of the first ever formal assessments of CGIC process improvements — offer preliminary insights on the effectiveness of this approach to improving the comprehensiveness and timeliness of NIBIN information, and more broadly, to reducing gun crime. Our descriptive analyses are suggestive of the value of CGIC and NIBIN information to advancing the investigatory process. While our quasi-experimental analyses do not find a causal effect of CGIC 2.0 *enhancements* on violent crime during the study period, there were a number of limitations associated with this component of the evaluation.

Additional feedback from CGIC partners suggests other mechanisms — not assessed here due to data limitations — through which the CGIC might help reduce violent crime outcomes. For instance, when there were high profile shooting events in the district, ATF, DFS, and MPD worked together to approve overtime and expedite the processing of casing evidence over weekends and holidays. Agency partners attribute this collective efficiency to the collaboration and connections created by CGIC 2.0.

Additionally, NIBIN information can be useful outside of just closing cases:

- NIBIN information from DC is also used by ATF in interstate firearms trafficking investigations that have led to arrests in other jurisdictions that are not recorded here.
- MPD's Patrol Command Staff also uses NIBIN to deploy officers to areas where crew violence appears to be escalating.
- Specialized units use NIBIN to target repeat offenders for other avenues of enforcement.
- NIBIN information may also be considered by judges in whether to grant the prosecution's request to hold a defendant.

Though we are unable to study these potential effects of CGIC 2.0 in this evaluation due to data and methodological limitations, we note them here as opportunities for future evaluations.

Taken together, our recommendation is to continue the CGIC 2.0 implementation and for CGIC partner agencies to track outcomes of interest through an additional 18- to 24-month period. This recommendation aligns to findings reported from the evaluation of Milwaukee, WI's CGIC program as well.[56] Extending the evaluation time frame would allow for further data collection, especially on law enforcement and prosecutorial processes that did not yet have final outcomes at the time this report was written. This evaluation also suggests that continuing efforts to expand detectives' use of NIBIN and CGIC products may help advance investigations, and in so doing, help reduce gun crime in Washington, DC.

[56] Koper, C., Vovak, H., and B. Cowell. Evaluation of the Milwaukee Police Department's crime gun intelligence center. Washington, DC: National Police Foundation (2019).