We're Building Something Here: Reducing Gun Violence Without Exacerbating the Harms of Policing in Baltimore's Western District*

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October 2, 2023

Abstract

The rate of Americans shot and killed in 2021 is near a record high. Much of this gun violence is concentrated in a handful of disadvantaged neighborhoods in U.S. cities. We report on a focused strategy to reduce neighborhood gun violence. This strategy—which directs police and social service resources to the small number of people actively engaged in gun violence—was implemented in an area with a per capita rate of homicides and shootings among the very highest in the United States: Baltimore's Western police district. In the 18 months after its introduction, we estimate that the strategy reduced homicides and shootings in the Western district by roughly a third, with no evidence of spillovers to other parts of Baltimore. Importantly, despite the central role played by police in this intervention, the large reduction in gun violence was not accompanied by a broad increase in arrests. The marginal cost of this intervention, which substantially reduced the most socially costly form of violence, is just $10 million, equal to 0.2% of Baltimore's 2021 city budget or approximately $18 per Baltimore resident.

*This research was made possible by the generous financial support of the Abell Foundation, Baltimore Community Foundation, Johns Hopkins University, Goldseker Foundation, Brown Advisory Board, Jacob and Hilda Blaustein Foundation, Crane Foundation, France Merrick Foundation, and Krieger Fund. We extend our deep appreciation to the dedicated individuals and organizations working to improve public safety in Baltimore: Mayor Brandon Scott, Deputy Mayor Anthony Barksdale and the Mayor's Office of Neighborhood Safety and Engagement, including former Director Shantay Jackson, acting Director Stefanie Mavronis and GVRS Deputy Director Terence Nash; the Baltimore City Police Department, including former Commissioner Michael Harrison and acting Commissioner Richard Worley; and the Baltimore City State's Attorney's Office, including State's Attorney Ivan Bates and Deputy State's Attorney Tom Donnelly; and Youth Advocate Programs, Inc., ROCA, and community "moral voices". All have been pivotal partners in our collaborative pursuit. We are also indebted to the Baltimore City Police Department and Baltimore City Office of Information & Technology for providing us with data access and their commitment to open science. Special recognition goes to numerous Baltimore Police personnel, including Sergeant Zachary Novak, Kai Ji, and Matthew Wickizer, for their support in helping us better understand the data. And, this work would not be possible without our research team members Deborah D'Orazi and Alexa Mason–we are grateful to them. The findings and conclusions reported here are solely the responsibility of the authors.

1 Introduction

Almost 21,000 Americans were victims of gun homicide in 2021 (Gramlich, 2023). The total number of gun assault victims that year, including of non-fatal shootings, is likely closer to 100,000 (Cook et al., 2017). The most disadvantaged neighborhoods in American cities—with predominantly Black and Hispanic populations—bear the greatest economic, social, and psychological burdens from gun violence (Cullen and Levitt, 1999; Cook and Ludwig, 2000; Sharkey and Sampson, 2010). In some of these neighborhoods, young men face a higher risk of gun homicide than did combat soldiers at the height of the Iraq war (Del Pozo et al., 2022).

Policing remains the primary means by which cities respond to gun violence. Hiring more officers and allocating them to higher-crime areas have been repeatedly shown to reduce crime and violence, including homicide.[1] Yet every interaction with a police officer carries risks, including the risk of violence (Weisburst, 2019a) and arrest. Some of these police actions undoubtedly yield considerable public safety benefits. But others may not, including many low-level arrests, for which the public safety benefits are likely to be especially low (Mas, 2006; Harcourt and Ludwig, 2006; Cho et al., 2021; Bacher-Hicks and de la Campa, 2021) and possibly negative.[2] The negative externalities of aggressive and indiscriminate enforcement actions such as abusive and disrespectful encounters (Tyler et al., 2015), unlawful stops and searches (Fagan and Davies, 2000), and excessive arrests (Vitale, 2021) are also borne by the same neighborhoods that suffer most from gun violence, leading them to be simultaneously over-policed and under-protected (Leovy, 2015).

How can a social planner maximize the public safety benefits of policing to reduce gun violence while minimizing its costs? A key insight for answering this question is that gun violence is highly social, often occurring within groups of interconnected people (Papachristos et al., 2012; Green et al., 2017; Bruhn, 2021). These groups are relatively small and usually span a small number of communities within a city (Papachristos et al., 2013) and their composition is often known to the police. Incorporating this insight into how police focus their attention offers the potential to generate a sizable multiplier effect. Changing the behavior of a small group of people—by deterring them from engaging in violence or incapacitating them through arrest and detention when they do—can potentially reduce gun violence at scale, without

[1] See, e.g., Evans and Owens (2007); Chalfin and McCrary (2018); Mello (2019); Weisburst (2019b); Chalfin et al. (2022); Braga and Bond (2008); Ratcliffe (2004); Braga et al. (2019a). For summaries of this literature, see, e.g., Cameron (1988), Nagin (1998), Eck and Maguire (2000) , Skogan and Frydl (2004), Levitt and Miles (2006), (Nagin, 2013), Carriaga and Worrall (2015), Lee et al. (2016), Eck et al. (2017), Chalfin and McCrary (2017) and McCrary and Premkumar (2019).

[2] Prosecuting people for non-violent misdemeanor offenses and detaining them in jail during the pendency of their case can increase criminal behavior (Leslie and Pope, 2017; Dobbie et al., 2018; Agan et al., 2021).

the need for broad-based enforcement activity.

We report results from the adoption of such a focused strategy in Baltimore, Maryland. Baltimore's homicide rate of 58 per 100,000 residents in 2021 is the second highest among larger U.S. cities.[3] In the city's Western police district, the site where this strategy was implemented, the homicide rate in 2021 was 112 per 100,000, implying that approximately 0.5% of its residents were shot or killed that year. Among 323 police districts across 27 large U.S. cities, the Western district's homicide rate in recent years is the fifth highest, surpassed only by two districts in St. Louis, one in Louisville, and one in New Orleans (Figure 1). Importantly for our research design, the Western district is not an outlier within Baltimore; the Southwestern and Eastern districts are not far behind—ranking seventh and tenth, respectively—making them reasonable counterfactuals for the Western district.

In January 2022, the city began implementing the Group Violence Reduction Strategy (GVRS) in the Western district.[4] The GVRS is a collaboration between the Mayor's Office, the Baltimore Police Department (BPD), and several non-profit and community-based organizations. At a high level, the strategy involves three parts: identification, notification, and action. A series of weekly meetings led by BPD identifies groups of people actively engaged in gun violence in the district. These individuals are then notified—either through a home visit involving some combination of an officer, an outreach worker, and a community member, or as part of a group "call-in"—that their behavior is the focus of GVRS and law enforcement. Finally, individuals are connected to outreach organizations that, in turn, can refer them to services ranging from housing assistance to transitional employment. In addition, BPD increased police presence in housing developments with a high concentration of GVRS targets and worked with the State's Attorney's Office and other agencies to investigate and develop criminal cases against those continuing to engage in violence.

We estimate the effects of GVRS on public safety and enforcement activity in the Western district. Though the Western district has historically had the highest rates of homicide in Baltimore, other areas of the city provide reasonable counterfactuals, including the Eastern and Southwestern districts (Figure 1). Using the related estimation methods of differences-in-differences, synthetic controls (Abadie et al., 2010), and synthetic differences-in-differences (Arkhangelsky et al., 2021), we construct counterfactuals from areas of Baltimore that had not yet received GVRS. Since Baltimore has only nine police districts,

[3] Baltimore's persistently high rate of violence is famously captured in several television dramas including *Homicide: Life on the Street* (1993 – 1999), *The Corner* (2000), *The Wire* (2002 – 2008), and *We Own This City* (2022).

[4] GVRS expanded to the Southwestern district in January 2023. However, in this paper, we limit our focus to the experience of the Western district from January 2022 through June 2023.

we follow Kapustin et al. (2022) and improve the quality of our counterfactuals by estimating models at the level of smaller police beats or "posts."

We find that GVRS in the Western district caused a 20-35% decline in homicides and shootings and a 20-55% decline in carjackings over the 18 months after its introduction. These results are robust to differences in how the data are aggregated, the set of donor areas from which counterfactuals are constructed, and the estimation method used. Importantly, we find no evidence that these crimes spilled over to other parts of Baltimore, including areas adjacent to, or with pre-existing ties to targeted groups in, the Western district.[5] Nor do we find evidence that GVRS broadly changed police enforcement activity. While 144 arrests of GVRS targets were made during the outcome period, we find no evidence of GVRS affecting the number of arrests for more serious "Part 1" crimes or the number of more discretionary arrests for lower-level offenses in the district. Thus, a change to policing—in coordination with other government and community partners—caused murders and shootings to fall by nearly a third for over a year, in one of the highest-violence places in the U.S., and without expanding the use of aggressive and indiscriminate enforcement.

The strategy adopted in the Western district is not new, even to the Western district. A similar approach was tried and abandoned there in 2014-15. Such "focused deterrence" strategies have been implemented widely and studied extensively by criminologists, with mostly promising results (Braga et al., 2018). Yet this prior evidence is primarily non-experimental, and often derives from settings where plausible counterfactuals for the treated area(s) are scarce or non-existent.[6] Prior studies are further limited in what they can say about the these strategies' impact on broader enforcement activity, the relative contributions of deterrence and incapacitation to any public safety gains they produce, and how they actually engage with the groups of people they target.

This paper expands this evidence base in two important ways. First, Baltimore's Western district is an ideal setting for studying this type of focused violence reduction strategy, both because of its persistently high levels of gun violence and associated group dynamics, and because it is far from the only place in Baltimore experiencing these challenges, increasing the likelihood that other areas in the city provide a reliable counterfactual. Second, we will be able to leverage extraordinarily detailed—and typically unavailable—data to study this intervention. These include granular data on the strategy's distinct

[5] In future analyses, we plan to look for further evidence of spillovers by studying individual-level arrest and stop data to determine whether GVRS targets shifted where they spent their time after January 2022.

[6] Three experimental studies test interventions that apply the principles of focused deterrence to individuals rather than groups, with two finding that this approach reduces offending among the targeted population (Hamilton et al., 2018; Ariel et al., 2019).

elements, ranging from police enforcement activities to individuals' receipt of social services. We can use these data to measure how many of the identified GVRS targets were exposed to the intervention, and whether those most exposed—including their peers linked through prior arrests—experienced larger changes in their behavior, a complement to our main estimates of the strategy's area-level impact. We can also try to unpack the relative contributions of deterrence and incapacitation—including through the study of five large-scale "group takedowns"—to the observed treatment effects, a critically important policy estimand for understanding the costs and benefits of the intervention.

The remainder of the paper is organized as follows. In Section 2, we briefly describe and review the literature on the focused deterrence approach. In section 3, we describe the implementation of GVRS in Baltimore's Western district. In Section 4, we discuss our data. Section 5 lays out our empirical approach, Section 6 presents results, and Section 7 concludes.

2 Prior literature

2.1 Focused deterrence

Focused deterrence was first developed in Boston, Massachusetts in the mid-1990s as a response to ongoing youth gun violence that had its roots in the receding crack cocaine epidemic (Kennedy et al., 1996, 2001). The so-called "Boston Gun Project" convened a working group of law enforcement, social service, community, and academic partners to analyze the underlying conditions associated with the persistence of youth gun violence in the city. The analysis found that the bulk of youth homicides were driven by ongoing disputes among a very small number of gang members who were very well known to the criminal justice system (Kennedy, 1997). The inter-agency working group developed and implemented Operation Ceasefire, a focused, law enforcement-led strategy which had the goal of preventing gang members from continuing to engage in gun violence (Kennedy, 1997). When outbreaks of gang-involved shootings erupted, the working group concentrated its enforcement capacity on holding the offending groups accountable for their violent behavior, while street outreach workers and community members attempted to convince gang members to stop shooting and take advantage of available services and opportunities.

