



An Evaluation of the Baltimore Police Department's Crime Gun Intelligence Center

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March 8, 2024



This report was supported by Grant No. 2019-DG-BX-0008 awarded by the Bureau of Justice Assistance (BJA) to the Baltimore Police Department (BPD). BJA is a component of the U.S. Department of Justice, Office of Justice Programs. Points of view or opinions contained herein do not necessarily represent the official position or policies of the U.S. Department of Justice, the Bureau of Alcohol, Tobacco, Firearms, and Explosives, or the BPD.

We thank the Baltimore Police Department, Baltimore Field Division of the Bureau of Alcohol, Tobacco, Firearms, and Explosives, and other law enforcement partners for their willingness to provide data and information regarding CGIC. Their cooperation was invaluable and without it we would not be able to complete this report.



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Background

Introduction

Gun violence remains a challenging problem for law enforcement agencies across the country. According to the Centers for Disease Control (CDC, 2023), there were 20,958 firearm homicide deaths across the United States in 2021 resulting in a rate of 6.3 per 100,000 residents. This rate understates the problem, as the risk for firearm homicide is not evenly distributed and certain segments of the population have a considerably higher risk of firearm homicide victimization. For example, for 15-19 year old Black males, the rate of firearm homicide death is 98.9 per 100,000 residents and for 20-24 year old Black males, the rate is 134.4 per 100,000 residents (CDC, 2023). Further, firearm homicide is concentrated within impoverished areas within cities (Kravitz-Wirtz, Bruns, Aubel, Zhang, & Buggs, 2022). Recent research suggests that firearm violence has increased in the aftermath of the COVID-19 pandemic (Kegler, Simon, Zwald, Chen, Mercy, Jones, et al. 2022; McDonald, Mohler, & Brantingham, 2022).

While the causes of firearm homicide are complex and involve both risk and protective factors (see American Psychological Association, 2013; Gaylord-Harden, Alli, Davis-Stober, & Henderson, 2022; Mattson, Sigel, & Mercado, 2020; Pardini, Beardslee, Docherty, Shubert, & Mulvey, 2020), there are strategies that law enforcement can adopt to reduce the prevalence of firearm violence (see Braga, Turchan, Papachristos, & Hureau, 2019; Braga, Weisburd, & Turchan, 2019; Uchida & Swatt, 2013). Recently, law enforcement agencies have sought to leverage forensic evidence from gun discharge events to improve gun violence suppression efforts. Traditionally, firearm forensic evidence – namely retrieved firearms and spent casings – were used mainly to enhance prosecutorial efforts at obtaining convictions. However, by rapidly entering and retrieving information from the ATF's National Integrated Ballistics Information Network (NIBIN) and electronic gun tracing database (eTrace), law enforcement can proactively use this information to identify linkages between seemingly disparate cases in order to apprehend likely shooters and disrupt gun trafficking networks (see Pierce, Braga, Hayatt, & Koper, 2004). To maximize the efficacy of this strategy, a number of agencies have been adopting coordinated interagency firearm enforcement programs – Crime Gun Intelligence Centers.

The Baltimore Police Department (BPD) is one of 46 agencies across the country that received funding from the Bureau of Justice Assistance (BJA) to stand up a CGIC. In 2018, BPD planned its CGIC and over the next five years implemented key components of it. Justice & Security Strategies, Inc. (JSS) served as the research partner on the grant and evaluated the program. This report details the results of this evaluation effort. In this chapter, we first discuss the CGIC concept, how CGICs can decrease gun violence, and the results of CGIC evaluations. In the second chapter, we discuss the City of Baltimore, the BPD, the implementation of CGIC, and the unique challenges facing this implementation to provide context for our findings. In the third chapter, we discuss the results of the process evaluation for CGIC and discuss CGIC activities,



challenges, and successes. The fourth chapter presents the results of the impact evaluation and examines whether CGIC was successful at reducing violent gun crime. The final chapter provides additional discussion of the conclusions of this research and provides a number of recommendations to BPD for the continuation of CGIC.

Crime Gun Intelligence Centers

Crime Gun Intelligence Centers (CGICs) were initially conceived and developed from the joint law enforcement work conducted by the Denver Police Department (DPD) and the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) in 2012. CGICs were conceived as an interagency cooperative effort to maximize the use and evidentiary value of core ATF resources – NIBIN and eTrace (see Police Executive Research Forum [PERF], 2017). Typically, CGICs involve collaboration between a local police department that collects firearm forensic evidence and the ATF that assists with processing the evidence and identifying case linkages and other case intelligence. However, the information produced through the CGIC process is also valuable to other agencies. CGICs often include other agencies, such as the local District Attorney’s office, the federal District Attorney’s Office, probation, parole, and other law enforcement offices. These agencies are expected to share information and coordinate strategies to solve incidents of firearm violence and obtain convictions to remove active offenders from the streets.

One of the core tools of CGIC is NIBIN. When a gun is discharged, features of the barrel, firing pin, firing chamber, breech face mechanism, ejector, and extractor generate distinct markings on the bullet casing. These markings are considered unique for each firearm, similar to fingerprints, and allow firearm examiners to identify whether recovered casings come from the same firearm (Bureau of Alcohol, Tobacco, Firearms, and Explosives [ATF], 2023a). The Integrated Ballistics Identification System (IBIS) was created to digitize these features of casings using laser optics at Data Acquisition Stations. The IBIS system then correlates the features of these casings to identify likely matches and ranks the probability of a match. Images from the short list of likely matches are then reviewed by firearm examiners at Signature Analysis Stations (ATF, 2023a). Through image analysis, firearm examiners can establish whether two firearms appear related, but strict confirmation requires direct microscopic comparison of the casings (PERF, 2017).

The ATF established NIBIN to coordinate the collection and dissemination of IBIS information among law enforcement agencies nationwide. NIBIN allows law enforcement agencies to upload IBIS information and search for correlations from IBIS records across participating agencies. This dramatically increases the breadth to which IBIS records can be compared and allows for the identification of cross-jurisdictional crimes. The ATF has been active in promoting the use of NIBIN technology among law enforcement agencies, further increasing the value of the NIBIN system (see ATF, 2023b). To support local law enforcement, the ATF has established the NIBIN National Correlation and Training Center (NNCTC). Analysts at the Center conduct correlational analysis and generate leads from NIBIN data to reduce the workload of firearm investigators in agencies and provide training and technical assistance with NIBIN (ATF, 2023c).



In CGIC, NIBIN correlations are used to determine when casings or firearms recovered from one incident are linked with casings recovered at other incidents. This information can assist detectives in identifying suspects for either incident. Generally, the volume of ballistics evidence will exceed the resources of investigators to conduct follow-up investigations. For this reason, CGICs often assign investigative resources using a triage system. The most common system employs three separate tiers of cases (see ATF, 2020). Tier 1 leads involve high profile cases (such as homicides) or have a high likelihood of solvability. Tier 2 leads involve less serious offenses with lower potential for solvability. Finally, Tier 3 leads often have low solvability (discharges with no suspects), but may still be helpful when identified as correlations for other shooting events or when incorporated with hotspot analyses of gun crime. The ATF's NIBIN Enforcement Support System (NESS) database incorporates information from NIBIN leads and eTrace gun traces and is commonly used to assist with triage (see ATF, 2022).

A key element of the success of CGIC is the extensiveness of the database of gun casings collected by the local law enforcement department. For this reason, CGIC programs emphasize *comprehensive collection* and entry of gun casings (National Police Foundation [NPF], 2019; PERF, 2017). Comprehensive collection of ballistics evidence includes casings or weapons recovered not only at the scene of fatal shootings and shooting incidents where the victim was injured, but also from non-injury shooting events, firearm discharge events, and other incidents where a firearm may have been discharged. Specific practices can enhance the success of comprehensive evidence collection. Two examples of these practices that have been employed by BPD include acoustic gunfire collection technologies and the use of canines to canvass areas where gunfire was detected. Acoustic gunfire detection technologies, such as ShotSpotter, can assist evidence collection by improving the geographic accuracy of the locations of shooting incidents and indicating the number of rounds fired in a discharge event. Acoustic detection systems can also direct officers to incidents where no calls for service were received. Canine canvassing of incidents can also increase the number of casings recovered from the scene.

Another key element of the CGIC model is that the NIBIN information is processed rapidly so leads are available to investigators during the initial phases of the investigative process. Prior to CGIC, there were lengthy delays in receiving the NIBIN results both from delayed entry into the IBIS system and the time spent processing NIBIN data. This delay limited the usefulness of NIBIN information during active investigations and leads were often returned after the suspect was identified (see King, Wells, Katz, Maguire, & Frank, 2013). In 2013, the ATF reorganized NIBIN operations to enhance its usefulness for police investigative purposes and emphasized rapid turnaround of NIBIN requests (see PERF, 2017). This resulted in NIBIN information being considerably more valuable during investigations as agencies were able to receive results in a timely manner. According to the National Police Foundation (2019) one of the best practices for a CGIC is that the timeframe between the recovery of evidence and the notification of a NIBIN lead should occur within 24 to 48 hours. Ideally, this should involve the entry of NIBIN casings within 24 hours after recovery to allow sufficient processing by the ATF (NPF, 2019).



The ATF's eTrace system is another tool that is leveraged in CGIC operations. ATF maintains information on all the legal sale and transfers of firearms in the United States. The paperwork associated with gun purchasing allows ATF to trace firearms used in gun crimes from the point of manufacture or import to the first domestic sale (PERF, 2017). These traces can allow police departments and ATF to identify gun trafficking networks by identifying possible retailers responsible for selling a disproportionate number of guns that are involved in crimes or "straw purchasers" who are legally purchasing guns on behalf of individuals prohibited from owning them (see Pierce et al. 2004). Ideally, eTrace information should be submitted within the same time frame as the NIBIN information. Specifically, firearm recovery forms should be submitted within 24 hours after the recovery of the firearm (NPF, 2019). Often this involves modifying the firearm processing procedures of the police department as firearms are often tested for DNA and fingerprint evidence, as well as used for test fires, during this same time period. To facilitate processing time, ATF allows for requests for "urgent traces" for guns linked with NIBIN leads, and these urgent traces are typically completed within 24 hours (NPF, 2019).

CGIC analysts often disseminate information from NIBIN and eTrace in the form of intelligence packets that summarize the information known about the leads. In complex cases, these intelligence packets may also include link analysis among the key involved people (see ATF, 2022). The packets are distributed to investigators to assist with the investigation of the case. Generally, these packets will be developed for all Tier 1 leads and some Tier 2 leads depending on available resources. Under the CGIC model, local investigators are expected to follow-up with additional investigation on the leads and if a federal nexus can be established, ATF investigators will participate. CGIC analysts are expected to track case outcomes and provide information on the CGIC cases on an as needed basis.