A hallmark of the Boston strategy was the direct communication of incentives and disincentives to the targeted audience through informal street conversations with specific gang members and formal "call-ins" of the offending groups (Kennedy, 1997). It was critically important for gang members to understand that shootings triggered the actions of the working group (i.e., demonstrating a "cause and effect" relationship

between their engaging in gun violence and law enforcement scrutiny). Maintaining the credibility of these communications required robust enforcement responses by police, prosecutors, and corrections officials, as well as the availability of appropriate services and opportunities for individuals who wanted to step away from violent gang life. Large reductions in gun violence immediately followed the implementation of Operation Ceasefire in Boston (Braga et al., 2001).

The success of the Boston experience inspired several U.S. cities to adopt a similar focused deterrence approach to address violent group offending, including Los Angeles (Tita and Abrahamse, 2004), New Orleans (Corsaro and Engel, 2015), Oakland (Braga et al., 2019b), and Philadelphia (Roman et al., 2019). In addition to these group violence interventions, the principles of focused deterrence have also been used to reduce repeat offending by violent individuals (Papachristos et al., 2007; Ariel et al., 2019) and control disorderly street drug markets (Saunders et al., 2015).

The potential efficacy of a more tailored approach to law enforcement is supported by several theoretical perspectives. Most directly, deterrence strives to reduce crime by changing potential offenders' perceptions of official action and associated risk of sanctions (Cook, 1980; Nagin, 2013). As such, effective deterrence necessarily involves both advertising and persuasion (Zimring et al., 1973). Potential offenders need to know the punishment risks they face and need to believe that these risks are genuine.[7] As a result, focused deterrence places a premium on effective communication with potential offenders. Focused deterrence programs also attempt to create a more certain and swift sanction environment through the creative application of existing enforcement capacity and legal authority (Kennedy, 1997). When responding to a violent gang in a particular jurisdiction, authorities can "pull all available enforcement levers" such as warrant service, review and follow-up on open investigations, drug market disruption, civil code and traffic enforcement, monitoring closely and perhaps enhancing probation and parole conditions, more vigilant prosecutorial attention to all legal liabilities, and so forth (Braga and Kennedy, 2021).

Beyond attempting to maximize the deterrence value of law enforcement, these programs also try to control violence by mobilizing informal social control, enhancing police legitimacy, and reducing crime opportunities through situational crime prevention. Focused deterrence strategies emphasize the importance of engaging and enlisting community members. Community-based action in focused deterrence strategies helps remove the justifications used by offenders to explain away their responsibility for the targeted

[7] While theoretically obvious, deliberate communication with potential offenders has been neglected in practice (Kennedy, 1997).

behavior. In call-ins and on the street, community members effectively invalidate the excuses for criminal behavior by challenging the norms and narratives that point to racism, poverty, injustice, and the like (Braga et al., 2001). Community members work with law enforcement and social service agencies to (1) set basic rules for group-involved offenders such as "don't shoot guns" and (2) alert the conscience of these offenders by appealing to moral values inherent in taking the life of another, causing harm to their neighborhood, or the pain that would be experienced by their mothers if they were killed or sent to prison for a long time in a far-away location (Kennedy, 2011).

2.2 Evaluation evidence

An ongoing systematic review suggests a positive impact of focused deterrence programs on serious violence. The most recent iteration of the systematic review identified 24 quasi-experimental evaluations of focused deterrence programs (Braga et al., 2018). Nineteen of the 24 evaluations included in the review reported at least one statistically significant crime control effect. A meta-analysis of the program impacts found moderate reductions in targeted crime problems associated with focused deterrence programs, with the largest impacts produced by the gang and group-violence reduction programs.

Several randomized controlled trials have tested the efficacy of focused deterrence applied to individual offenders as opposed to gangs or groups. These interventions leverage the principle of maximizing the deterrence value of law enforcement alongside the offer of social supports. However, these interventions were not designed to leverage group dynamics and therefore may not produce the multiplier effect that intervening with groups could generate. Two of the three randomized evaluations find that focused deterrence reduces offending among the target population, thus offering support for the responsiveness of criminally active individuals to law enforcement messaging.[8] The third evaluation found that individuals randomized to attend notification forums at various sites in New York State were substantially less likely to violate their parole (Aboaba et al., 2022). However, the program did not affect individual arrest rates or neighborhood level gun violence.

[8] In St. Louis, MO, Hamilton et al. (2018) found parolees and probationers who were randomized to attend a focused deterrence notification meeting were less likely to be arrested over the following 17 months relative to those who did not attend the meeting. In Sacramento, CA, arrests of prolific offenders who were randomized to a policing program comprising "preemptive engagements with prolific offenders by a police officer offering both 'carrots' (desistance pathways) and 'sticks' (increased sanction threats)" decreased by 21% relative to a randomized control group (Ariel et al., 2019).

3 Institutional setting

Baltimore experienced more than 300 homicides and over 630 non-fatal shootings each year between 2015 and 2021. Nearly 88% of the 2,238 homicides during this period were committed with guns. In 2021, Baltimore had a homicide rate of 58 per 100,000 residents, over eight times higher than the U.S. homicide rate of 6.9 per 100,000 that same year and approximately double the homicide rate in Chicago. Among U.S. cities with more than 100,000 residents, Baltimore's homicide rate was surpassed that year by only that of St. Louis.

Baltimore has previously tried to implement several variants of focused deterrence to address persistently high levels of homicide during the late 1990s and again in the mid-2010s. Beginning in 1998, Baltimore developed and implemented a focused deterrence strategy, called Operation Safe Neighborhoods, which targeted violent groups in a drug market area in the Park Heights neighborhood. Despite some promising initial violence reductions, the strategy was dismantled due to political infighting, resistance to operational changes, and obstruction by some of the partnering agencies (Kennedy, 2011). Between 2014 and 2015, Baltimore implemented a precursor to GVRS in the Western district. Once again, after some promising initial reductions, the focused deterrence strategy was discontinued following upper management turnover, lack of governance and accountability structures, and inadequate development of social service capacity and community engagement (National Network for Safe Communities 2016). The 2015 death of Freddie Gray at the hands of Baltimore police officers in the Western district and subsequent social unrest effectively ended the pilot program.

Baltimore's near record level of gun violence in 2019, and debates over the city's inability to implement and sustain a violence reduction strategy to address it, were core issues in the mayoral election race that year. Then President of the City Council Brandon Scott pledged to fully support the adoption of a focused violence reduction strategy as part of his election platform. Immediately following his June 2020 election as the Democratic nominee in the citywide elections, presumptive Mayor-Elect Scott engaged the Crime and Justice Policy Lab at the University of Pennsylvania for technical assistance in the design and implementation of a such a strategy. In 2021, the city's Western district was selected as the initial implementation site based on data showing that it experienced the largest number of combined homicides and shootings between 2016 and 2020 among the city's nine police districts, almost 16% of Baltimore's 1,994 homicides and 4,161 shootings during this period.

The Crime and Justice Policy Lab completed a problem analysis of homicides and shootings in the Western district to guide initial operations. The analysis revealed a strong overlap between victim and offending

populations: both were mostly Black (>95%), male (>80%), ages 16–34 (>70%), and very well known to the criminal justice system (>81% had prior criminal justice involvement with a mean 12 prior arrests). Most homicides (72%) stemmed from interpersonal disputes that involved members of gangs, drug trafficking organizations, robbery crews, and other criminally active groups (70%). At the time of the research, the Western district had 18 criminally active groups with an estimated 615–735 members representing less than 2% of the area's 38,619 residents. Some groups were more engaged in violence than others, with the Poe Homes housing development crew generating at least 13 shootings in the 18 months between January 2020 and June 2021.

In 2021, the Mayor's Office, BPD, and community partners continued laying the groundwork for GVRS. The Mayor's Office of Neighborhood Safety and Engagement (MONSE) developed contracts with Roca, Inc. and Youth Advocate Programs, Inc. (YAP) to serve as the strategy's primary street outreach and service providers. Case management systems were adopted to monitor service uptake by treated individuals. MONSE partnered with the Baltimore Community Mediation Center (BCMC) to support initial community engagement work in the Western district and elsewhere in the city. MONSE and BCMC held a series of listening sessions with residents on GVRS and recruited community members, such as clergy and local anti-violence activists, to serve as "community moral voice messengers" to support communications with targeted groups and individuals.[9]

The BPD established weekly reviews of shooting incidents to develop and disseminate intelligence on group dynamics driving gun violence in the Western district. A specialized Group Violence Unit (GVU) was set up, staffed with 30 officers and detectives, led by a lieutenant, and trained in the required investigation, suppression, and partnership work needed to implement GVRS. Commitments from other local, state, and federal law enforcement agencies to support GVRS operations were secured. Weekly coordination meetings were also scheduled closely following BPD's shooting reviews to help outreach and community partners focus on individuals directly connected to recent shootings. The BPD also established monthly strategic enforcement meetings to ensure that law enforcement partners were following through with actions that maintained the credibility of promised sanctions in response to outbreaks of gun violence in the Western district.

On-the-ground implementation of GVRS started in January 2022 with efforts to communicate the strategy's anti-violence message to targets. Focused initially on a group operating in the Poe Homes housing development, this communication strategy started with "custom notifications," or in-field visits to GVRS

[9] In 2022, the BCMC partnership ended as MONSE strengthened its staffing to continue community engagement work.

targets usually carried out by one GVU detective, MONSE's Community Partnership Manager, one service representative, and one community member. During a visit, team members engage the individual in a respectful manner, tell them that they have been identified as being at the highest risk of shooting or being shot, and that further engaging in violence would bring focused law enforcement attention. A local community member communicates that they support law enforcement in making the neighborhood safe, discuss the harm that gun violence is inflicting on the community, and encourage them to take advantage of services. Finally, a Roca or YAP outreach worker discusses the services and opportunities available. In addition to custom notifications, eight members of the Poe Homes group participated in a formal "call-in" session in July 2022 with GVRS law enforcement, street outreach, and community partners who reiterated the strategy's anti-violence message.

In parallel with communication efforts, GVRS also focused enforcement actions towards Poe Homes group members. The GVU and their law enforcement partners engaged in suppression activities to deter group members from continuing to be involved in shootings, and investigation activities to incapacitate specific individuals who were known to be committing violence. Suppression activities included increased presence in the housing development by GVU and Western district officers and arrests of GVRS targets for observed criminal and disorderly behavior. Investigation activities, led by GVU, prosecutors from the State's Attorney Office, and federal law enforcement agencies, focused on the ongoing violent and criminal behavior of Poe Homes group members, eventually resulting in the indictment of 11 targeted individuals on a variety of violent, gun, and drug charges in March 2022. Suppression activities continued after these indictments to signal that investigative attention into the Poe Homes group continued. The BPD, State's Attorney's Office and other local, state and federal law enforcement partners conducted four more focused, group-based operations intended to modify and deter the violent behaviors of targeted groups and groups in their broader networks between January 2022 and July 2023.

It is important to emphasize that the implementation of GVRS in the Western district was constantly evolving and progress was non-linear. The parties involved are continuing to learn how to coordinate with each other. A monthly planning meeting was established at the outset and attended by Mayor Scott, BPD Commissioner Harrison, and then-State's Attorney Marilyn Mosby. When GVRS-related activities experienced downturns in 2022 and 2023, this structure was refined through the addition of new staff (a GVRS Deputy Director within MONSE), new coordination mechanisms (meetings of senior managers involved in implementation and of street outreach and service provision partners), and new ways to measure performance (a dash-

board of intervention activities and the integration of GVRS into the citywide PoliceStat management meetings). In January 2023, the GVRS expanded into the adjacent Southwestern district following a similar analysis of homicides and shootings and clear and consistent evidence of interconnected violence dynamics between groups in the Western and Southwestern districts. Due to a combination of factors, including staff and leadership turnover and capacity challenges, the GVRS has not expanded to additional districts as of July 2023.

Table 1 provides a summary of criminally active groups and group violence dynamics in the Western district, and activities associated with GVRS. Members of criminally active groups ($N = 672$ to 1,045) in the Western district account for a relatively small share of the overall district population ($\sim$2%), yet are associated with anywhere between 70–75% of homicides—as victims, suspects, and/or persons of interest.

Due to concerns about the spread of COVID-19, communication efforts skewed heavily toward individual-focused custom notifications rather than group-focused call-ins. In 2022, there were 113 custom notifications, with 62 in the first six months of 2023. It is worth highlighting the two types of custom notifications. "Full" custom notifications encompass participation from law enforcement, service providers, and community representatives, concluding with a hand-off to service providers for ongoing outreach and intensive case management support. In contrast, "law enforcement-only" custom notifications are for individuals who are under active investigation or facing imminent arrest. In 2022, there were a total of 35 law enforcement-only custom notifications, increasing to 44 in the first half of 2023. This surge is largely attributed to the custom notifications provided upon the arrest of individuals indicted in the March 2023 Baltimore and Bentalou group takedown.[10]

Arrests fall into three general categories: (1) arrests linked to proactive group investigations (i.e., takedown arrests), (2) arrests associated with targeted enforcement efforts directed at specific individuals or groups, and (3) arrests not associated with any targeted enforcement efforts but that nevertheless involve GVRS targets. In 2022, 23 group members were arrested in connection with group investigations, increasing to 50 in the first half of 2023. Targeted GVRS enforcement led to 34 group member arrests in 2022 and 10 in the first half of 2023. Meanwhile, general police enforcement resulted in 7 group member arrests in 2022 and 20 in the first half of 2023. This brings the total number GVRS targets arrested to 64 in 2022 and 80 in 2023, or 144 over the 18-month outcome period.

Finally, a total of 70 group members accepted services in 2022, with only 20 doing so in the first half of 2023. These services could include cognitive behavioral therapy, educational support for GED completion,

[10] A complete list of the five group takedowns can be found in Appendix Table A1.

transitional and permanent employment opportunities, housing assistance, counseling, assistance procuring documents (e.g., a driver's license), workshops, life coaching, and stipends for achieving program milestones outlined by service providers. Across the call-ins, arrests, custom notifications, and services, the total number of group members in the Western reached by GVRS during this period is 247, or between 24% and 37% of all group members identified.[11]

4 Data and methods

4.1 Data

To measure the impact of GVRS in Baltimore's Western district, we use records obtained from the BPD. These include incident-level data on reported crimes and arrests.[12] Due to potential under-reporting issues for some crimes in earlier years, we focus on the period starting in January 2015 and going through June 2023 for both reported crimes and arrests. We categorize reported crimes into distinct types, focusing on four that commonly involve the use or threat of firearms against a person: 1) homicides and non-fatal shootings, 2) assaults, 3) robberies, and 4) carjackings.[13]

The arrest data from BPD begin in January 2011 and go through June 2023. Each observation is an individual charge associated with an arrest, where the $N = 388{,}682$ arrests can have multiple charges. Our goal is to categorize arrests into one of several high-level types based on the charges they contain. To do this, we must first categorize each charge. The information available to do this are a standardized Criminal Justice Information System (CJIS) charge code and description, and a non-standardized pair of charge descriptions entered by BPD officers.[14] We base our categorization on a charge's CJIS code when available, and on the descriptions entered by BPD officers when the CJIS code is missing.[15] Each charge is categorized into one of the following mutually exclusive types: (a) Part 1 property crimes (burglary, larceny, theft, breaking and entering, auto theft, and arson), (b) Part 1 violent crimes (murder, robbery, kidnapping, rape,

[11] Appendix Figure A1 provides a timeline of each of the four primary activities constituting the focused deterrence intervention: custom notifications, call-ins, GVRS arrests and arrests that were part of a group takedown in the Western district. Over the entire 18-month period, staff delivered more than 150 custom notifications, the majority of which were delivered during months 4-12 of the intervention. Not including 75 arrests made during a gang takedown, there were 80 arrests made of GVRS targets—approximately 4 per month.

[12] Reported crime data are publicly available at Open Baltimore's website: https://data.baltimorecity.gov.

[13] Following convention, we count each homicide and non-fatal shooting victim separately, but for all other offenses count incidents themselves.

[14] For CJIS codes, see https://mdcourts.gov/district/chargedb.

[15] We exclude $N = 19{,}808$ arrests that lack CJIS codes or charge descriptions of any kind for all associated charges.

first-degree aggravated assault, and carjacking), (c) simple assault, (d) drug distribution, (e) drug possession, (f) disorderly conduct, (g) weapons offenses and (h) warrants for failure to appear. Once we have categorized charges, we use this information to categorize arrests into four types. First, we identify arrests containing either a Part 1 property (a), Part 1 violent (b), or simple assault charge (c). Then, among the remaining arrests, they can belong to one or more of the following types: 1) drug possession (without any corresponding charge for drug distribution), 2) disorderly conduct, 3) weapons possession, and 4) failure to appear.

After categorizing each reported crime and arrest, we aggregate this information into counts at a geographic level. Baltimore is divided into nine police districts, which are themselves divided into 126 "posts." To have greater flexibility in constructing counterfactuals to the Western district, we focus on an aggregation of reported crime and arrest counts to the post by quarter level. The reported crime data have complete geographic information, with each incident mapping to a post. In contrast, the arrest data have considerably more variability in the availability and quality of geographic information available. Approximately 18% of arrests cannot be geocoded to a post due to having a missing address, incorrect geocoordinates, or an address that resolves to a location outside of Baltimore City.[16] Where available, we prioritize geocoordinates in determining the post for an address.[17]

4.2 Empirical methods

We estimate the effects of GVRS in the Western district by constructing counterfactuals from areas of Baltimore that did not receive the intervention. Adopting the notation of Arkhangelsky et al. (2021), let Y_{idt} be an outcome—for example the rate of homicide and shooting victims per capita—observed in post i in district d in quarter t. A binary measure of whether GVRS was active in a district in a given month is denoted by $W_{dt} \in 0,1$. Consider estimating for the Western district d^* the average treatment effect τ_{d^*} of GVRS launched in $t = T^{d^*}_{post}$. Our panel dataset consists of N posts observed for T quarters, with the first $N^{d^*}_{tr}$ posts being those in the Western district d^* (treated) and the remaining $N_{co} = N - N^{d^*}_{tr}$ being those in districts that did not have GVRS during the 18-month post-intervention period (control), and where $W_{d^*,t} = 1$ for $t = T^{d^*}_{post},...,T$ and $W_{dt} = 0$ otherwise.

Given this setup, estimating τ_{d^*} requires us to make two choices: which estimation method to use,

[16] We exclude $N = 65{,}542$ arrests that lack geographic information. Among arrest records with both a valid address and geocoordinates, 44% of the time these two pieces of information resolve to different posts in different districts.

[17] The BCPD Data Driven Strategies Department (DDSD) informed us that geocoordinates should be based on the listed addresses when available, and neither piece of information will be present on warrant arrests.

and which pool of control or donor units to use. We first consider the choice of estimation method. As Arkhangelsky et al. (2021) show, two commonly used panel data estimation methods can be shown to solve similar regression problems. Basic two-way fixed effects difference-in-differences (DID) solves:

$$(\hat{\tau}^{did}_{d^*},\hat{\mu},\hat{\alpha},\hat{\beta}) = _{\tau,\mu,\alpha,\beta}\left\{\sum_{i=1}^{N}\sum_{t=1}^{T}(Y_{idt}-\mu-\alpha_i-\beta_t-W_{dt}\tau)^2\right\}.$$

Similarly, synthetic controls (SC) (**?**Abadie et al., 2010; **?**) solves:

$$(\hat{\tau}^{sc}_{d^*},\hat{\mu},\hat{\beta}) = _{\tau,\mu,\beta}\left\{\sum_{i=1}^{N}\sum_{t=1}^{T}(Y_{idt}-\mu-\beta_t-W_{dt}\tau)^2\hat{\omega}^{sc}_i\right\}.$$

This representation of both methods highlights their key differences. By including unit fixed effects, DID is robust to time-invariant, unit-level differences in Y between treated and donor units. The DID estimator, $\hat{\tau}^{did}_{d^*}$, is the difference in within-unit changes in Y between treated and donor units. The key assumption for $\hat{\tau}^{did}_{d^*}$ to be unbiased is that Y would have trended similarly in donor units as it would have in treated units in the absence of treatment ("parallel trends"). By contrast, SC does not include unit fixed effects. Instead, it seeks to overcome any unit-level differences and approximate parallel trends using donor unit weights, $\hat{\omega}^{sc}_i$, chosen to minimize differences in pre-treatment outcomes between the donor units and the treated unit, and subject to constraints against extrapolation.[18] Note that, while the Western district d^* contains multiple posts ($N^{d^*}_{tr}>1$), these are averaged together to form a single treated unit ($Y_{d^*,t}=\frac{1}{N^{d^*}_{tr}}\sum_{i=1}^{N^{d^*}_{tr}}Y_{idt}$) prior to the estimation of donor weights, as is typically the case in applications of the SC method.

Our setting poses potential challenges for both estimation methods, as the Western district has both the highest levels of violence in Baltimore and experienced some of the largest increases in violence in the period prior to the start of GVRS. We therefore also report results from a newer estimation method that combines features of both DID and SC: synthetic difference-in-differences, or SDID (Arkhangelsky

[18] The papers establishing the SC method emphasize that donor weights are chosen to minimize differences in pre-treatment covariates with the treated unit, where the covariates can include, but are not limited to, pre-treatment outcomes. In practice, as Klößner et al. (2018) note, many researchers include the entire pre-treatment outcome path among the covariates, which renders other covariates irrelevant for which weights are chosen. Lacking detailed covariates on our donor units, we adopt this approach as well.

et al., 2021).[19] The SDID method solves:

$$(\hat{\tau}_{d^*}^{sdid}, \hat{\mu}, \hat{\alpha}, \hat{\beta}) = _{\tau,\mu,\alpha,\beta} \left\{ \sum_{i=1}^{N} \sum_{t=1}^{T} (Y_{idt} - \mu - \alpha_i - \beta_t - W_{dt}\tau)^2 \hat{\omega}_i^{sdid} \hat{\lambda}_t^{sdid} \right\}.$$

Like DID, the SDID method allows for unit fixed effects. Like SC, the SDID method assigns donor weights that approximately match the pre-treatment trends of the treated unit.[20] However, unlike either DID or SC, the SDID method introduces time weights $\hat{\lambda}_t$, giving greater emphasis to the pre-treatment time periods that are most similar to the post-treatment time periods. The combination of donor and time weights are intended to make the estimator more robust to deviations from parallel trends than using either set of weights alone.

To avoid concerns that potential spillovers from the Western district into neighboring areas might bias our estimates, in our main specification we exclude from the donor pool all posts that are adjacent to the Western district. We also exclude all posts in the adjacent Central district due to pre-existing ties between groups there and in the Western district.

For all three estimation methods, we compute both heteroskedasticity-robust analytic standard errors from weighted least squares as well as clustered bootstrap standard errors from 500 iterations. Given the robust performance of bootstrap inference for SDID and related methods (Arkhangelsky et al., 2021), we use this as our main approach.

In Section 5.3, we report the robustness of our main results to the choice of estimation method, donor pool, and inference approach.

5 Results

5.1 Descriptive trends

We begin by providing information on crime and arrest trends in Baltimore and the Western district from 2017 to 2021, immediately prior to the implementation of GVRS. Table 2 reports the five-year total number of each type of crime and arrest for Baltimore in the left-hand column and the Western district in the right-hand column. Over the five-year study period, the city recorded just over 5,200 shooting and gun homicide victims, an annual rate of approximately 200 per 100,000 residents. More than 200,000 Part 1 crimes were reported to law enforcement during this period, an annual rate of approximately 7,500 per 100,000 residents.