While NIBIN and eTrace are the main tools leveraged in a CGIC, a successful center requires organizational and operational changes that are critical for success. The CGIC concept emphasizes that there are many different agencies involved in addressing gun crime within a jurisdiction. In addition to the local police department, ATF is critically involved by providing local agencies with support for NIBIN and eTrace applications, sharing intelligence about active cases, and in instances where a federal nexus can be established providing direct investigative assistance. Local prosecutor's offices and U.S. Attorney's offices (USAO) are also important components for a successful CGIC. Current guidance for prosecutor's offices suggest that prosecutor's offices should assign a liaison to CGIC and should regularly attend CGIC meetings (see NPF, 2019). Further, prosecutors should also consider strategizing with CGIC partners to target prolific shooters and engage in vertical prosecution to minimize information loss across prosecution (NPF, 2019). Noting that gun crime is a multifaceted problem that touches a number of agencies and jurisdictions, CGICs often involve other agencies including other nearby police agencies, state or county police agencies, probation, parole, and other agencies.

One of the first factors that shapes the CGIC implementation is the degree to which the personnel assigned to CGIC is integrated. Some of the most integrated CGICs involve co-located analysts and investigators from multiple agencies within the same space. The advantage of co-location is



that agencies can more easily share resources and intelligence on active cases. However, co-location requires a designated space and dedicated resources by each agency and both of these may be in short supply. On the other hand, it is also possible for CGICs to operate decentralized with each agency housing their own CGIC personnel and having formal/informal “touch points” between the agencies on a regular basis with regular intelligence-sharing meetings. The main advantage of this model is that it is flexible and easy to implement. This flexibility was very important during the COVID-19 pandemic as a considerable amount of analysis work could be done remotely. The level of integration between CGIC partners varies based on several factors, such as the workload of the agency, the logistics of acquiring shared space, the willingness of participants to volunteer collaborative resources, and other organizational factors.

Another factor that shapes the operation of CGIC is whether investigators are assigned directly to the CGIC unit. When investigators are within CGIC units, these individuals are trained in firearm and NIBIN investigation and are assigned NIBIN leads to follow. In this model, the investigators work across district boundaries and assist investigators with cases that have NIBIN linkages. In an alternative model, no specific investigators are assigned to the CGIC unit, in which case it is the responsibility of analysts to communicate with investigators when NIBIN linkages are present and of unit supervisors to monitor whether follow-ups occur. Ultimately, whether investigators are directly assigned to CGIC depends on available resources (both financial and personnel) and agencies may move between models when circumstances dictate.

Regardless of the structure and operation of CGICs, they all share the common goals of improving the use of ballistics information, increasing the use of ballistics evidence in investigation, increasing the clearance rates for gun crime, increasing the number of successful prosecutions of gun offenders, and reducing the amount of gun crime. While the linkage between CGIC operations and reducing gun crime may be indirect, it is important to discuss the specific ways that CGIC can result in decreasing gun crime.

CGIC Mechanism of Action

While many violence intervention programs are driven by theory, it is uncommon for these programs to be explicit about the mechanisms that are supposed to lead to reduced violence. For this reason, it is helpful to discuss the possible mechanisms that underlie the CGIC effort for reducing gun violence. There are four main ways that CGIC may lead to reductions in firearm crime: 1) reduction in the number of active or potential shooters, 2) reduction in the numbers of “tools of crime,” *i.e.*, firearms, 3) increasing the police resources dedicated to the problem of firearm violence, and 4) increasing community trust and cooperation with law enforcement.

Decreasing Active Shooters.

One of the most direct strategies that CGICs adopt for reducing firearm violence is by identifying, apprehending, and convicting individuals directly involved in gun crime. Similar to the groundbreaking research by Wolfgang and colleagues on crime (Tracy, Wolfgang, & Figlio,



1990; Wolfgang, 1983; Wolfgang, Figlio, & Sellin, 1972), a small number of shooters are involved in the majority of gun violence events (Papachristos, Braga, Piza, & Grossman, 2015; Papachristos, Wildeman, & Roberto, 2015). NIBIN and eTrace information from the scene of shooting events can be used to identify these individuals and apprehending and convicting these individuals should decrease the amount of gun violence (see PERF, 2017).

Importantly, these impact players often lie at the center of shooting networks. Social network analysis of traced NIBIN leads demonstrate that networks of individuals are linked with multiple discharge incidents, suggesting that these social networks are an important mechanism for the distribution of firearms among potential shooters (see Gill & Fox, 2022). In addition to networks of shooters, there is an expanded network of individuals that are either directly present at shooting incidents or are facilitators of these incidents (e.g., gang or group leaders, getaway drivers, gun purchasers, lookouts, or gun holders/possessors). By apprehending the impact players and identifying and charging facilitators, law enforcement agencies can disrupt these social networks and reduce the prevalence of gun crime.

CGIC may also have important impacts on potential shooters – individuals who are at-risk for becoming an active shooter. The CGIC process is designed to increase the clearance rates for gun-involved crime, which increases the risk for detection and apprehension for individuals involved in gun crime. This may affect the risk-benefit calculation of engaging in gun crime, creating a deterrent effect for potential shooters. This increase in certainty of punishment may be particularly salient for potential shooters after the apprehension and conviction of prominent impact players – particularly if they were acquainted/aware of the offender.

Decreasing Firearm Availability.

CGIC can also affect gun violence by reducing the “tools” of crime, namely reducing the number of crime guns on the street. Many of the guns used in crime are “passed around” between individuals involved in gun crime (see Cook, 2018; Gill & Fox, 2022). Similar to the concentration of active shooters, a limited number of crime guns are responsible for a disproportionate amount of criminal activity. NIBIN linkages can identify these crime guns and when seized results in a notable reduction in the supply of crime guns.

Many firearms used in crimes are associated with diversions from retail gun sellers (see Braga, Wintemute, Pierce, Cook, & Ridgeway, 2012). The eTrace results accompanying the NIBIN information can help identify and prosecute black market dealers and straw purchasers who are responsible for the diversion of firearms into criminal activity. In this way, federal, state, and local law enforcement can disrupt illegal firearm trafficking networks and further reduce the number of guns on the street (see Braga & Pierce, 2005; Pierce et al. 2004).

A final mechanism through which CGIC can reduce the availability of guns for criminal activity is by increasing the risk of apprehension and punishment of gun carrying among crime facilitators. By increasing the clearance rates of gun violence and aggressively arresting and



prosecuting firearm violence facilitators, the change in risk-benefit calculus of potential traffickers or other facilitators may deter these individuals from providing firearms that may be traced in the future, further reducing the supply of crime guns.

Increasing Resources Devoted to Firearm Violence.

CGIC itself may indirectly lead to reductions in firearm violence by increasing the amount of police resources devoted to addressing gun crime. CGIC necessitates reallocating police resources to the investigation of gun crime, at a minimum by increasing the number of employee hours spent by analysts, detectives, and supervisors who investigate gun crime. While arguably there may be little difference in the time spent on high profile (often Tier 1) cases, CGICs lead to increased time spent on less prominent (often Tier 2 and 3) crimes that may have been left unsolved previously. Further, the emphasis on comprehensive casing collection and complete NIBIN entry implies that many crimes that may have been uninvestigated (such as discharge events) have now had dedicated forensics resources spent towards the investigation.

CGIC often leads to integrated discussions of gun crime and NIBIN hits within CompStat meetings or other crime meetings with command staff. Further, CGIC meetings often involve information sharing between agencies regarding active gun violence cases and coordination of interagency strategy. These meetings have the additional effect of increasing accountability among investigators for case progress. This accountability not only elevates gun violence generally as a topic of concern but also ensures that many cases, which may have been overlooked previously, are given higher priority for resolution.

Finally, CGIC may indirectly increase departmental resources devoted to addressing gun crime by prompting additional gun crime related activities – such as targeted patrol or enforcement activities to complement CGIC activity. Further, even if these efforts are not directly coordinated, information from leads and investigations can be used to supplement enforcement activity of other police initiatives. A good example can be seen in the BPD as CGIC information was routinely provided to the Group Violence Reduction Strategy program¹ that was operating concurrently with CGIC.

Increasing Community Trust and Cooperation.

Black and brown communities have long experienced deficits of trust with local police departments. This erosion of trust can be attributed to a list of potential factors, including police misconduct, discriminatory enforcement, over policing, and lack of procedural justice in police-citizen interactions, among others. One often understudied factor is that community trust can be

¹ GVRS is a program initiated and funded by the Mayor's office as a comprehensive strategy to address gun violence. This is a focused deterrence based program that includes BPD, the States Attorney's Office, and community groups designed to promote anti-violence norms, conduct street outreach, and apprehend individuals engaged in group violence. This program is described in more detail in Chapter 2.



impacted by “under-policing,” where police are perceived to neglect certain areas of a community – leading to unchecked crime and violence (see Boehme, Cann, & Isom, 2020). Starting a CGIC program may have an impact on violent crime within a community simply by showing members of the community that the police department is serious about addressing gun crime and thereby increasing trust and cooperation with residents who are concerned about violence in their community. Social media campaigns may be helpful in convincing the community that the concerns regarding gun violence are being taken seriously, and this in turn may enhance community trust and cooperation with the police to address the problem.

Relatedly, another issue that police regularly encounter within communities is a reluctance to provide information that may lead to the prosecution of violent offenders. The “don’t snitch” mindset actively impedes investigations and results in a decreased clearance rate for gun crime. In Baltimore, the department incorporated public awareness campaigns for anonymous tip lines, like Metro Crime Stoppers, as part of their activities.

Finally, CGIC partners may directly be involved with communities as part of their crime reduction strategy. This may include efforts such as gun turn-in or buyback programs to remove guns from the street. Alternatively, CGICs may benefit from collaborating with other community programs, such as Cure Violence or other community-based violence interruption programs that seek to deescalate conflicts and prevent future shooting events.

Previous Research on CGIC

To date, there have been 46 CGIC sites that have received funding from the Bureau of Justice Assistance (National Policing Institute, 2023).² Table 1 presents the list of these sites along with their violent crime rates per 100,000 residents when available from the Uniform Crime Reports or the individual department’s website along with the estimated population from the U.S. Census Bureau. As is apparent, there is a large range in the population served by many of the jurisdictions that have adopted CGICs. There is also a range in the level of violence experienced by these communities, although these agencies typically experience violence at high levels. There are also a number of larger agencies (county, state, and parish) that serve multiple jurisdictions with their CGIC.

Few of these sites have received formal evaluations of their success. Generally, the results from evaluations of CGIC are promising and there are indications that the CGIC approach can improve clearance for firearm investigations, result in greater apprehension and prosecution of gun offenders, and reduce the prevalence of gun crime. However, since CGICs operate at either the division or department level within the local police department and involve collaborations between multiple agencies, the research design of these evaluation studies are generally limited to time series or similar quasi-experimental designs rather than true experimental designs.

² Denver, CO is not on this list as their CGIC was the first established and therefore did not receive funding under this initiative.



Table 1. List of Sites that Received BJA Funding for CGIC Programs and Crime Rate per 100,000 and Population Served.