[19] We implement the SDID, SC, and DID methods all using the `sdid` package in `Stata` (**?**).

[20] Because SDID allows for unit fixed effects, the SDID weights need only to approximately match pre-treatment trends, whereas the SC weights must also approximately match pre-treatment levels.

With respect to district-specific patterns, the Western district—home to approximately 6% of Baltimore's population—stands out as having the highest proportion of victims of gun homicides and shootings, accounting for 15.2% of all such cases. After the Western district, the Eastern district closely follows with 15.1%, followed by the Southwestern district at 14%. In contrast, when considering all other Part 1 crimes, the Western district accounted for a lower but still outsize share of crime, representing 7.8% (N=16,620) of cases in the city. Across crime types, shootings, assaults, carjackings and auto thefts are the crimes that are over-represented in the Western district relative to the remainder of the city.

In Figure 2, we present time series plots of key Part 1 violent crimes separately, expressed as rates per 100,000 population, for Baltimore and the Western district.[21] Across all four crime types, the Western district consistently experienced higher crime rates than the city as a whole. With respect to gun crimes, the city of Baltimore experienced 181 homicides and shootings per 100K population annually prior to 2022. Since 2022, that number has declined by 7% to 168.[22] The Western district has also experienced a decline in homicides and shootings, though the decline is considerably larger. Prior to 2022, the Western district was averaging 529 homicides and shootings per 100K population. Since 2022, the number of homicides and shootings has dropped by 35% to 353 per 100K population.

Next we turn to assaults, which have consistently been nearly twice as common, on a per capita basis, in the Western district as compared to the city of Baltimore as a whole. Trends have been largely parallel and in both the Western district and Baltimore, and higher in the post-2022 period than in the pre-period. However, the increase in assaults in the Western district (+2%) is lower than in the city as a whole (+9%). The Western district and Baltimore as a whole have also been on roughly similar trajectories with respect to robberies. However, while robberies have risen slightly in Baltimore since the city's local minimum in 2021, in the Western district, robberies in 2022-23 have declined by 11% relative to 2020-21. Finally, we turn to carjackings, a crime that tends to inspire an outsize degree of fear among community residents (Jacobs, 2013; Jacobs and Cherbonneau, 2023). Carjacking trends in the Western district do not mirror those of Baltimore as a whole. However, it is potentially notable that carjackings, which were consistently between 50 and 100% higher on a per capita basis in the Western district than the citywide average, briefly fell *below* the city's average in 2022.

In Figure 3, we consider trends with respect to police enforcement. The figure plots the number of arrests per capita for Baltimore as a whole and the Western district separately for four different arrest categories:

[21] Because data for 2023 run through June, the counts here are doubled to facilitate comparisons with the full years prior.
[22] Baltimore is one of a handful of U.S. cities that did not experience an increase in gun violence in 2020.

1) Part 1 crimes with the addition of simple assaults, 2) drug possession, 3) disorderly conduct and 4) warrants for failure to appear in court. Several items are worth noting. First, with respect to arrests for Part 1 crimes, there has been a 40% reduction in arrests throughout the city from 2015 until the present day. However, there is no evidence of an abrupt change in enforcement that is specific to the Western district. Second, there has been a large and important change with respect to how the police department enforces laws that criminalize drug possession. In accordance with several citywide shifts in policy, drug possession arrests have fallen by 96% from 712 per 100K in 2015 to 31 per 100K in the first half of 2023. The Western district has experienced an even larger decline in drug possession arrests given that drug arrests were considerably higher there than in the rest of the city in 2015. Finally, a similar pattern emerges with respect to arrests for disorderly conduct, another type of arrest that is highly subject to police discretion (Goldstein, 1963). These have also fallen citywide by 92% since 2015 and by 96% in the Western district. With respect to both drug possession and disorderly conduct arrests though, we note that these declines in enforcement occurred between 2015 and 2019 and pre-date the focused deterrence intervention by several years.

Taken as a whole, the descriptive trends point to a decline in crime after 2022 in the Western district relative to the rest of the city, without a clear change in arrests occurring at the same time. The descriptive trends suggest that the implementation of focused deterrence could have led to important reductions in crime without a corresponding increase in arrests. We explore these trends more formally in the next section of the paper.

5.2 Main results

In this section, we turn to our estimates of the impact of GVRS on our four key types of Part 1 violent crimes: homicides and shootings, assaults, robberies, and carjackings. In the left-hand panel of Figure 4, for each of the crime types, we plot the quarterly number of crimes per 100,000 residents in the Western district alongside the number of crimes per 100,000 population in the Western district's counterfactual constructed using the synthetic controls method. On the right-hand side, we provide two additional counterfactuals: those from the difference-in-differences method (which plots the per capita crime rate in the remainder of Baltimore) and from the synthetic difference-in-differences method (which uses both cross-sectional and temporal weights to identify a counterfactual for the Western district). Time weights for the synthetic difference-in-differences method are also presented in the figure. Below each panel, we report estimates of the average treatment effect on the treated (ATT) in levels and as percent changes,

alongside indicators of statistical significance based on 500 bootstrap iterations.

With respect to homicides and shootings, the Western district is well-matched with its synthetic comparison in the period prior to the intervention, with the two series diverging early in 2022 after the launch of GVRS. The magnitude of the estimated treatment effect varies according to the estimation method but all three point to a statistically significant reduction in homicides and shootings in the Western district relative to a matched comparison of other areas in Baltimore city. The magnitudes of the estimates are large—the synthetic controls estimate, the smallest of the three, is a 21% reduction in homicides and shootings. The synthetic difference-in-differences estimate is that homicides and shootings were 31% lower in the Western district than they would have been in the absence of the focused deterrence intervention. Importantly,it appears as though the treatment effects were initially larger before attenuating in the final two quarters of the intervention. We will explore this finding in further detail in Section 5.4.

Turning to assaults and robberies, we see far less evidence for crime reductions in the Western district after 2022. However, for carjacking, a crime with a stronger theoretical and ethnographic nexus to gang activity (Jacobs and Cherbonneau, 2023), we do observe meaningful reductions in crime in the Western district—an 18% reduction in carjackings using the synthetic controls method, a 39% reduction in carjackings using synthetic difference-in-differences and a 47% reduction using standard difference-in-differences. The larger two estimates are statistically significant at conventional levels.

Next, we consider the possibility that the intervention spatially displaced crime to other areas in Baltimore. While there is now a great deal of evidence—including from randomized experiments of hot spots policing interventions—that offenders tend to be strongly tied to place and do not shift seamlessly to other locations (Weisburd et al., 2006), a small number of papers have found evidence of crime spillovers in response to a shift in law enforcement presence (Blattman et al., 2021). We therefore consider whether the reductions in crime observed in the Western district came at the expense of other areas of Baltimore. Figure 5 plots the annual number of homicides and shootings, assaults, robberies and carjackings that occurred in different areas of Baltimore. The figure considers a number of different heuristics for where spatial crime spillovers might go, including to posts that border the Western district, posts within the neighboring Central district that have known social ties to the Western district, other areas of the Central district and the remainder of Baltimore. Several findings are worth noting. First, crime was largely constant during this time period in Baltimore. Relative to 2021, homicides and shootings and robberies

were slightly lower and assaults were slightly higher. Carjackings rose substantially, consistent with a nationwide trend in recent years (Robertson, 2022). Second, with the possible exception of carjackings, we see little evidence that crime increased in neighboring posts or posts in the nearby Central district. To more formally test for spillovers, we also re-estimate each of our models varying whether we include neighboring posts (Section 5.3) and find the results to remain substantively unchanged.

Finally, we consider whether the findings reported earlier in this section are an artifact of broader changes in policing in Baltimore. Figure 6 is the analog to Figure 4 and estimates changes in various type of arrests in the Western district relative to similar places in Baltimore. We report estimates for arrests for Part 1 crimes and simple assaults, as well as arrests for drug possession, disorderly conduct, and failure to appear warrants, each of which is a marker for proactive policing and the willingness of police officers to make discretionary arrests. Taken as a whole, there is little evidence for a meaningful change in policing in the Western district relative to other similar areas of Baltimore, albeit with a nuance that is worth discussing. In line with results presented in Figure 3, between 2015 and 2019 there were large declines in arrests for drug possession and disorderly conduct across the entire city. The declines were especially large in the Western district given that it is the district with the highest crime rate. This means that the classic difference-in-differences estimates which do not give greater weight to time periods for which there is a better match are potentially confounded by the presence of pre-trends. This explains why the difference-in-differences estimates for drug possession, disorderly conduct and failure to appear warrant arrests are all negative and statistically significant, while the synthetic difference-in-differences estimates—which place greater weight on the time periods closest to the intervention—yield smaller and statistically insignificant estimates. The synthetic difference-in-differences estimates are far more robust to the pre-intervention trends in these variables than the classic difference-in-differences estimates.

5.3 Robustness and additional analyses

We test the robustness of our findings to a number of modeling decisions. First, in Figure 7 and Figure 8, we provide a comparative accounting of estimated treatment effects and standard errors for each of our three main estimation methods: difference-in-differences, synthetic difference-in-differences, and synthetic controls. For each estimation method, we compare inferences made using heteroskedasticity-robust analytic and bootstrap standard errors. We also present estimates in which we include all posts in Baltimore in the donor pool as well as models in which neighboring posts and posts in the Central district were excluded

from the donor pool, an analysis which implicitly accounts for potential spatial spillovers to adjacent areas.

With respect to homicides and carjackings (Figure 7), the two violent crimes which were most responsive to GVRS in our primary models, the estimates are, in general, robust to the choice of estimation method, inference procedure and restrictions on the donor pool. While the statistical significance of the estimates from the synthetic controls models is lower and estimates are not significant at $\alpha = 0.05$, estimates are nevertheless similar and statistically indistinguishable from the SDID and DID methods. With respect to measures of police enforcement Figure 8, we continue to see little evidence that discretionary arrests are sensitive to the intervention.

In Appendix Figure A2 and Appendix Figure A3 we plot synthetic difference-in-differences estimates that separately estimate treatment effects for each of the six post-intervention quarters, with standard errors estimated via the bootstrap. While the estimates are noisier when the post-period is sub-divided into quarters, it appears as though the beneficial impacts of the intervention are greatest during the first year of the outcome period.

5.4 Mechanisms

This section of the paper will explore the mechanisms through which the GVRS had an effect on violence. First, leveraging the availability of extraordinarily granular—and typically unavailable—programmatic data, we will be able to characterize periods of higher- and lower-fidelity implementation. We will thus be able to observe if the crime reductions observed during the 18-month followup period appear to be related in time to the delivery of individual programmatic elements such as police enforcement activity, custom notifications or the provision of social services. We expect this test to provide critical insight into the black box of the focused deterrence strategy. A secondary benefit of this analysis is that it provides an additional means of assessing whether the reduction in violence that we observe is due to the focused deterrence intervention as opposed to some other cause.

Second, we we will use individual-level information on Baltimore arrestees, including those who are GVRS targets, to study whether individual behavioral changes result from contacts with law enforcement or social services providers that are key elements of the GVRS intervention. Data we have access to include the date upon which an individual received a custom notification, received services or was arrested. We will thus have the ability to observe whether individuals become less likely to be arrested after such contacts.

Finally, understanding that the more focused policing strategy in the Western district has a deterrence as

well as an incapacitation pathway through which it can reduce crime, we will test whether there is a reduction in crimes committed by individuals who were *not* arrested but who were otherwise targets of the intervention, as well as other individuals living in the Western district. This analysis will allow us to unpack the relative contributions of deterrence and incapacitation to the observed treatment effects, a critically important policy estimand when thinking about the costs and benefits of the intervention. Relatedly, we will study the aftermath of six large-scale "gang takedowns" that occurred in the Western district and which targeted individuals identified by the intervention, a secondary analysis that will allow us to unpack the relative importance of deterrence versus incapacitation effects. We anticipate that this will be the first such analysis in the literature.

6 Discussion

Investments in police tend to be effective at reducing violence but entail high financial costs and have the consequence of widening the net of the justice system by exposing larger numbers of people to the destructive effects of arrests and prosecution (Chalfin et al., 2022). The fact that a small number of offenders drive an outsize share of the gun violence problem motivates the possibility that a more precise style of policing that focuses attention on the so-called "power few" might be able to capture many of the benefits of policing while minimizing the burdens (MacDonald, 2023). We evaluate the 2022 rollout of more focused policing in Baltimore's Western police district, one of the most persistently violent police districts in the United States. Motivated by the core economic principle of deterrence, the initiative was delivered by a collaborative of law enforcement, community-based, and social service organizations and uses a mixture of "carrots and sticks" to change the behaviors of high-risk people involved in gangs, drug selling organizations, robbery crews, and other criminally active groups.

In the 18 months since the focused policing strategy was implemented in the western district, homicides and shootings have declined by approximately one third compared to other areas of Baltimore that were, prior to the intervention, equally challenged by endemic violence. We observe little evidence that violence spilled over to other Baltimore communities outside the city's Western district. Importantly, while the focused policing initiative led to arrests among the individuals identified as priority targets, the large reduction in gun violence was not accompanied by a general increase in arrests in the western district. The evidence thus suggests that by focusing their attention to a greater degree on the principal drivers of violence, police can have a meaningful effect on homicides and shootings without ramping up enforcement for the community writ large. These effects mirror findings from research on large-scale "gang takedowns" (Chalfin

et al., 2021; Domínguez, 2021) but, importantly, while gang takedowns deliver only the stick, a strength of focused deterrence is that the approach strives to reduce harm by warning others of the consequences to come, encouraging the use of services and includes community members as key actors to prevent future violence.

Beyond the cost of police personnel who were repurposed from other duties, the marginal cost of the intervention was approximately $10 million, equal to 0.2% of Baltimore's 2021 city budget or approximately $18 per Baltimore resident. Our estimates suggest that the intervention led to 74 abated homicides and shootings in the Western district during the 18-month period from January 2022 until June 2023. Valuing a shooting using an expected cost of $2.1 million – an estimate derived from a contingent valuation conducted by Ludwig and Cook (2001) and adjusted for inflation – means that the benefits of abated gun violence alone are approximately 15 times higher than the program's financial costs. These are benefits that accrued disproportionately to some of Baltimore's most disadvantaged and socially isolated communities.

Focused deterrence strategies are notoriously difficult to implement and, once launched, challenging to sustain (Braga and Kennedy, 2021). As noted earlier, Baltimore twice previously discontinued focused deterrence programs that were generating some promising preliminary impacts on serious violence. Strong leadership by the Mayor and Police Commissioner distinguished this effort from prior experiences with the strategy. Importantly, City Hall and the BPD implemented a management structure that ensured the varied enforcement, communications, community mobilization, and outreach and service provision components of the strategy were implemented with integrity to the focused deterrence framework. This structure was supported by the development of key performance indicators to track activities and outcomes over time. The robust violence reduction impacts in the Western District and subsequent expansion of the approach into the Southwestern District provide ample evidence that the GVRS should be scaled up to a citywide effort.

Expansion plans have been developed but mustering the needed resources to do so has been challenging. For instance, like many U.S. police departments after the events of 2020, the BPD suffers from a severe shortage of sworn personnel that grows worse with each passing year. As of August 2023, the BPD had 2,062 sworn officers – over 500 short of its authorized strength of 2,605 sworn positions. It is difficult to staff innovative crime reduction programs when there aren not enough officers to provide basic services such as answering calls for service, investigating crime incidents, managing traffic, and responding to emergencies. Whether Baltimore can expand focused deterrence from two districts to an additional seven districts remains an open question. Nevertheless, the large violence reduction impacts and apparent cost effectiveness

of the approach warrants rethinking the deployment of police resources in other areas of the city supported by further assistance from state and federal funding sources to address existing resource shortfalls.

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Figure 1: Homicides per 100K across police districts in major U.S. cities



Note: Figure shows annual homicide rates per capita for all 323 police districts in a set of 27 major U.S. cities, ranked from lowest to highest homicide rate. Homicide rates calculated based on the median number of annual homicides in each district over a 3 to 5 year period ranging from 2017 to 2022, depending on the publicly available data for each city. The Western district in Baltimore ranks 5 out of 323, with only two districts in St. Louis, one in Louisville, and one in New Orleans having a higher homicide rate. The Southwestern and Eastern districts in Baltimore rank 7 and 10, respectively. The set of cities includes: Atlanta, Baltimore, Boston, Charleston, Charlotte, Chicago, Cleveland, Dallas, Detroit, Houston, Indianapolis, Kansas City (Missouri), Los Angeles, Louisville, Memphis, Miami-Dade County, Milwaukee, Minneapolis, Nashville, New Orleans, New York City, Philadelphia, Phoenix, San Francisco, Seattle, St. Louis, and Washington, D.C.