City/Jurisdiction	State	Agency Name	Violent Crime Rate				Population Served			
			2019	2020	2021	2022	2019	2020	2021	2022
Little Rock	AR	Little Rock Police Department	1534.1	1804.8	2022.9	1817.0	197,312	202,622	202,230	202,864
Phoenix	AZ	Phoenix Police Department	702.1	848.5	807.5	822.2	1,680,992	1,608,190	1,625,356	1,644,409
Los Angeles	CA	Los Angeles Police Department	738.8	740.8	--	--	3,979,576	3,898,767	3,837,986	3,822,238
Oakland	CA	Oakland Police Department	1274.7	1282.8	1519.4	1421.4	433,031	440,660	436,291	430,553
San Francisco	CA	San Francisco Police Department	691.9	558.6	608.4	654.6	881,549	873,959	811,253	808,437
Santa Clara County	CA	Santa Clara County Sheriff's Office ¹	--	--	--	--	1,927,852	1,936,274	1,886,595	1,870,945
Stockton	CA	Stockton Police Department	1400.7	1254.0	1145.0	1165.6	312,697	320,810	322,607	321,819
Aurora	CO	Aurora Police Department	734.0	881.4	1017.8	1165.8	379,289	386,324	390,370	393,537
Bridgeport	CT	Bridgeport Police Department	583.8	563.8	531.7	413.8	144,399	148,644	148,571	148,377
Connecticut State	CT	Connecticut State Police ¹	--	--	--	--	3,565,287	3,605,944	3,623,355	3,626,205
New Haven	CT	New Haven Police Department	824.6	658.8	547.1	481.6	130,250	134,024	138,731	138,915
Washington	DC	Washington D.C. Metropolitan Police Department	977.1	990.2	615.7	570.1	705,749	689,546	668,791	671,803
Wilmington	DE	Wilmington Police Department	1135.9	1105.9	1032.2	835.6	70,166	70,893	70,823	71,569
Broward County	FL	Broward County Sheriff's Office ¹	--	--	--	--	1,952,778	1,944,376	1,935,729	1,947,026
Ft. Lauderdale	FL	Ft. Lauderdale Police Department	531.1	539.5	590.1	--	182,437	182,775	182,011	183,146
Miami	FL	Miami Police Department	627.8	613.4	612.4	586.2	467,963	442,260	441,999	449,514
Palm Beach	FL	Palm Beach County Sheriff's Office ¹	--	--	--	--	1,496,770	1,492,198	1,503,223	1,518,477
Tampa	FL	Tampa Police Department	405.8	550.9	--	--	399,700	384,661	392,893	398,173
Chicago	IL	Chicago Police Department	948.5	967.9	637.7	660.9	2,693,976	2,746,352	2,698,029	2,665,039
Indianapolis	IN	Indianapolis Police Department	1029.5	873.6	728.7	--	886,220	887,661	882,420	880,621
Kansas City	KS	Kansas City Police Department	708.7	797.5	946.4	--	152,960	156,606	154,789	153,345
Wichita	KS	Wichita Police Department	1144.5	1323.6	1065.3	--	389,938	397,547	396,679	396,192
Louisville	KY	Louisville Metro Police Department	759.5	902.2	1060.2	--	617,638	632,550	627,709	624,444
East Baton Rouge	LA	East Baton Rouge Parish Sheriff's Office ¹	--	--	--	--	440,059	456,781	453,653	450,544
Baltimore	MD	Baltimore Police Department	1870.5	1641.8	1614.3	1693.7	593,490	585,693	576,981	569,931
Detroit	MI	Detroit Police Department	1945.3	2248.4	2309.7	--	670,031	639,115	628,167	620,376
Saint Paul	MN	Saint Paul Police Department	568.7	744.7	786.9	--	308,096	311,518	307,150	303,176
Kansas City	MO	Kansas City Police Department	1463.7	1558.9	1453.6	--	495,327	507,971	508,949	509,297
Jackson	MS	Jackson Police Department	833.0	1050.1	--	--	160,628	153,705	149,727	145,995
Charlotte	NC	Charlotte-Mecklenburg Police Department	788.7	916.4	847.6	--	885,708	874,607	882,503	897,720
Henderson	NC	Henderson Police Department	1488.8	2009.7	1656.8	--	14,911	15,077	14,848	14,822
Winston-Salem	NC	Winston-Salem Police Department	1077.3	1209.3	1145.0	--	247,945	249,562	250,922	251,350
Newark	NJ	Newark Police Department	617.7	478.9	470.5	--	282,011	311,552	307,312	305,344
Paterson	NJ	Paterson Police Department	839.3	897.0	--	--	145,233	159,759	157,905	156,661
Albuquerque	NM	Albuquerque Police Department	1363.4	1337.6	1436.1	1326.5	560,513	564,581	563,108	561,008
Cincinnati	OH	Cincinnati Police Department	850.8	880.3	803.1	--	303,940	309,561	308,685	309,513
Cuyahoga County	OH	Cuyahoga County Sheriff's Department ¹	--	--	--	--	1,235,072	1,264,813	1,247,808	1,236,041
Toledo	OH	Toledo Police Department	962.0	1007.5	1082.1	--	272,779	270,880	268,744	266,301
Tulsa	OK	Tulsa Police Department	988.1	1102.6	1083.9	--	401,190	413,123	412,770	411,867
Columbia	SC	Columbia Police Department	789.1	724.4	707.5	--	131,674	136,803	136,394	139,698
Myrtle Beach	SC	Myrtle Beach Police Department	1199.0	1378.3	1219.4	--	34,695	35,697	36,986	38,417
Chattanooga	TN	Chattanooga Police Department	1066.7	1383.0	1402.6	--	182,799	181,057	181,163	184,086
Memphis	TN	Memphis Police Department	1905.3	2424.2	2521.6	--	651,073	631,539	625,982	621,056
Harris County	TX	Harris County Sheriff's Office ¹	--	--	--	--	4,713,325	4,731,129	4,735,287	4,780,913
Houston	TX	Houston Police Department	1094.8	1280.6	1236.0	--	2,320,268	2,301,572	2,291,655	2,302,878
Milwaukee	WI	Milwaukee Police Department	1350.3	1629.7	1663.5	1662.9	590,157	577,225	565,840	563,305

¹ Crime rate not included as the county/parish/state site serves several local jurisdictions and crime rates would be misleading

PERF (2017) conducted a process evaluation of CGICs in Denver, Milwaukee, and Chicago. In all three sites, the CGIC model led to increases in the number of NIBIN leads and a decrease in the time between the recovery of ballistics evidence and the generation of leads from NIBIN. All sites also reported that the CGIC process yielded new investigative leads in active cases that would not be found otherwise. Finally, the researchers noted that all sites processed evidence in



excess of the investigative resources available for follow-up, suggesting opportunities to increase personnel to enhance CGIC operations.

Koper, Vovak, and Cowell (2019) evaluated the CGIC program in Milwaukee, WI. The CGIC program was implemented citywide in Milwaukee in 2014. They determined that about half of all shootings in Milwaukee were associated with repeat shooter networks, suggesting that the CGIC strategy has the potential to reduce gun crime within the city. They also found that clearances for non-fatal shootings increased, particularly in regard to clearing cases with NIBIN evidence. Finally, they found preliminary data suggesting that NIBIN arrests may be associated with a reduction in shootings.

Uchida, Quigley, & Anderson (2019) conducted a process evaluation of the Los Angeles Police Department CGIC program. This CGIC program was implemented in the 77th Street Division in 2018 and was then later expanded to the three other divisions (Harbor, Southwest and Southeast) in 2018. In 77th Street Division, the focus on comprehensive case collection and entry led to an increase in the number of shootings with casings recovered by 23 percent, the number of casings entered into NIBIN by 50 percent, and the number of NIBIN leads by 68 percent. An examination of crime trends in 77th Street suggested that CGIC might have contributed to a drop in homicides, robberies, and aggravated assaults with a firearm. Swatt (2022) examined the impact of LAPD's CGIC using an interrupted time series design in a reanalysis of the crime data collected during the original evaluation. He found that robbery with a firearm and aggravated assault with a firearm decreased considerably in Southwest division after CGIC with an average treatment effect of 43% and 39% decreases over the subsequent 24 months respectively.³ For 77th and Southeast divisions, the average treatment effect over 24 months for robbery with a firearm was 36% and 37% decreases respectively. No significant effects were observed for the Harbor division, which was not surprising given the division's low base rate of violent crime.

Schiabale and Six (2017) conducted an initial evaluation of Denver's CGIC and found that NIBIN entries and NIBIN hits increased after the program started. Further, they found increases in arrest rates for violent crimes with firearms after a NIBIN hit. Additionally, neighborhoods with higher numbers of NIBIN-informed arrests were associated with lower gun and gang violent offenses. Uchida, Swatt, Land, Anderson, and Hock (2020) also examined the Denver CGIC program, and its successor, the Regional Anti-Violence Enforcement Network (RAVEN). CGIC was expanded to regional partners across the Denver Metropolitan Area through RAVEN. Using an interrupted time series design, they found that robbery with a firearm decreased sharply after CGIC began with an average treatment effect of a 48% decrease over the subsequent 24 months. While the implementation of the RAVEN program was not associated with statistically significant

³ In the Swatt (2022) and Uchida et al. (2020) study, the average treatment effect for an interrupted time series design using the segmented regression model is defined as the average of the monthly treatment effects over the subsequent 24 months. This can be found using $b_1 + b_2 \cdot tat$, where b_1 is the coefficient of the dichotomous treatment indicator (0 = before treatment, 1 = the month treatment begins and every month thereafter), b_2 is the coefficient for the time after treatment variable, and tat is the time after treatment variable (0 = before treatment and 1st month, 1 = month after treatment, and the variable increments by 1 every month thereafter).



reductions in firearm crime, these crimes were trending downward and might have been significant with a longer post-implementation observational period.

Mei, Owusu, Quinney, Ravishankar, and Sebastian (2019) evaluated the CGIC 2.0 program in the Washington D.C. Metropolitan Police Department. The original Washington D.C. CGIC program began operating in 2015. A process evaluation was conducted to identify several areas of enhancement to CGIC including increasing the number of personnel assigned to CGIC, conducting additional trainings, integrating CGIC personnel into district-wide strategic and tactical crime meetings, and improving the efficiency of processing and entry of gun casings. The research team then conducted a multi-method assessment of the CGIC 2.0 enhancements. While the researchers found that the CGIC 2.0 enhancements were helpful and that CGIC and NIBIN investigations are perceived as effective by detectives, there was no statistically significant impact of crime for CGIC 2.0 over the original CGIC implementation.