Figure 2: Reported crimes per 100K in Baltimore vs Western district

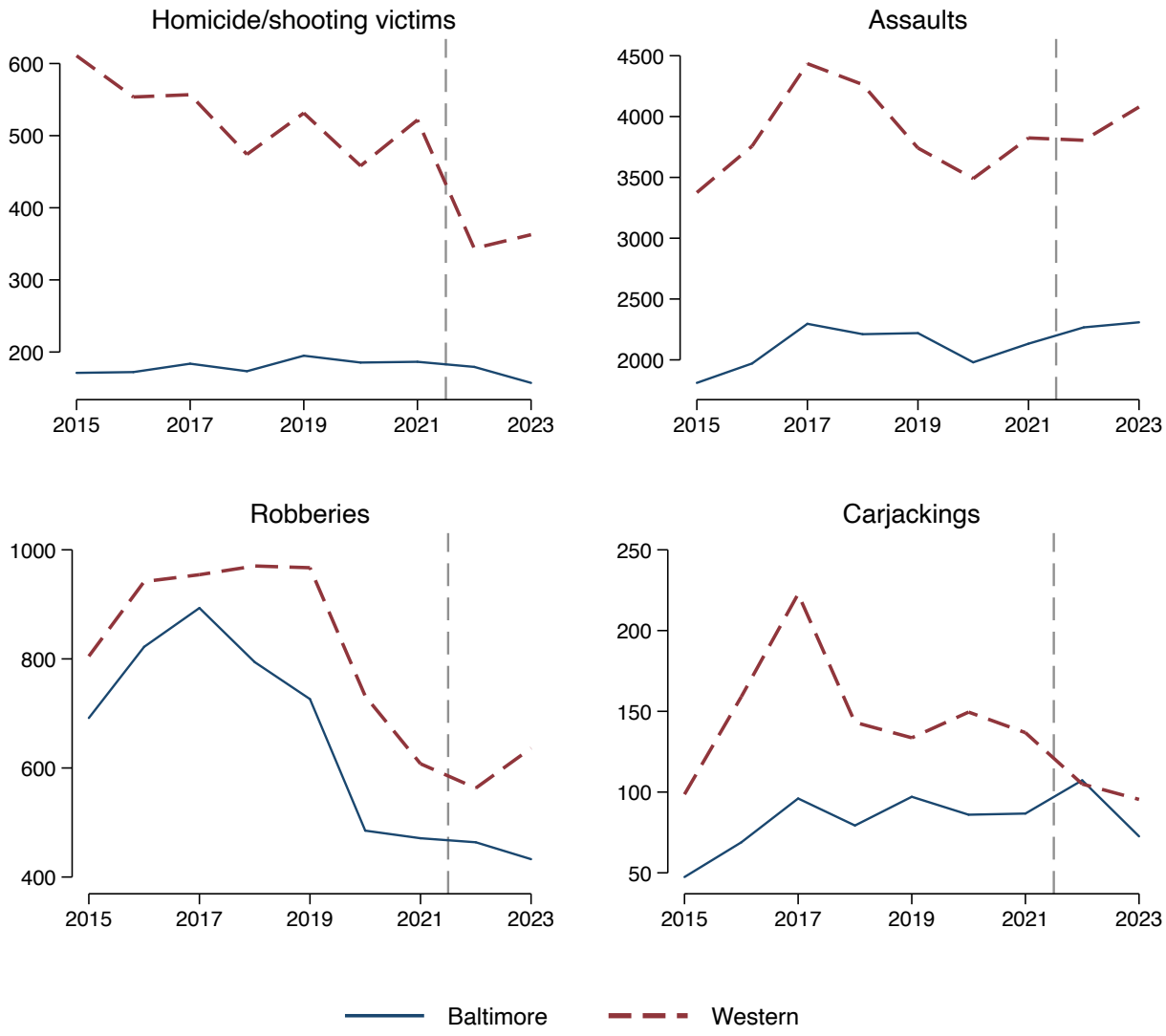


Figure 3: Arrests per 100K in Baltimore vs Western district

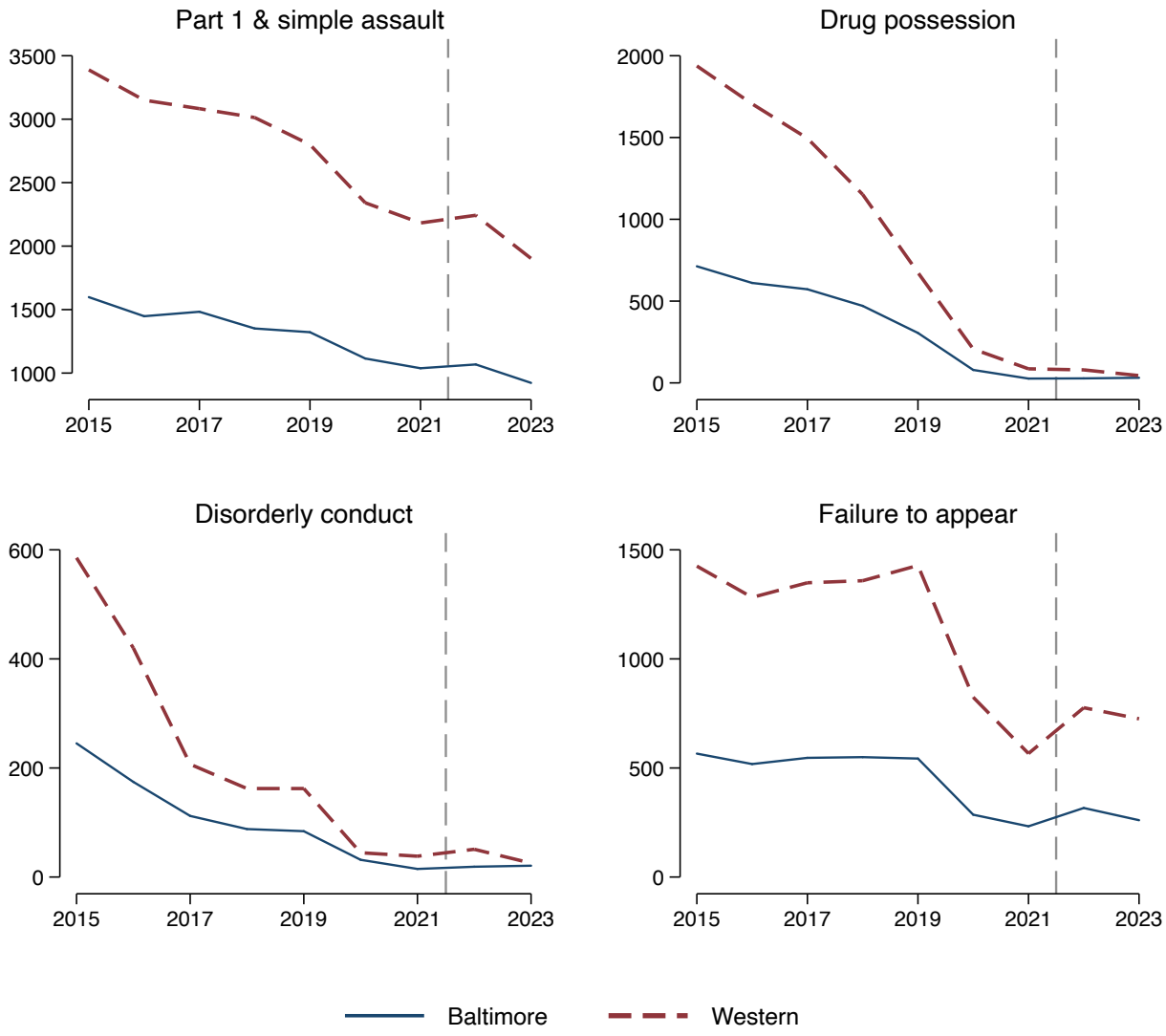
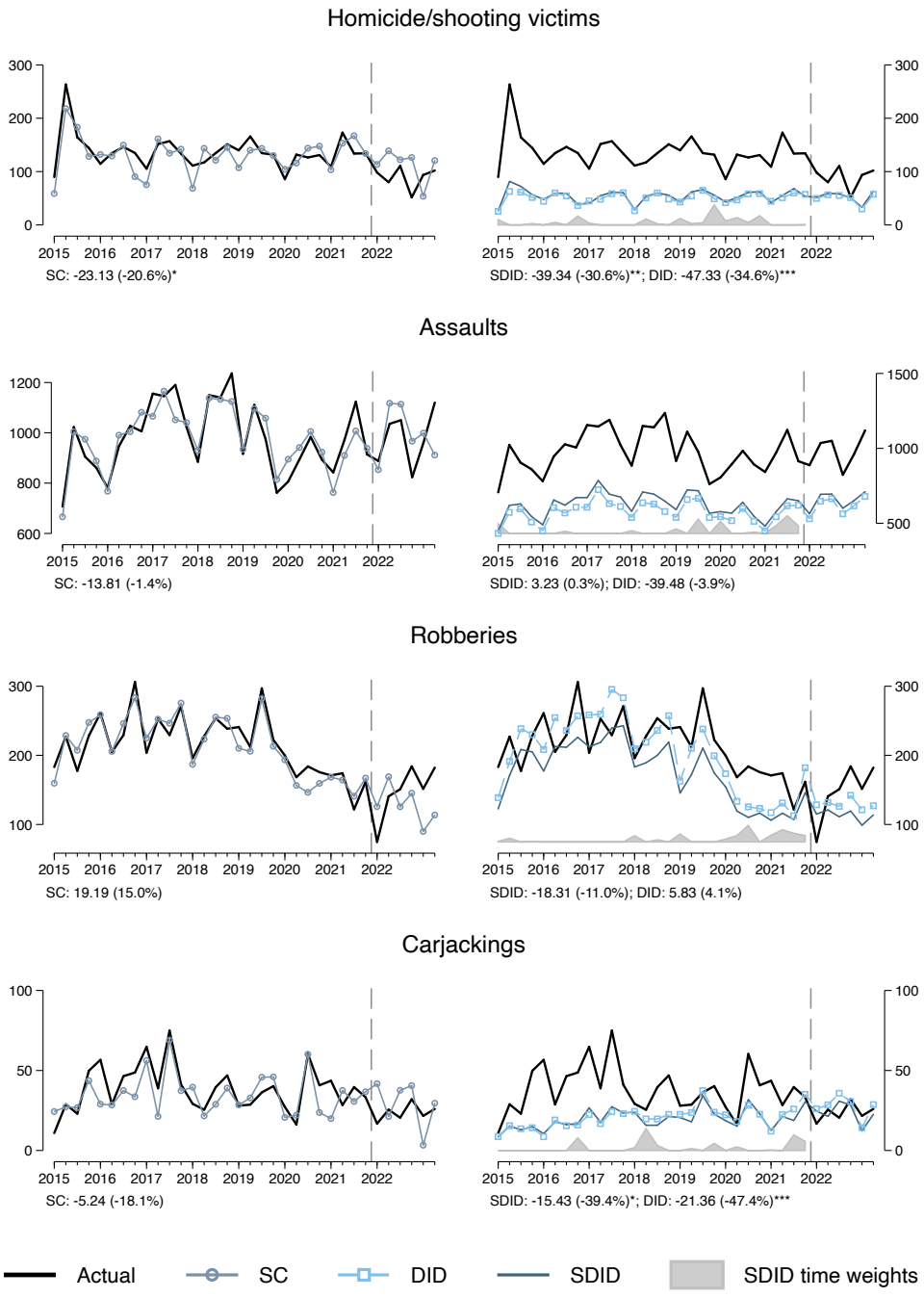


Figure 4: Reported crimes per 100K in Western district vs. counterfactuals



Note: Each panel reports the per capita rates of the indicated reported crimes in an average post in the Western district (thick black line) and various counterfactuals. The figures on the left show counterfactuals from synthetic controls (SC). The figures on the right show counterfactuals from difference-in-differences (DID) and synthetic difference-in-differences (SDID). Estimates of the average treatment on the treated (ATT) are reported below each figure from the relevant estimator, with a standard error from 500 bootstrap iterations in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$

Figure 5: Spatial displacement of crime from the Western district to other areas of Baltimore

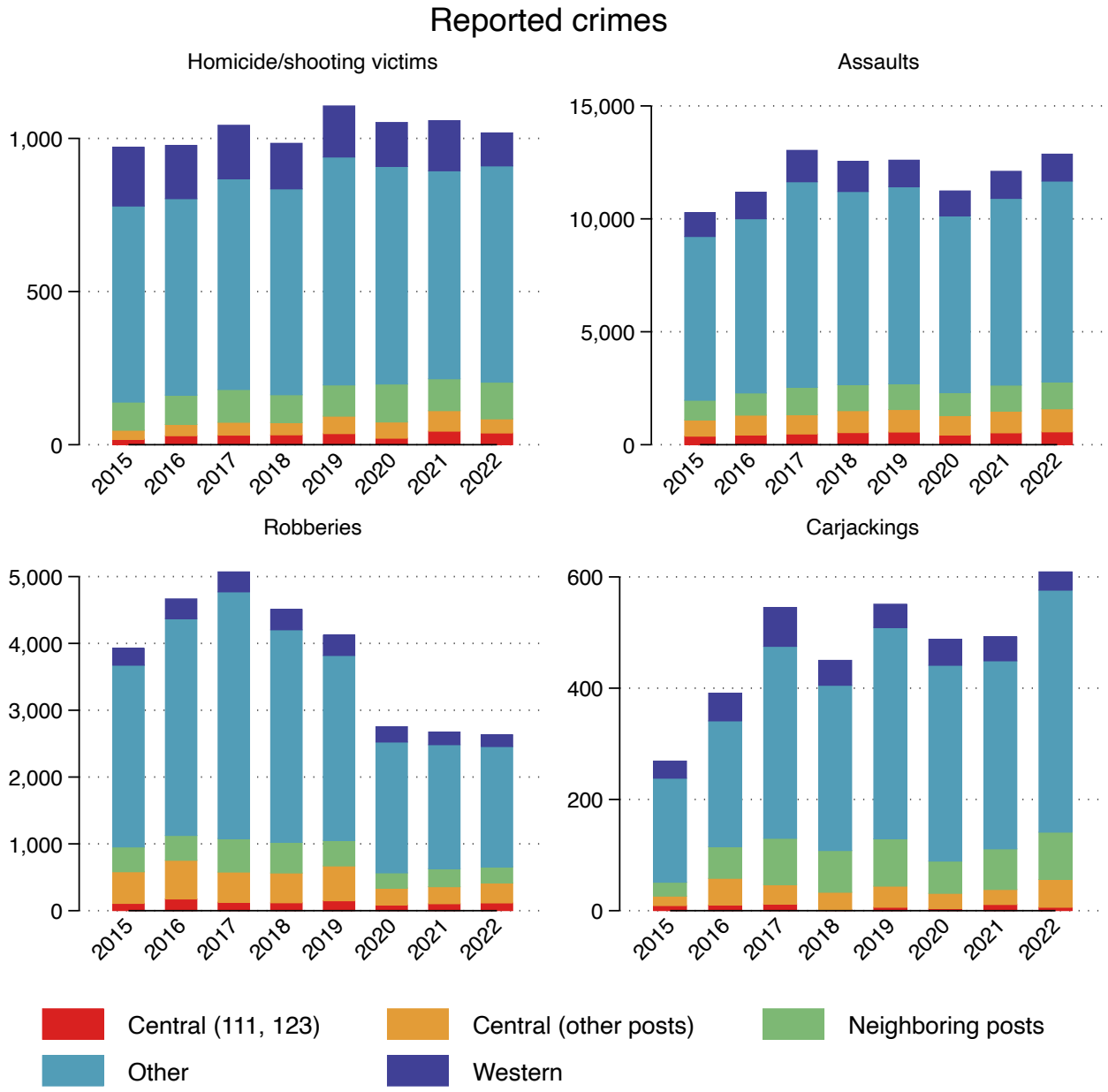
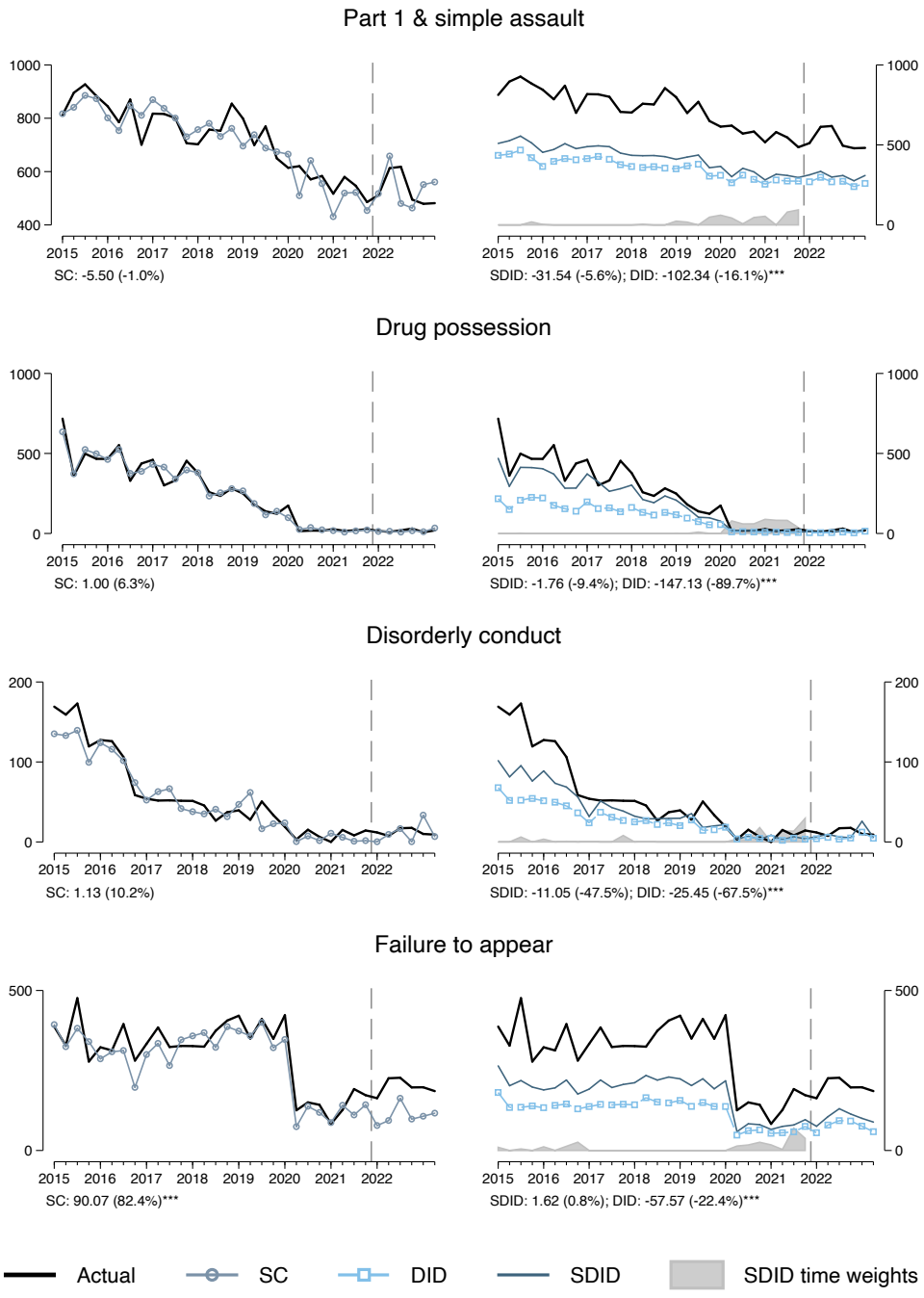
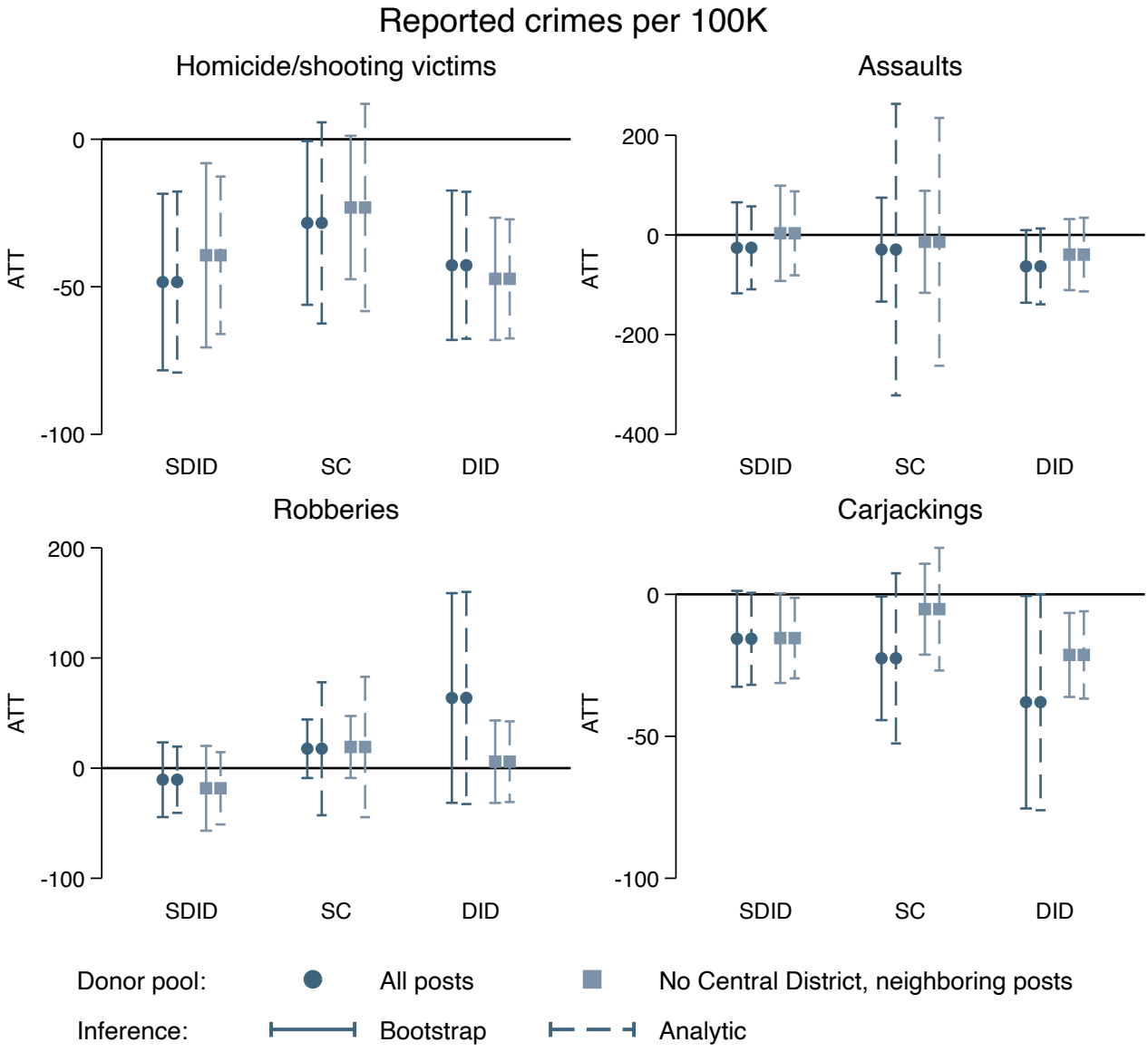