A number of recent evaluations confirmed the improvements in the collection and use of ballistics evidence after CGIC, but did not examine the impact of CGIC on gun crime. Novak and King (2020) examined the CGIC in Kansas City, MO and found that CGIC increased the collection of ballistics evidence and an increase in NIBIN leads. Similarly, Katz, Flippin, Huff, and King (2021) evaluated the Phoenix Police Department's CGIC and found that CGIC was associated with an increase in evidence collection and leads as well as higher clearance rates, but this did not translate into additional charging and conviction rates. Hipple (2022) examined the Indianapolis Metropolitan Police Department CGIC and found that CGIC led to an increase in ballistics evidence collection, NIBIN entries, and NIBIN leads. Khojasteh (2022) evaluated the CGIC established by the Tulsa Police Department and found that the implementation of CGIC led to a dramatic increase in the use of NIBIN traces by the department. Finally, Rojek, Biasi, and McGarrell (2022) evaluated the Detroit CGIC and found increases in evidence collection and NIBIN leads. Unfortunately, the COVID-19 pandemic and George Floyd protests made it impossible to conduct a formal evaluation including pre- and post-implementation measures.

Summarizing across these evaluations, there is considerable evidence to suggest that CGICs are successful at increasing the amount of ballistics evidence collected, increasing the amount of ballistics evidence entered into NIBIN, and increasing the number of leads and hits returned from NIBIN. Further, many sites report increased cooperation between agencies cooperating in CGIC. Less clear, however, is whether CGIC leads to increases in the numbers of gun arrests, increases in the clearance rates of gun crimes, increases in prosecutions of gun offenders, and decreases in the amount of gun crime within the serviced jurisdictions. While the evidence for these outcomes is limited, there are some promising indications that CGICs may be effective at combatting gun crime. Clearly additional research and evaluation is needed.



Baltimore Police Department's Crime Gun Intelligence Center

This chapter provides context for the overall study and begins with a brief description of the city of Baltimore and the Baltimore Police Department (BPD). We also discuss the levels of crime and violence experienced by the city and then provide specific details about the implementation of the Department's Crime Gun Intelligence Center (CGIC). Finally, the chapter concludes by detailing the unique circumstances and challenges faced by CGIC during its implementation.

Site

Baltimore is the largest city in Maryland with an estimated 569,931 residents as of July 1, 2022. The city has been steadily shrinking, as this represents a decrease of 8.2 percent since the 2010 Census (U.S. Census Bureau, 2023). Residents of Baltimore are primarily Black or African American (62 percent), with sizable numbers of White, non-Hispanic (27 percent), Hispanic or Latino (6 percent), and Asian (3 percent) residents. Approximately eight percent of Baltimore residents were born in a foreign country. As of 2023, about 21 percent of residents are younger than 18 years and 14 percent are older than 65 years. Nearly 53 percent of residents are female (U.S. Census Bureau, 2023).

Baltimore is a highly urbanized area with residents living in approximately 244,893 households or an average of 2.32 persons per household (U.S. Census Bureau, 2023). Approximately 48 percent of these households are owner occupied with a median value of \$175,300. About 86 percent of residents are high school graduates or received their GED equivalent and 34 percent achieved a Bachelor's degree or higher. The median household income in 2021 dollars is \$54,124 and over 20 percent of residents report living in poverty. About 7 percent of residents under 65 report having no health insurance (U.S. Census Bureau, 2023).

Baltimore Police Department.

The Baltimore Police Department (BPD) serves the city.⁴ The BPD employs almost 3,100 sworn officers and civilian support staff.⁵ For most of the grant period, the BPD was led by Police Commissioner Michael Harrison. In June 2023, Commissioner Harrison announced his departure and was succeeded by Police Commissioner Richard Worley, who was formerly the Deputy Commissioner of the Operations Bureau and oversaw patrol and investigations functions, including CGIC, in the department.

The BPD has been under a consent decree since 2016 after an investigation by the Department of Justice found that it engaged in a "pattern and practice of unconstitutional policing" (Baltimore Police Department, 2023a). This decree mandated a number of reforms for the BPD and

⁴ The areas surrounding Baltimore are part of Baltimore County (which excludes the City of Baltimore) and are serviced by the Baltimore County Police Department.

⁵ This information can be found on the BPD's website at: <https://www.baltimorepolice.org/about>



implementation of those changes is ongoing (see Baltimore Police Department, 2023b). Notable reforms include additional officer training on community policing, problem-solving, and bias-free policing; the creation and implementation of a community engagement plan, revisions of the policies on stops, searches, and arrests; the establishment of a Crisis Intervention Team for responses to citizens with behavioral health crises; revisions to the policy on use of force and mandated reporting on use of force incidents; among other reforms.

While much of the consent decree does not directly impact CGIC, it is important to understand that BPD is an agency in transition. Under the consent decree, there are a number of competing initiatives required for compliance. While these initiatives do not directly compete with CGIC, they do compete for scarce resources within the department (financial, personnel, and priority). Further, the organization itself is under change with leadership and personnel shifts, organizational turnover, technological updates and changes, and other factors that can create difficulties during implementation or shift the goals or objectives of any project. This is not to suggest that the consent decree is only creating problems for CGIC, instead the increased vibrancy and organizational churn may make the organization more receptive to innovation. Additionally, the increased scrutiny of the department may improve efforts to ensure accountability for the success or failure of initiatives.

CGIC Partners

The main partner with BPD's CGIC is the Baltimore Field Division of the Bureau of Alcohol, Tobacco, Firearms, and Explosives. The ATF Baltimore field division is located seven blocks from BPD headquarters, where BPD CGIC was originally located. ATF Baltimore also has offices in various divisions throughout the city and is co-located with different federal partners. ATF Baltimore has a dedicated CGIC team named the Crime Gun Enforcement Team (CGET) as well as various Intelligence Research Specialists and analysts. While there is a team of analysts that are focused on Baltimore NIBIN leads, the same group is responsible for NIBIN information from surrounding areas in Maryland, Delaware, and Washington D.C. When BPD launched the grant program, a team of one supervisor and two analysts were working daily to bring Baltimore CGIC up to standard. This group met with the BPD CGIC coordinator and analyst weekly to discuss program implementation and updates, NIBIN leads, and data problems.

The Baltimore office of the ATF has been a critical partner in all aspects of the CGIC implementation. The office has been responsible for generating and sharing NIBIN leads and providing guidance to the assignment of tiers to these leads. The ATF has also shared intelligence and provided feedback on successful CGIC federal cases through the weekly CGIC meetings.

In addition to direct support, the ATF has also been active in providing training and assistance to BPD officers regarding CGIC and ballistics evidence. Training for BPD firearms examiners allows them to enter and correlate spent firearm casings and test fires from recovered guns, ATF has also taught classes for various groups of BPD detectives. The ATF Baltimore CGIC group



supervisor facilitated multiple classes of NIBIN 101 training targeted towards homicide detectives and intelligence officers. This training focused on providing basic information about CGIC, how to utilize NIBIN leads, and highlighted success stories that utilize NIBIN, eTrace, and other CGIC related tools to close cases. The goal of this training, aside from providing information, was to show detectives how they could utilize NIBIN to solve their cases. The BPD CGIC team also brought in ATF to teach officers about Privately Made Firearms (PMFs), which are often called “ghost guns.” This training taught officers what constitutes a PMF, how they are made, and what officers should be aware of when collecting them as evidence.

In many instances, ATF investigators take the lead on Tier 1 cases in order to establish a federal nexus and try these cases in federal court. This has been necessary in several situations where there has been a perceived hesitancy for charging offenders through the State Attorney’s Office (SAO). Due to the nature of firearms in Maryland, if a firearm is recovered, it is not difficult to establish a federal nexus because most guns have crossed state lines at some point since manufacture. If the firearm is not yet recovered, ATF has a more difficult job finding a federal nexus. Often times, ATF utilizes the location of incidents, like proximity to a school.

Another important partner for CGIC is the SAO for Baltimore City. Marilyn Mosby served in that position from 2015 to 2023. She was succeeded by Ivan Bates in January 2023. Initially, the SAO was active in CGIC investigations and planned to co-locate an analyst at the BPD Watch Center. Unfortunately, this plan was not implemented due to COVID-19 concerns, but there was initially strong informal communication between analysts at the SAO and CGIC. About halfway through the grant period, the liaison with the SAO left the agency and the replacement liaison stopped attending weekly CGIC meetings and ceased participating in CGIC operations. This coincided with considerable organizational changes within the SAO. With a new SAO, there appears to be renewed interest in CGIC and BPD is exploring ways to re-engage the office.

The U.S. Attorney’s Office (USAO) for the District of Maryland has also been a partner to CGIC. While the U.S. Attorney does not participate in CGIC activity through the BPD side, they remain an active partner with the ATF as many of the Tier 1 leads are prosecuted through this venue.

The National Policing Institute (NPI, formerly the Police Foundation) provides training and technical assistance for the BPD CGIC. Assistance has come from advice and guidance during the draft of the Strategic Plan as well facilitating site visits to other CGIC sites (Cincinnati, OH and Miami, FL). Training on recovered firearms evidence was conducted by Mark Kraft on May 8, 2023. NPI also conducted monthly and then quarterly check-in calls to monitor the implementation of CGIC and to offer additional assistance as needed.

Justice & Security Strategies, Inc. (JSS) serves as the research partner for this project and is responsible for the process and impact evaluation. In addition, JSS assisted CGIC analysts on request and conducts monthly check-in meetings regarding the development and activities of CGIC.

Gun Crime in Baltimore

In order to get a fuller picture of the context of the CGIC program, it is important to understand the levels and trends in crime and specifically gun crime across the city. BPD provided police incident data from 2017 through the middle of 2023 to support this evaluation. The information in this section was taken from these data.

Table 2. Baltimore Police Department Crimes, January 2017 to June 2023.

	2017	2018	2019	2020	2021	2022	2023 YTD
Homicide	342	309	348	335	334	330	140
Rape	380	366	317	296	294	232	118
Agg. Assault - Shooting	703	677	766	721	726	688	308
Agg. Assault - Other	5,864	5,631	5,735	5,347	5,682	6,165	2,972
Robbery - Carjacking	574	483	584	518	579	714	235
Robbery - Commercial	735	631	518	355	553	806	233
Robbery - Other	4,879	4,404	4,059	2,715	2,739	2,755	1,447
Burglary	8,082	6,218	5,427	4,058	3,568	3,853	1,477
Auto Theft	4,664	4,218	3,769	3,006	3,246	3,632	3,978
Arson	266	127	115	105	136	132	72
Larceny	10,805	10,711	10,776	7,682	7,762	8,891	4,758
Larceny from Auto	6,186	6,377	5,777	3,657	3,775	3,200	1,899

Table 2 presents yearly crime statistics for Part 1 crimes (homicide, rape, aggravated assault, robbery, burglary, and motor vehicle theft, arson, and larceny) from January 2017 to June 2023.⁶ A number of crimes showed different patterns across years. Homicide reached a low point in 2018, rose in 2019, but steadily declined over time. Rape decreased consistently from 2017. Shootings decreased in 2017 and 2018, but reached a high point in 2019 and then decreased thereafter. Other aggravated assaults decreased through 2020, but increased in the subsequent two years. Both carjacking and commercial robbery decreased through 2020, but strongly increased afterwards. Other robberies, however, decreased slowly before dropping precipitously in 2020. A slight increase occurred in other robberies across the last two years. Burglary dropped considerably since 2017 with only a slight increase in the 2022. Auto theft also decreased

⁶ BPD's crime data contains multiple rows for each victim and crime type that occurred within an incident allowing each crime incident to have multiple victims and crime types. When presenting data from homicide, rape, and shootings, BPD counts victims. For other non-serious violent offenses, BPD counts incidents, allowing multiple victims to be aggregated into a single incident. Since the focus of this report is on violent gun crime, we elected to work with victims consistent with BPD reporting on serious violent crime. However, rather than introduce inconsistencies associated with switching between aggregations, we present and analyze the crime report data consistently in this way. This implies that the correct interpretation of these counts are the number of crime victims. Further, the numbers of all non-serious crime counts will be inconsistent with those reported by the BPD.



through 2020, but slowly increased through 2022. Interestingly, there has been explosive growth in auto theft in 2023 as the numbers through June already outpace the yearly total from 2022.

Table 3 presents the yearly gun crime statistics for homicide, aggravated assault, and robbery for 2017 to 2022. Here, gun offenses are defined as any incident that included an indicator for a firearm (regardless of type) being involved in the crime. Importantly, this does not suggest that a firearm was discharged during the crime, but rather that it was at least present at the scene. Gun homicide decreased in 2018, stabilized at around 300 victims per year. Shootings, by definition, follow the same trends discussed from the prior table. However, other aggravated assaults involving guns increased since 2017. Carjackings with a firearm fluctuated from increases to decreases from 2017 to 2021, but increased dramatically in 2022. Commercial robbery with a firearm decreased through 2020, but increased in 2021 and 2022. Finally, other types of gun-involved robbery decreased considerably through 2021, but increased in 2022.

Table 3. Baltimore Police Department Violent Gun Crimes, January 2017 to June 2023.

	2017	2018	2019	2020	2021	2022	2023 YTD
Homicide	300	273	312	296	295	299	123
Agg. Assault - Shooting	703	677	766	721	726	688	308
Agg. Assault - Other	1,476	1,489	1,505	1,620	1,659	1,653	729
Robbery - Carjacking	396	346	448	393	439	548	171
Robbery - Commercial	430	386	262	176	252	353	98
Robbery - Other	2,321	2,218	1,885	1,245	1,058	1,117	625

Table 4 shows the trends in Part 1 violent crimes (homicide, rape, aggravated assault, and robbery) by district from 2017 to June 2023. Across most of the nine districts, 2020 had the lowest violent crime counts. This is unsurprising as this is a direct impact of the COVID-19 pandemic and the ensuing lockdowns that occurred across the city. However, for many of these districts, crime increased since 2020. The trends for the two districts of interest, the Western and the Southwest districts appear different from many of the other districts. While there was a slight increase in violence in the Western following 2020, this increase was small and violent crime remained at lower levels than pre-pandemic years. Interestingly, violent crime decreased consistently across years in the Southwest.

Table 4. Baltimore Police Department Part 1 Violent Crimes by District, January 2017 to June 2023.

	2017	2018	2019	2020	2021	2022	2023 YTD
Central	1,325	1,374	1,520	1,027	1,276	1,401	618
Eastern	1,283	1,207	1,343	1,106	1,112	1,091	455
Northeast	1,958	1,720	1,694	1,530	1,509	1,738	888
Northern	1,213	1,126	991	950	930	1,034	487
Northwest	1,360	1,226	1,187	1,046	1,147	1,314	544
Southeast	1,698	1,585	1,459	1,116	1,265	1,336	760
Southern	1,650	1,387	1,278	1,032	1,257	1,366	587
Southwest	1,452	1,426	1,422	1,307	1,214	1,154	580
Western	1,259	1,183	1,163	993	1,032	1,005	513

Table 5 presents the trends in violent Part 1 gun-involved crime by district from 2017 through June 2023. Again, all nine districts experienced a decrease in violent gun crime in 2020, but then increased after the pandemic. The Western and Southwest districts were exceptions to this general trend. For both districts, violent gun crime was considerably lower in 2022 than 2020.

Table 5. Baltimore Police Department Part 1 Violent Gun Crimes by District, January 2017 to June 2023.

	2017	2018	2019	2020	2021	2022	2023 YTD
Central	447	419	544	345	433	433	198
Eastern	566	561	580	562	523	490	171
Northeast	892	799	752	649	562	693	382
Northern	538	524	460	421	351	410	199
Northwest	617	637	561	507	501	555	170
Southeast	632	654	569	441	500	515	283
Southern	665	565	493	419	527	603	250
Southwest	607	602	573	567	512	490	207
Western	554	510	540	454	469	396	184

While violent crime and gun crime improved in recent years throughout the city, at the time of the CGIC grant application (2018), gun crime was persistently high across the city. CGIC was seen as one strategy, out of many, for the BPD to combat this persistently high level of gun crime.



CGIC Development

Planning for CGIC began in 2019 upon receipt of the grant from the Bureau of Justice Assistance. In late 2019 and early 2020, the executive planning council began meeting with representatives from the ATF, SAO, and the USAO and led by the BPD Deputy Chief of Detectives and Data Driven Strategies Director among others. This group created a Strategic Plan for implementation. Memoranda of understanding between each partner outlined roles and responsibilities. In the fall of 2020, the CGIC coordinator and analyst were hired implementation the program began. In late 2020, meetings were held with internal and external partners to ensure seamless integration of new initiatives.

As a pilot project, CGIC started operations in the Western district in January 2021. In the first week of the program, CGIC personnel and command staff from BPD and ATF attended roll calls for patrol officers and detectives to share information about what to expect. Examples of Tier 1 lead intelligence packets, Tier 3 situational awareness notifications, and other CGIC bulletins were brought and described to officers. NIBIN intelligence was still available for the entire department, but in the Western, additional resources were made available and new initiatives were launched.

During the pilot in the Western, the CGIC program was seen as beneficial, and BPD decided to expand it to include the Southwest district. The Southwest district was selected because many of the NIBIN leads in the Western that linked to out of district incidents occurred in the Southwest. The BPD team determined that initiatives from the Western district, including the intelligence reports and weekly meetings, would be expanded to the Southwest. CGIC operations began there in June of 2022. As before, CGIC staff conducted a series of roll call trainings to officers within the Southwest to acquaint them with CGIC principals and operations.

BPD CGIC Structure and Operation

BPD CGIC was housed within the Watch Center, a real-time crime-tracking center organized within the Data Driven Strategies Division.⁷ At the start of CGIC, it was designed to be decentralized, as there were no specifically assigned CGIC detectives until the end of March 2023. Instead, analysts worked directly with detectives in their home divisions and used NIBIN intelligence to support ongoing investigations into fatal and non-fatal shooting incidents. This support consisted of the production of intelligence packets that were distributed to investigators when Tier 1 and Tier 2 leads were identified. Each district's intelligence detective was designated to be the CGIC liaison. They were responsible for initiating contact between district detectives or surrounding areas if a lead was cross-jurisdictional. Additionally, the district

⁷ In September 2023 during the completion of this report, CGIC was moved to the Anti-Crime Unit, which is part of the Detectives Bureau. All of the CGIC activities discussed within this report was conducted under the prior organization.



intelligence detectives were responsible for staying up-to-date with NIBIN leads and creating situational awareness flyers for officers from Tier 3 leads.

At the start of CGIC, the unit was staffed by one CGIC coordinator and one CGIC analyst. However, the CGIC coordinator departed BPD in April 2022 and the BPD struggled to fill this position until April 2023. In the interim, additional staff were brought in to support the remaining analyst including, for a time, one part-time analyst who had been employed under a previous grant and an intern who briefly supported CGIC. At the later part of this grant, BPD assigned one detective to CGIC for conducting follow-ups on NIBIN-related investigations in March 2023 and one sergeant on August 2023 to support CGIC.

NIBIN and eTrace entry were handled by the BPD's Firearms Analysis Unit (FAU). This unit has the capacity to test fire weapons, enter NIBIN information directly to the ATF, conduct firearm forensic examinations, reconstruct dismantled firearms, restore obliterated firearm serial numbers, and collect other forensic evidence (primarily DNA and fingerprints) from recovered firearms. The FAU has an impressive collection of in-house equipment, including BrassTrax IBIS entry machines, microscopic firearm inspection machines, a firing range, a water firing tank, and an extensive collection of both firearms for restoration purposes and ammunition for test fires. In part due to the extensive in-house capacity, FAU has declined to participate in the ATF's NIBIN National Correlation and Training Center (NCTC), preferring instead to conduct test fires and NIBIN entry in-house. For many years, the FAUS at BPD was in the top ten in the country when time from collection to entry was analyzed.

The bulk of BPD's CGIC effort involved leveraging NIBIN leads and hits. Comparatively, little time was spent using information from the e-Trace leads for actionable intelligence. A site visit in July 2022 revealed that there were considerable impediments in the process for collecting, analyzing, and disseminating e-Trace information. Due to the high volume of guns processed by the Firearms Lab at BPD, the lab conducted bulk uploads of gun serial numbers to the ATF system. These bulk uploads were transmitted via a flat datafile that required a specific format to be imported into the ATF system. According to agents at the ATF, it was often necessary to reformat and upload these files multiple times. The net impact of this process resulted in a delay of up to three weeks after the incident for the traces to be completed. This limited the value of the e-Trace results to both analysts and investigators. During the visit, it was recommended that BPD consider moving away from the bulk upload strategy and hire additional personnel to assist in processing gun serial numbers for immediate upload. BPD responded in January 2023 by hiring a contractor to assist in the process and they became responsible, in part, for the collection and submission of the serial numbers of firearms.

NIBIN leads were converted into intelligence packets that were disseminated to detectives working on relevant cases, as well as command staff in each affected district. CGIC personnel provided direct assistance to detectives through ad-hoc NIBIN requests and other intelligence information (maps, link analyses, etc.) for information related to the NIBIN leads. The CGIC team at BPD was unable to complete an intelligence packet for every Tier 1 and Tier 2 so the



decision was made to focus on Tier 1 leads. At the outset of the program, detectives rarely requested additional information on Tier 2 leads. However, in the last year of the grant, detectives were often seeking out additional CGIC information and intelligence.

To assist with comprehensive casing collection as well as to support community outreach goals, BPD implemented an initiative that utilized the department's canine unit to recanvas areas in the 24 hours following ShotSpotter alerts. BJA and the National Policing Institute recommend that CGIC sites implement "Door Hangers." These door hangers would be placed on the doors of citizens in the immediate area of an incident after the incident with the purpose of providing citizens with instructions on how-to call-in information and any other relevant information. After consulting with the Western district Neighborhood Coordination Officers, it was determined that these programs had been attempted previously and resulted in citizen complaints about additional litter. In lieu of door hangers, BPD felt canine canvasses would show officers in the area following violent incidents to give citizens peace of mind and assure them that the department was addressing violent gun crime. The additional benefit would be that the canine squad would be able to recover additional firearms casings that would have been missed during the original canvas. The CGIC team was responsible for running point on this initiative and pulled ShotSpotter alerts from the Western district every morning. These alerts were disseminated to canine officers to follow up and those officers inputted notes in a tracking spreadsheet after the recanvas. While BPD felt that the canine canvasses were beneficial for community outreach, the low yield rate of these canvasses did not support their continued use.