Figure 6: Arrests per 100K in Western district vs. counterfactuals



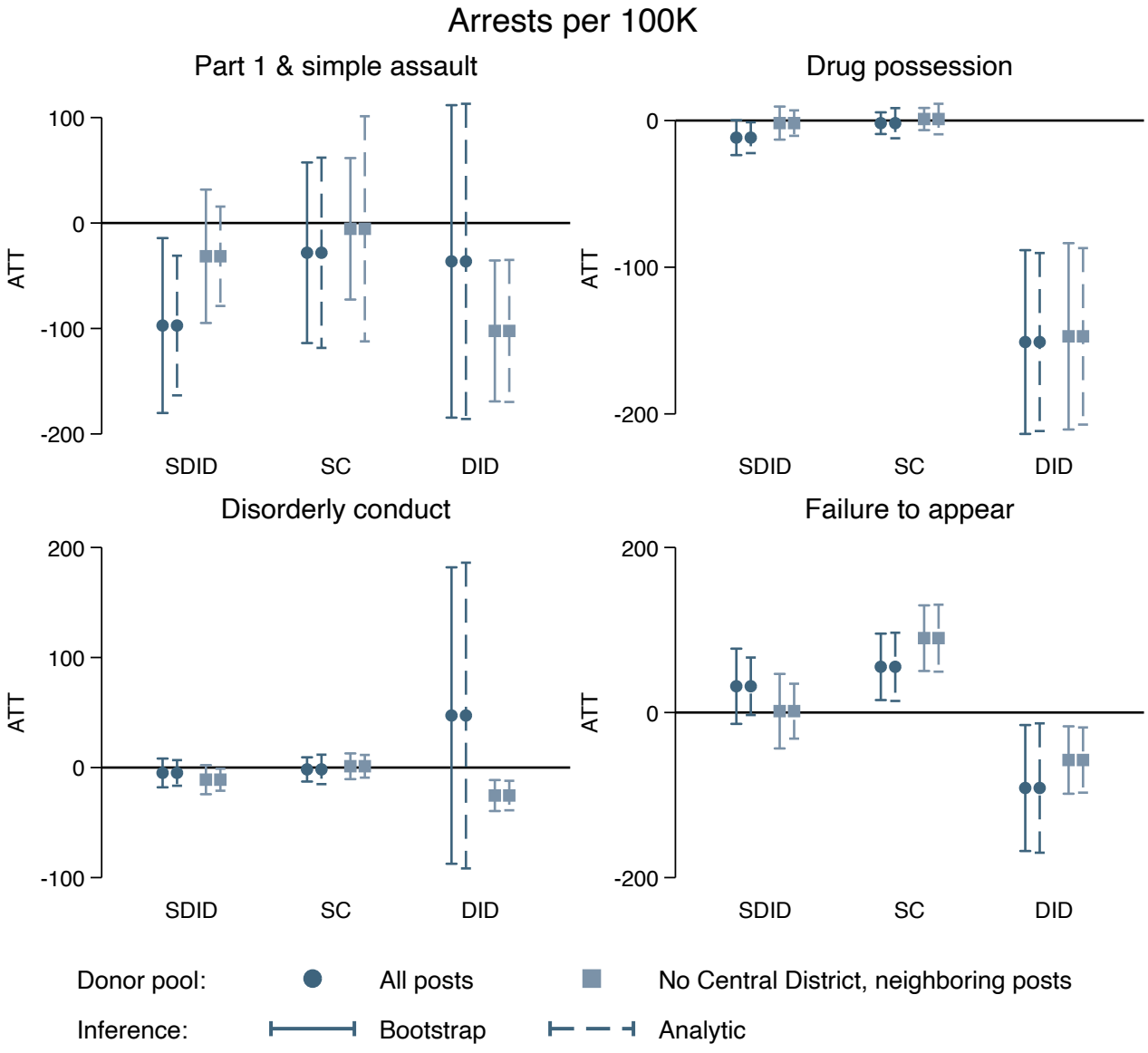
Note: Each panel reports the per capita rates of the indicated arrests in an average post in the Western district (thick black line) and various counterfactuals. The figures on the left show counterfactuals from synthetic controls (SC). The figures on the right show counterfactuals from difference-in-differences (DID) and synthetic difference-in-differences (SDID). Estimates of the average treatment on the treated (ATT) are reported below each figure from the relevant estimator, with a standard error from 500 bootstrap iterations in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$

Figure 7: Robustness of estimates and inference, reported crime



Unit of analysis is the post-quarter. Bootstrap = 500 iterations.
SDID = Synthetic difference-in-differences. SC = synthetic controls. DID = difference-in-differences.

Figure 8: Robustness of estimates and inference, arrests



Unit of analysis is the post-quarter. Bootstrap = 500 iterations.
SDID = Synthetic difference-in-differences. SC = synthetic controls. DID = difference-in-differences.

Table 1: GVRS activities, 2022-2023

Category	**Jan. - Dec. 2022**	**Jan. - Jun. 2023**
Group audits	2	1
Groups identified	55	55
Group members identified	672-1,045	672-1,045
Communication activity		
Call-ins	1	0
Group members attending call-ins	8	0
Custom notifications (total)	113	62
Full	78	18
Law enforcement only	35	44
Enforcement activity		
Group takedowns	2	3
Group members arrested (total)	64	80
Group members arrested, GVRS investigations (takedowns)	23	50
Group members arrested, GVRS enforcement	34	10
Group members arrested, non-GVRS enforcement	7	20
Service provision activity		
Group members receiving services	70	20

Notes: Table summarizes identification of group members in the Western district and GVRS-related activities. Full custom notifications involve representatives from law enforcement, social service organizations, and community members. Arrests from GVRS enforcement refer to those that occur as the result of suppression activities such as heightened police presence in areas with high concentrations of GVRS targets. Arrests from non-GVRS enforcement refer to arrests unrelated to GVRS-related efforts.