CGIC partners met on a weekly basis for most of the grant period, but these meetings often changed in time, form, and function across the implementation. At the beginning of the implementation, the intelligence meetings were included in the Group Violence Reduction Strategy (GVRS) weekly investigation meetings that were conducted virtually due to the COVID-19 pandemic. CGIC was given time during the second half of these meetings to discuss Tier 1 and 2 leads with detectives. Generally, during this time, CGIC would discuss the leads in more detail with detectives from the Western district and the homicide investigations division. Further, as part of these meetings, they would inquire about the status of follow-ups for leads discussed the previous week if detectives were unaware when asked previously or if intelligence was still being investigated. The ATF would also provide relevant information on how these leads connected to active cases that they were investigating. After approximately one year, these meetings were changed to in-person with fewer attendees with the hope of facilitating better discussion of leads and cases. These meetings transitioned to fully supporting GVRS efforts but CGIC analysts continued to attend and offer support for NIBIN related incidents.

The BPD experimented with providing the CGIC team time to discuss NIBIN information during the Wednesday weekly crime strategy meeting. This meeting included both detectives and police command staff. During these meetings, CGIC was provided time at the beginning of the meeting to discuss NIBIN leads. Command staff discussed the leads and inquired about follow-up investigations to these leads. ATF attended these meetings and provided additional information



about their investigations and leads. These meetings continued for several months until the crime strategy meetings were overhauled and reorganized for different purposes.

After the site visit to Cincinnati in 2023, CGIC and ATF attendees were interested in fostering more coordination through efforts towards co-location. It was decided that one opportunity for co-location was to increase the length and detail of the CGIC discussions and to hold these meetings offsite at a location convenient for staff of both offices. These meetings began in April 2023, and continued through the remainder of the grant period. After a brief acclimation period, ATF and BPD began sharing information freely about NIBIN leads and CGIC cases. The majority of meeting participants were from ATF, including analysts and agents, but more BPD members began attending the meetings as they continued. BPD CGIC employees and district intelligence detectives attended the meetings and case detectives were always welcome.

Another important aspect of the CGIC implementation in Baltimore was providing feedback to the officers involved in CGIC operations and to the general public. The CGIC Facebook page gave the public program updates, as discussed above. However, providing feedback to BPD officers proved more difficult. Many different channels were explored with some success. First, the CGIC team created a survey that was linked in the CGIC Coordinator and analyst's email signatures. This survey asked what each officer liked or disliked about the program and what they would change. Unfortunately, the survey did not return a high number of responses, but those who were closely involved in the program did respond and provided advice.

Lastly, the CGIC team recognized the services of BPD supervisors, detectives, and patrol officers as they recovered firearms and collected spent shell casings that turned into NIBIN information. Officers were selected for recognition by reading through gun seizure, discharging, or shooting event reports, and finding their excellent work. Each officer was then recognized by letter, signed by the Deputy Chief of CID and the CGIC Coordinator. Officers were also eligible for the ATF NIBIN recognition program and received awards or recognition through that program. The CGIC team also produced a monthly newsletter that was distributed throughout the department to spread awareness of the program and new initiatives. The newsletter included recognition of the officers who received letters, described new initiatives from the last month, and highlighted positive statistics. The Baltimore CGIC team had success with some of these mechanisms but continued to look for additional ways to provide feedback, both to officers and from officers on what was working or not working for them.

Using Social Media and Tips

A unique and critical facet of BPD's CGIC was its initiative to conduct public outreach in the Western district. In addition to the canine canvases discussed previously, CGIC conducted community outreach through social media. CGIC analysts created and updated a Facebook page as the primary venue for communication through social media. Posts generally consisted of information about CGIC operations including guns seized and gun arrests made, as well as community alerts about shooting incidents. The information was pushed out on how to contact



BPD or Metro Crime Stoppers, and how to provide more information about the incidents. The social media activities of CGIC are discussed in more detail in the corresponding section in the process evaluation section of the report.

A tip reference guide was produced with the social media campaign to teach citizens about Metro Crime Stoppers and other avenues to report information. When CGIC began and wanted to implement community outreach, there were conversations with district neighborhood coordination officers to learn what might be beneficial to communities and what was already being done. One topic mentioned was the unease some citizens had with tip lines like Metro Crime Stoppers or even ATF-run firearm hotlines and anonymity. Citizens were concerned that although tip lines promised anonymity, others in their neighborhood could still find out. To quell these fears, a series of informational posts were made to the CGIC Facebook page detailing how anonymous tips were handled. Information was gathered through Metro Crime Stoppers, ATF tip lines, and BPD homicide tip lines to assure citizens that the information they send in would remain confidential. The tip reference guide provided information on all available tip lines in the city as well as email or text capabilities and social media accounts.

In addition to social media, CGIC conducted community outreach through the distribution of business outreach pamphlets to owners of retail establishments in the Western on January 24, 2022 and Southwest on October 13, 2022. These pamphlets were created to increase crime prevention among businesses, provided contact information for Metro Crime Stoppers and described a city-run program that offered grant dollars to improve the façade of businesses that would improve the environment of their store and subsequently deter crime.

Additional Contextual Factors during CGIC

Group Violence Response Strategy

CGIC was not the only program targeting gun violence that was operating in the Western and Southwest districts during this time. Due to the concerns over the amount and severity of gun violence in the Western district, Mayor Scott announced the implementation of the Group Violence Response Strategy (GVRs) as part of the Baltimore City Comprehensive Violence Prevention Plan. GVRs began limited operations in terms of detective strategy meetings in the Western in the winter of 2020. The focused deterrence component of the intervention was launched later in the Western on January 11, 2022. GVRs then expanded the initiative in the Southwest district in December 2022.

GVRs is a focused deterrence program that emphasizes systematically bringing in members of violent groups in the city to deter other members of their group from violence. The GVRs program began by spending several months reviewing all violent crime from the last three years in the Western district. This review was necessary to inform future decisions on which groups to target. The violent crime review led to the creation of the group violence scorecard that scored how many violent incidents in which each group was involved. In the planning phase of GVRs,



the team was relatively small with a captain in the Anti-Crime Section appointed to lead the program, a sergeant, and an analyst. After program implementation, the program gained several detectives and was then able to investigate and enforce program elements.

GVRs required various partnership with several external partners that provided group members with various resources. These partners made up three facets of the program, the community moral voice, outreach and support, and law enforcement. Those from the first two components were responsible for providing resources to group members and support if they chose to step back from the violence. A report conducted by the Crime and Justice Policy Lab at the University of Pennsylvania (2023) provides more detail about GVRs.

For this study, it is important to note that CGIC and GVRs did not operate in isolation. Seeing that both programs are specifically focused on reducing gun violence, CGIC analysts attended GVRs weekly meetings and provided operational intelligence about NIBIN leads connected to fatal and non-fatal shootings in the Western and Southwest districts and engaged with GVRs detectives to recommend follow-up investigation based on these leads. CGIC provided discussions of specific NIBIN leads during many of the meetings in the Western district. However, due to the prominence of this strategy as part of the Mayor's crime reduction strategy, GVRs was staffed at considerably higher levels compared to CGIC. Recently (2023), CGIC was moved to the Anti-Crime Section division within the BPD, which is also where GVRs is housed. In the short time that these programs have been co-located, there have been a number of instances of collaboration and sharing of detectives and other resources between CGIC and GVRs. It is expected that this cooperative arrangement will continue.

COVID-19

The COVID-19 pandemic began in January 2020 and by the end of March, the State of Maryland entered a "lockdown" with mandatory stay-at-home orders across the state. The City of Baltimore began reopening on June 5, 2020 with the state reaching Stage 3 reopening at the beginning of September (Wikipedia, 2023). Additional restrictions were placed during the second wave of COVID-19 infections that November. The COVID-19 state of emergency was lifted on July 1, 2021 (Wikipedia, 2023).

We cannot understate the impact that the COVID-19 pandemic had on the BPD CGIC program. The pandemic started during the planning period for CGIC. BPD was not able to make in-person site visits to other CGIC location during this time. Often these site visits are highly informative and helpful as they provide opportunities for the agency to observe the functioning of CGIC units, ask specific questions about policies and procedures, and increase buy-in by attending personnel.

The CGIC program was initiated during the early stages of the second wave of the pandemic when there were restrictions on remote work for non-essential personnel. Although all BPD personnel are considered essential employees, civilian staff were provided the option to work



remotely several days a week. At times however, civilian staff were strongly encouraged to work remotely full-time for two to three week stretches due to COVID-19 spikes in the city. The City of Baltimore also restricted the size of in-person meetings, which necessitated that GVRS/CGIC weekly meetings were conducted virtually via video conferencing.

George Floyd Protests

Like many other cities, Baltimore experienced mass protests in the aftermath of the murder of George Floyd during his arrest in Minneapolis, MN. Protest events occurred in late May and early June of 2020 at various points throughout the city. At least five separate protest events during this time caused some disruption in city activities during this time.⁸

The Baltimore Police Department had experienced substantial protests after the killing of Freddie Gray in 2015. The consent decree between the BPD and the Department of Justice began shortly after the event and the corresponding protests and mandated that the BPD improve its responses to public protests. In contrast to the protests over the Freddie Gray death that resulted in at least 250 arrests, 20 police injured, and numerous businesses damaged,⁹ the George Floyd protests only resulted in 29 arrests, mostly for burglary (Baltimore Police Department, 2021). Observers have credited both the BPD and protesters with ensuring that the George Floyd protests were much more peaceful than the ones surrounding the death of Freddie Gray.¹⁰

Workforce Turnover and Hiring Difficulties

Turnover is a natural process for police agencies. Officers often retire, seek other employment, or are reassigned. Generally, organizations rely on new recruits or veteran officers coming from other agencies to fill open positions due to turnover. However, BPD has been struggling in recent years to attract new sworn officers to fill these vacancies. This problem has not been limited to sworn officers but has affected civilian positions as well. While there are many contributing factors, some of the more notable issues have been exacerbated by the COVID-19 pandemic. The pandemic accelerated the retirements of a number of near-retirement workers leading to a larger than normal labor shortage across industries. Coupled with this, the labor pool has shrunk due to an abnormally high number of yearly deaths or long-term disabilities due to COVID.

BPD has been hit particularly hard by these factors. According to the 2022 update to the staffing plan, BPD should be employing 2,605 sworn staff and 925 civilian staff given the current calls for service workload. These estimates also include efforts to convert some sworn positions to civilian positions. As of April 30, 2022, BPD was employing 2,262 sworn staff and 504 civilians. This represents a shortfall of 343 sworn and 421 civilian employees (see Baltimore Police Department, 2022). While BPD is actively recruiting additional employees, there are

⁸ See https://en.wikipedia.org/wiki/George_Floyd_protests_in_Maryland

⁹ See https://en.wikipedia.org/wiki/2015_Baltimore_protests

¹⁰ See <https://www.bloomberg.com/news/articles/2020-06-04/why-baltimore-s-george-floyd-protest-is-different>



considerable barriers to meeting this level of staffing, including budgetary authorizations, continued employee attrition, and lower than anticipated trainee hirings (see Baltimore Police Department, 2022). In discussions during a site visit, several officers and commanders commented that the staffing shortages were impacting their operations and plans for the future. Regarding CGIC, the unit experienced difficulties replacing a CGIC coordinator and hiring a CGIC specific detective.

Relationship with the States Attorney's Office

At the beginning of CGIC, the SAO intended to have an analyst co-located at BPD. At the early stages of this implementation, personnel and organizational changes led to the abandonment of the co-located position and the SAO became a silent partner to CGIC. The SAO experienced considerable turnover and the office was in the process of reorganization. Key champions of the CGIC approach within office departed the organization and direct support of CGIC was lost in favor of other initiatives. Further, there were disagreements between BPD and the SAO associated with the decision to decline prosecuting offenders of lower-level offenses in the aftermath of the COVID-19 pandemic. These factors limited the participation of the SAO in CGIC.

In January 2023, a new State's Attorney was elected and reversed some of the decisions made by his predecessor.¹¹ He has expressed interest in CGIC and the use of NIBIN evidence and has directly participated in meetings with the new CGIC detective.

Taken as a whole, this information is helpful to understand the context of the CGIC implementation in the BPD and to understand which parts of the implementation worked well and which parts were less successful. It is important, however, to recognize that CGIC continues to operate and evolve in the BPD, and it is likely that some of the initial challenges faced by BPD will be resolved in later iterations of this program. The next chapter discusses the process evaluation of the CGIC program and highlights some of the important lessons learned from BPD's implementation.

Summary

The information in this section provides important contextual information about the city of Baltimore, BPD, the implementation and structure of CGIC, and the unique challenges experienced by BPD during this implementation. Baltimore is a large, diverse city that has experienced a considerable amount of violent gun crime over the years. While violent crime, and gun crime in particular, has been improving in Baltimore, the levels of violence remain high across the city. One of the responses to this level of violence has been to implement CGIC to

¹¹ Marilyn Mosby was indicted in 2022 on federal charges for perjury (trial pending). She subsequently lost the Democratic primary election to her successor Ivan Bates in July 2022 and remained in office through the end of the year.



enhance the ability of officers to identify and remove active shooters from the community. CGIC was implemented as a multi-agency partnership to improve NIBIN evidence collection and processing and leverage this information for successful identification, arrest, and prosecution of gun offenders. BPD's CGIC was also enhanced by an emphasis on providing community engagement and sharing information about shooting events with the community.

This program was implemented first in the Western district and then followed by the Southwest district. The Mayor's Group Violence Reduction Strategy (GVRS) began operations in both districts around the same time as CGIC as part of Baltimore's comprehensive response to violence across the city. While the CGIC program was successfully implemented, it faced a number of challenges during its operation, including the COVID-19 pandemic, the George Floyd protests, a chronic staffing shortage, and a shift away from CGIC by the State Attorney's Office. This context is vital for understanding how CGIC grew and changed across the implementation period. The next section of the report includes the process evaluation for BPD's CGIC and provides more information about the activities of CGIC, its successes and challenges, and the lessons learned from the program.



Process Evaluation

The BPD implemented CGIC in the Western and Southwest districts from 2020 to 2023. This chapter describes the implementation and includes descriptions of the activities of police and investigators and the challenges confronted by administrators. Further, this process evaluation is helpful for interpreting the results of the impact evaluation in Chapter 4.

For this process evaluation, we asked four major questions:

- What were the activities of the CGIC program?
- What were the measurable successes of CGIC?
- What were the challenges of CGIC?
- What were the lessons learned from CGIC?

To answer these questions, JSS collected a considerable amount of information from BPD regarding the CGIC program. This information included:

- Performance metrics tracked by the BJA Technical Assistance provider, the National Policing Institute;
- Official data collected by BPD on NIBIN leads and weapons seized;
- Brief police officer self-report internet surveys administered in two waves at each division;
- Engagement metrics from the CGIC Facebook page; and
- Collated material from a number of semi-structured interviews, informal discussions, site visits, and monthly meetings.

Each item is reviewed separately and a concluding summary shows how the information is used to answer the aforementioned questions.

Performance Metrics

One of the main sources of data on CGIC activities comes from the performance metrics that were reported by CGIC to NPI on a monthly basis for monitoring the progress of the implementation. This information provides context regarding the activities of CGIC across the implementation period. This information was tracked at the start of the program in the Western and Southwest districts and did not provide any pre-implementation information.

The first performance metric examined in Figure 1 is the ballistics evidence entered into NIBIN across the department (blue line). BPD consistently employed NIBIN since the beginning of the project and maintained a monthly average of 190 entries across the study period. This average includes an initial jump from about 150 to 200 entries starting around May 2021 and persisted until October 2022. This high level of NIBIN submissions is not surprising as BPD's firearms analysis unit was participating in the NIBIN program prior to the start of CGIC and has touted thorough and quick NIBIN turnarounds as a performance indicator of the unit.

The second metric presented in Figure 1 is the number of gun test fires for NIBIN ballistics entry (grey line). BPD averaged around 161 test fires per month. The number of test fires is consistent from 2021 through the end of 2022 as the points considerably lower than the trend are followed by points considerably higher than the trend (suggesting that the firearms unit was experiencing a slight backlog). There is, however, a considerable drop in the number of test fires at the beginning of 2023. This period coincided with the closure and refurbishment of the firearms test fire station and the number of test fires have not yet returned to pre-closure levels.

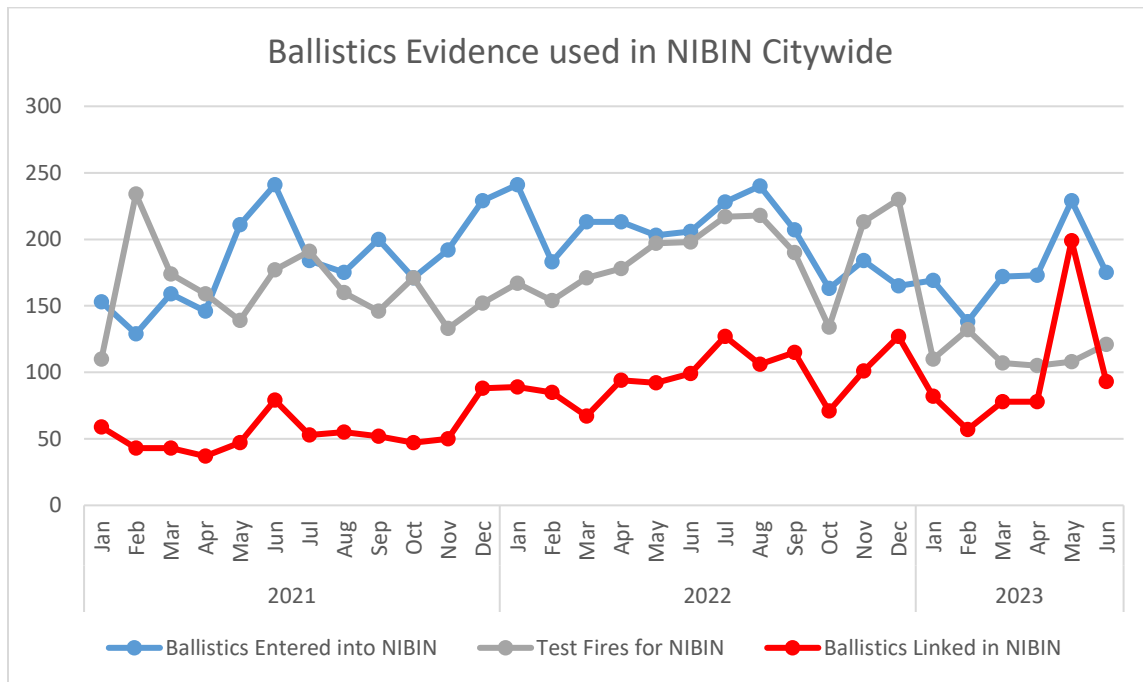


Figure 1. Citywide Ballistics Evidence Entered into NIBIN, January 2021 – June 2023.

The final metric presented in Figure 1 is the number of ballistics entries into NIBIN that were linked to other incidents (red line). Importantly, the links described here should not be interpreted as a percentage of the submissions as the metrics were provided as counts and there may be delays that misalign the monthly submissions and monthly links. On average, approximately 80 entries per month resulted in linkages with crime guns. There was a slight increase in the number of links beginning in December 2021. There is also an aberrant data point in May 2023 representing nearly double the average number of links, but this is likely to be a reporting error as the subsequent month appears to return near the running average.

Figure 2 presents the metric for the number of crime guns recovered by BPD each month. The first metric (blue line) shows the number of crime guns recovered citywide. As with prior metrics, this trend appears stable but slightly increasing until February 2023. This drop off likely represents the backlog of crime guns that were unable to be test fired at that time. We suspect

that these guns were not appearing in the data as data entry was delayed due to the delay in test fires. The second metric in Figure 2 is the citywide number of crime guns linked to other crimes using NIBIN (red line). About 20 to 30 guns are linked per month, with the period between June 2022 and December 2022 resulting in a higher number of linkages at 30 to 50 per month.

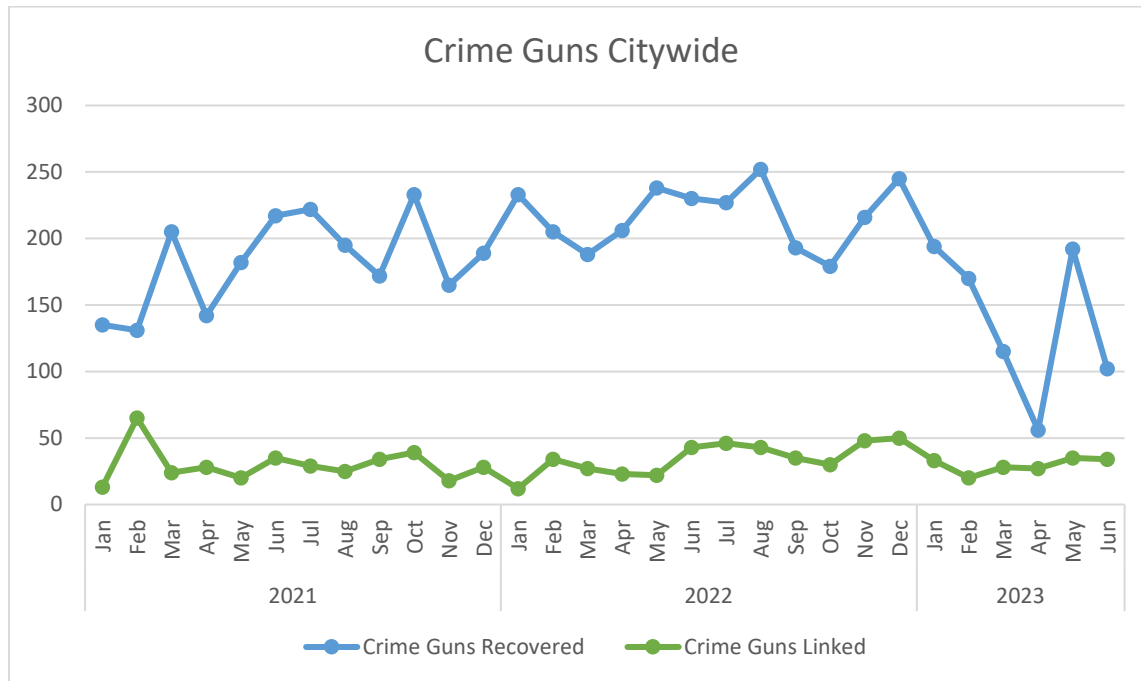


Figure 2. Citywide Crime Guns Recovered, January 2021 – June 2023.