Table 2: Crime and arrest trends in Baltimore City and the Western district, 2017-2021

Offense Categories	Baltimore City	Western District
Crimes	N (%)	N (%)
Gun homicide & shootings (total victims)	5,243 (100.0%)	799 (15.2%)
Total incidents	212,777 (100.0%)	16,620 (7.8%)
Robbery	21,002 (9.9%)	1,416 (8.5%)
Assault	68,730 (32.3%)	6,886 (41.4%)
Carjacking	2,659 (1.3%)	259 (1.6%)
Auto theft	18,495 (8.7%)	1,631 (9.8%)
Rape	1,642 (0.8%)	145 (0.9%)
Arson	739 (0.4%)	59 (0.35%)
Larceny	72,329 (33.9%)	4,181 (25.2%)
Burglary	27,181 (12.8%)	2,043 (12.3%)
Arrests	79,748 (100%)	10,041 (12.6%)
Part 1 violent, non-violent, and simple assault	35,806 (44.9%)	4,218 (42.0%)
CDS possession	6,816 (8.6%)	946 (9.4%)
Disorderly	1,788 (2.2%)	184 (1.8%)
Weapons	5,661 (7.1%)	674 (6.7%)
Failure to Appear	12,244 (15.4%)	1,737 (17.3%)
Identity theft	113 (0.1%)	19 (0.2%)
Other	17,320 (21.7%)	2,263 (22.5%)

Appendix

Figure A1: GVRS activities over time

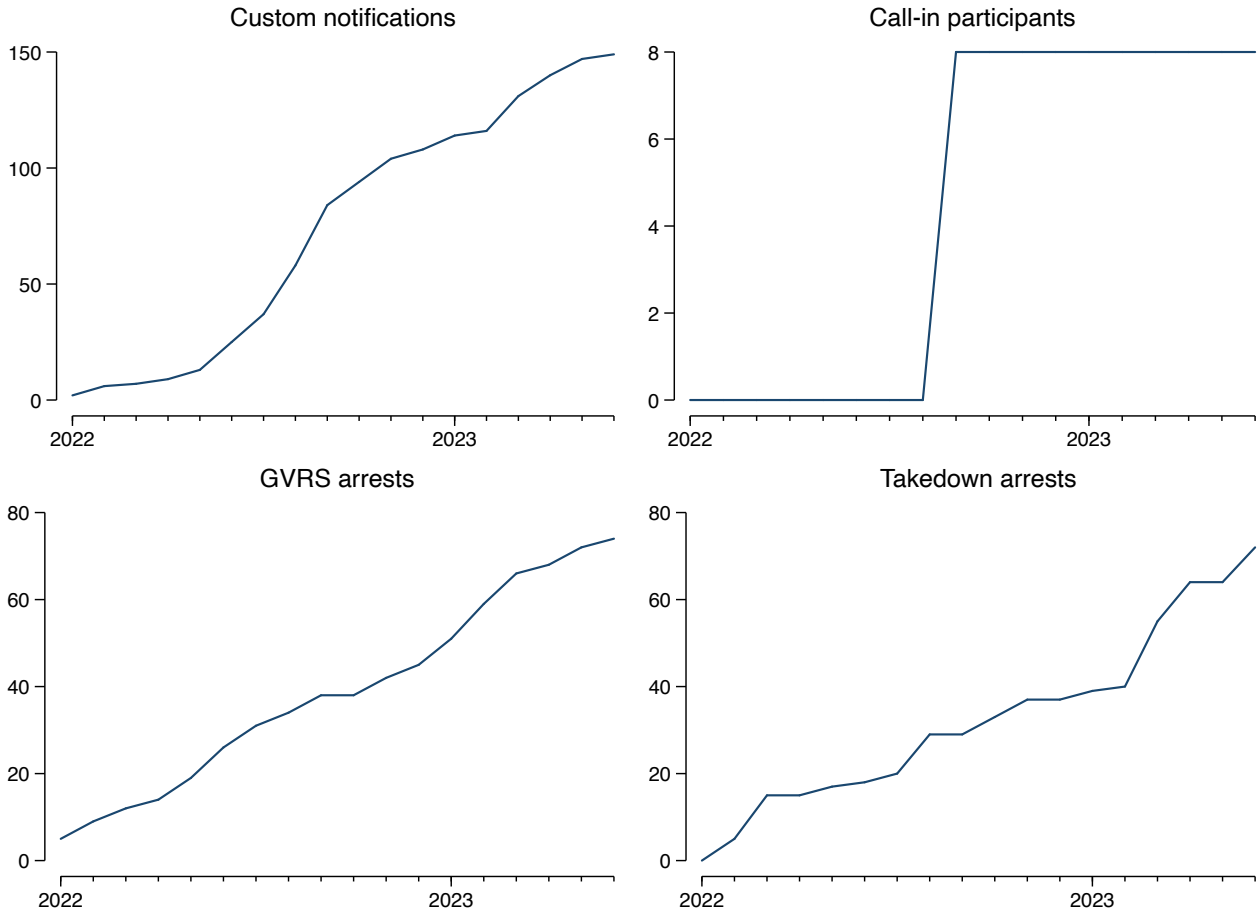
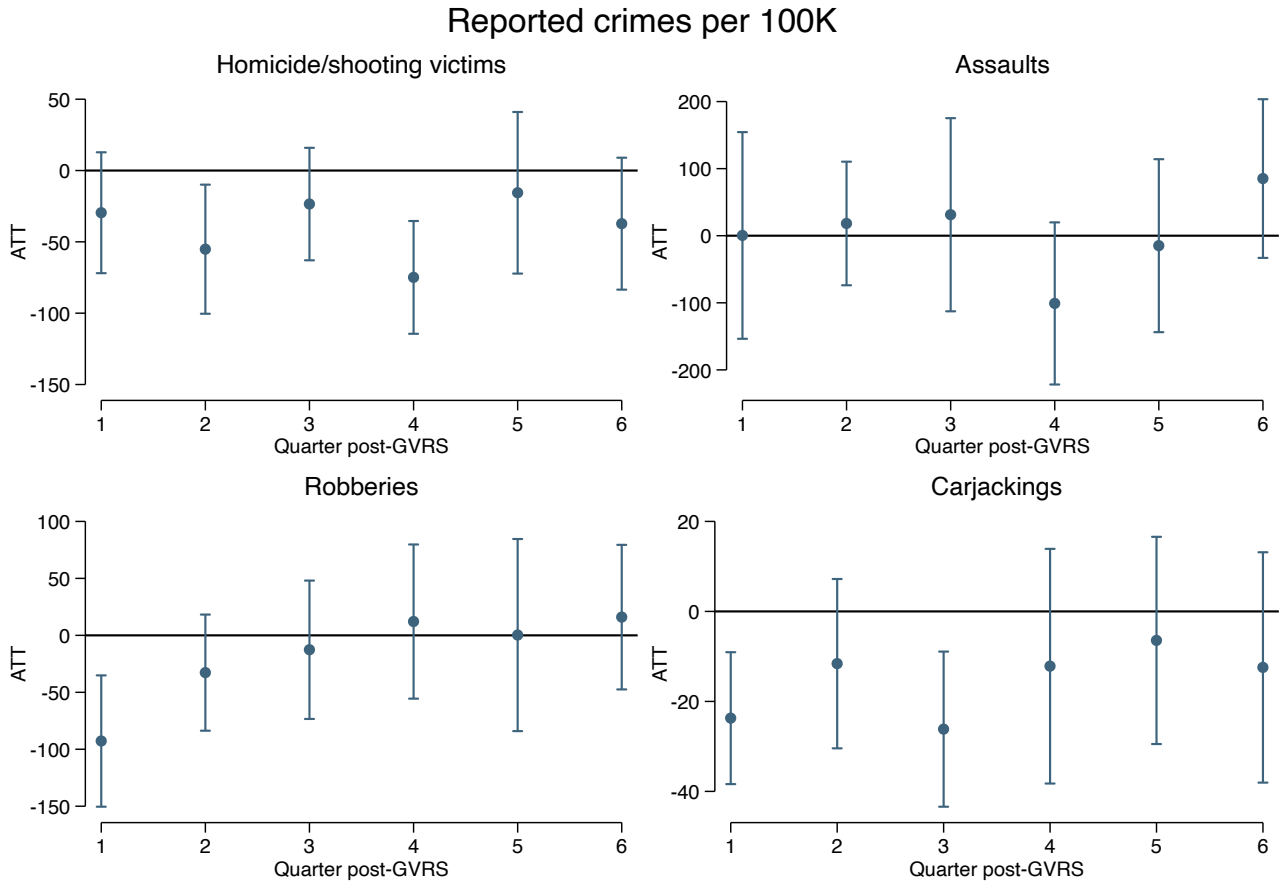
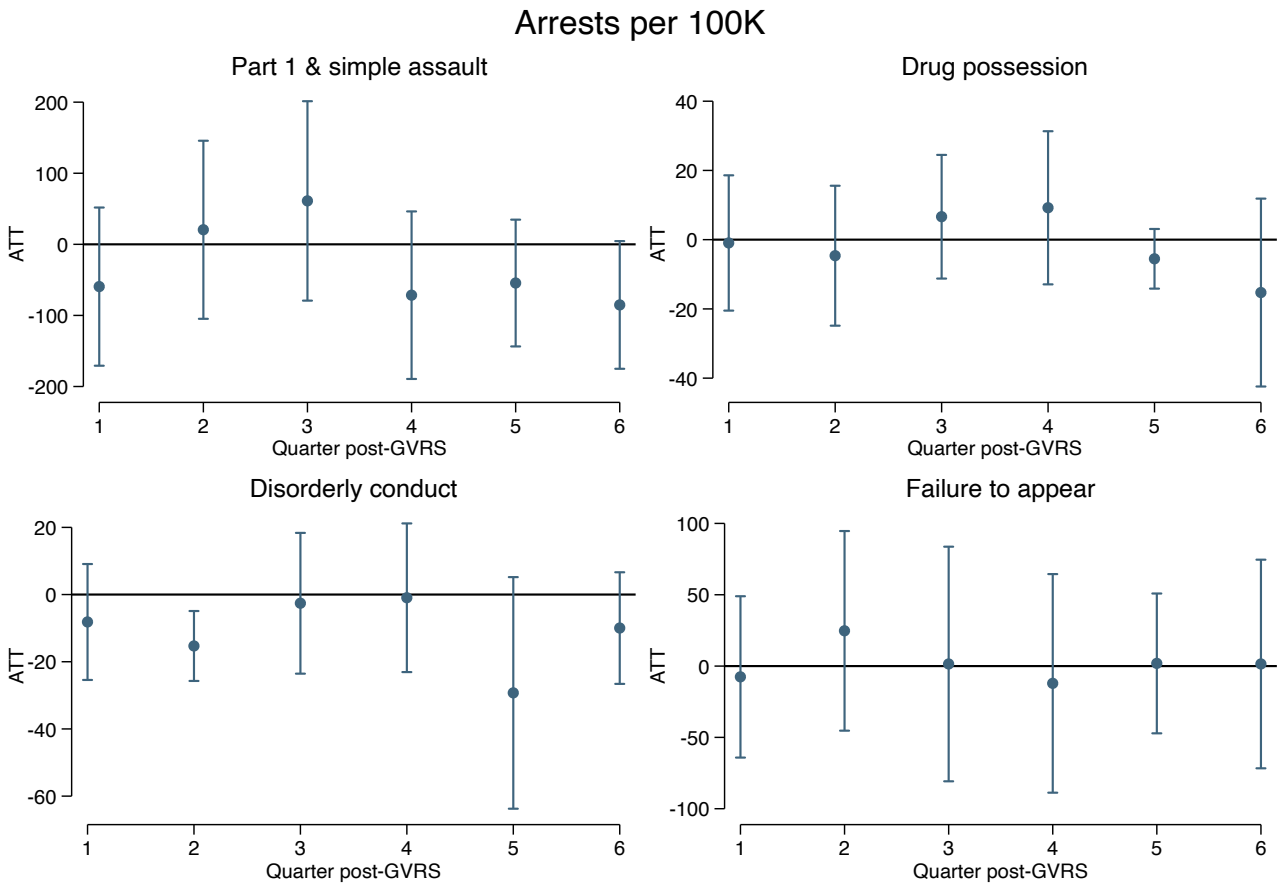


Figure A2: Event study estimates, reported crime



Unit of analysis is the post-quarter. 95% confidence intervals from 500 bootstrap iterations.

Figure A3: Event study estimates, arrests



Unit of analysis is the post-quarter. 95% confidence intervals from 500 bootstrap iterations.

Table A1: List of group/gang takedowns

Takedown	District	First arrest	Last arrest	Press Conference	Indictments
Poe	WD	March 2022	March 2022	N/A	11
Princess Plaza	WD	August 2022	August 2022	August 2022	12
Wick Squad	WD	October 2022	January 2023	January 2023	9
Baltimore + Bentalou	WD	March 2023	June 2023	March 2023	33
Carey Boyz	WD	June 2023	June 2023	June 2023	8