Citywide eTrace submissions (blue line) and hits (red line) are presented in Figure 3. Baltimore averaged approximately 189 eTrace submissions during the observational period. The trend in submissions is highly variable with a low of 53 submissions in September 2021 and a high of 317 in May 2023. The trend in eTrace hits appears to follow that of eTrace submissions with an average of approximately 120 hits per month. There was considerable variability in the trend with a low of 50 hits in September 2021 and a high of 265 in May 2023.

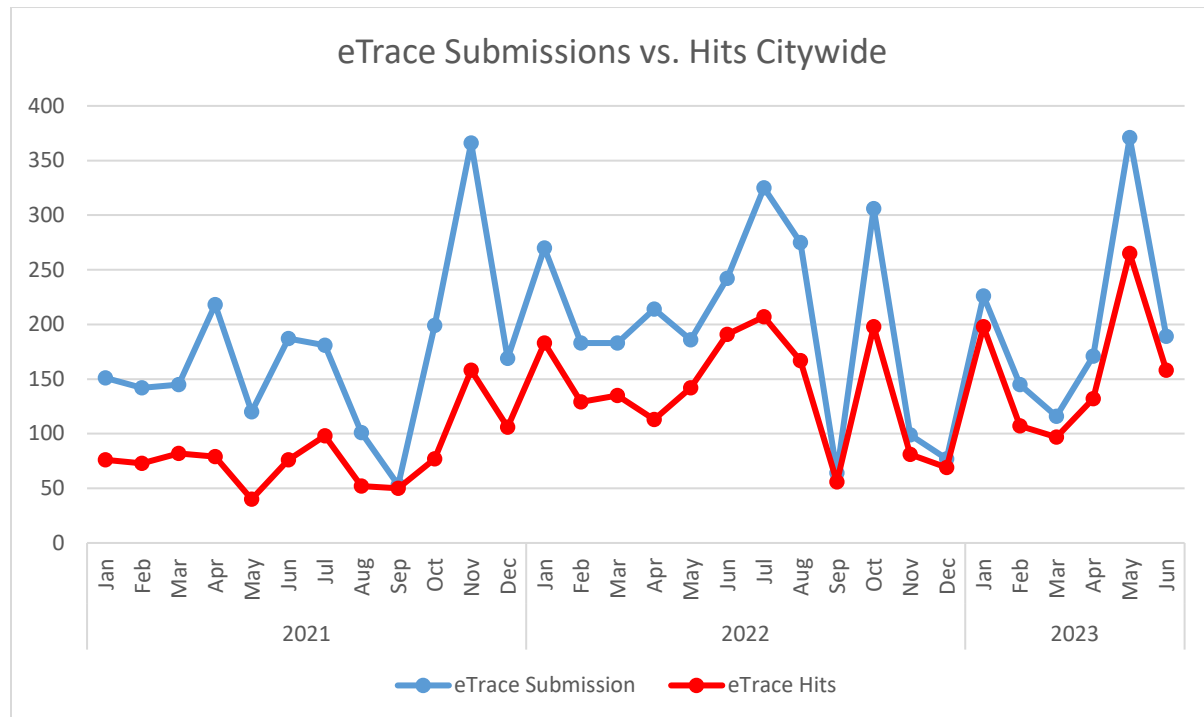


Figure 3. Citywide eTrace Submissions and Hits, January 2021 – June 2023.

Figure 4 presents the number of ballistics linked in the Western (blue line) and the Southwest (red line) during their implementation of CGIC. The Western district averaged approximately 13 links per month and accounted for about 15.6 percent of citywide ballistics links during that time. The Southwest district averaged about 14 links per month and accounted for about 13.8 percent of citywide links during its operation. Importantly, the trend does not suggest that there was a drop off in links in the Western when the Southwest CGIC began operating. This means that there were no capacity issues with processing of ballistics evidence – in fact the Western average appeared to increase during this time. There also appears to be a drop in the number of links in February for the Southwest district.

Figure 5 shows the number of crime guns linked in the Western (blue line) and Southwest (red line) districts throughout their CGIC implementations. The Western district averaged around five crime guns linked per month or 16 percent of the total citywide crime guns linked over this period. Starting in June 2022, the Southwest district also averaged about five crime guns linked per month or 12.7 percent of the citywide crime guns linked over this period. There is a substantial drop in the number of links in both districts in April 2023 corresponding to the firearms range refurbishment.

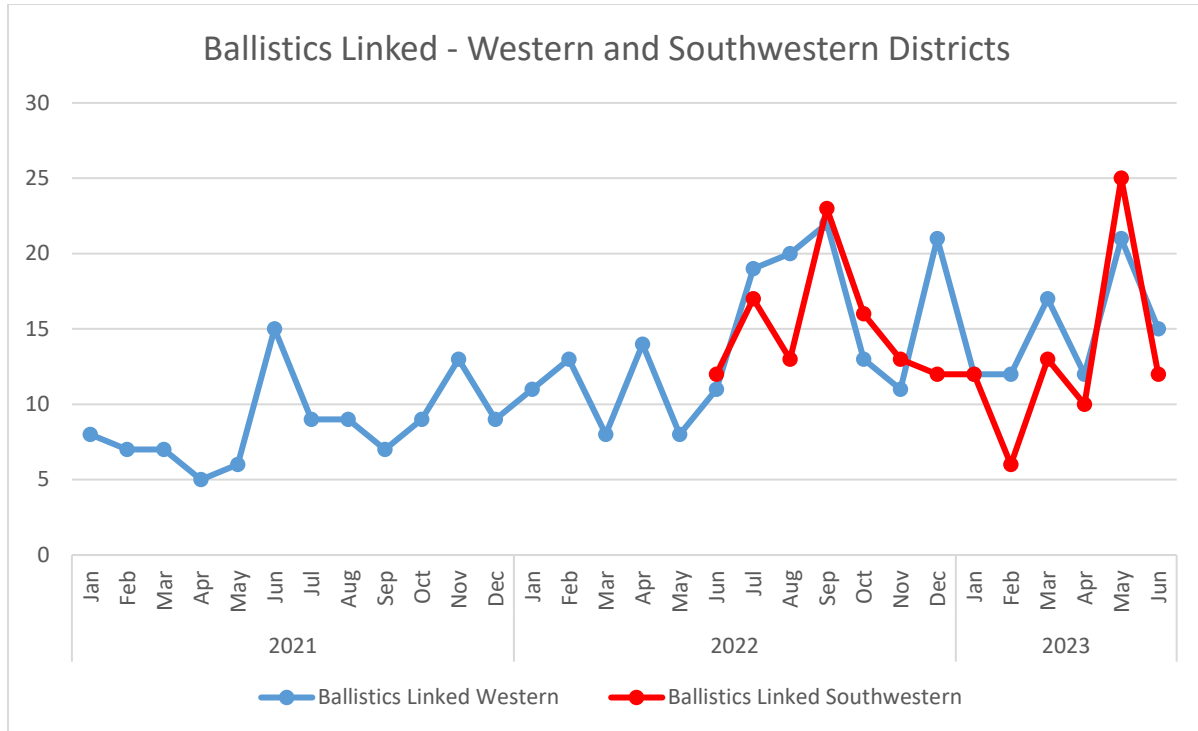


Figure 4. Western and Southwest Districts Ballistics Linked, January 2021 – June 2023.

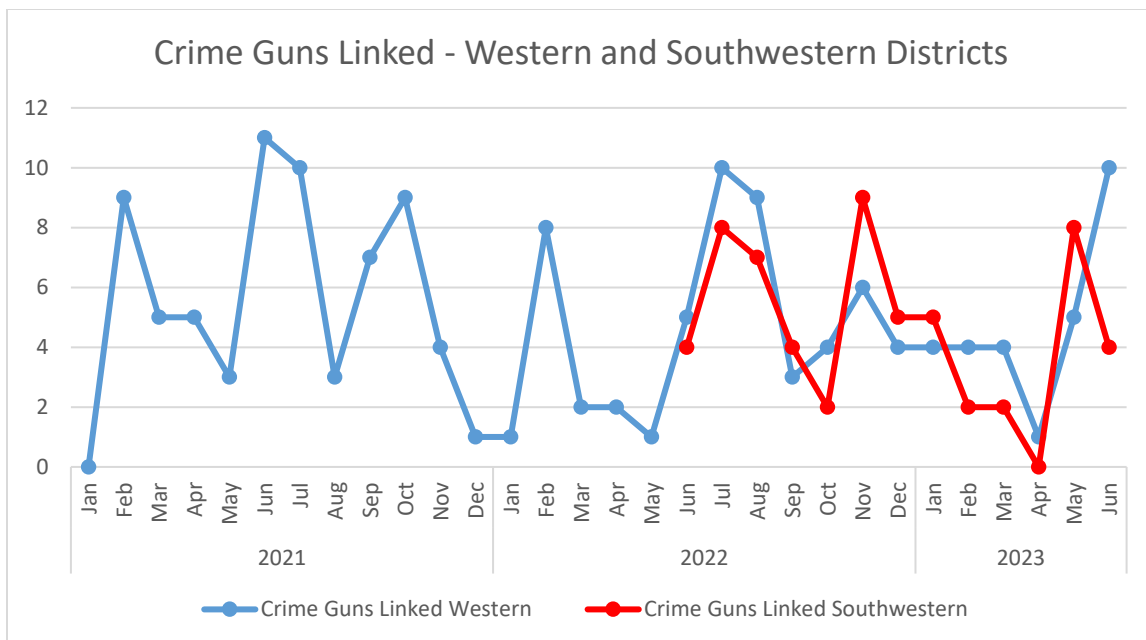


Figure 5. Western and Southwest Districts Crime Guns Linked, January 2021 – June 2023.

The number of monthly trainings conducted by CGIC personnel is presented in Figure 6. The main CGIC trainings occurred in two main waves. The first was in January and February 2021

and corresponded to the implementation of CGIC in the Western district. The second occurred in June 2022 with the implementation of CGIC in the Southwest district. In 2023, CGIC conducted refresher trainings to improve officer understanding and retention of CGIC procedures.

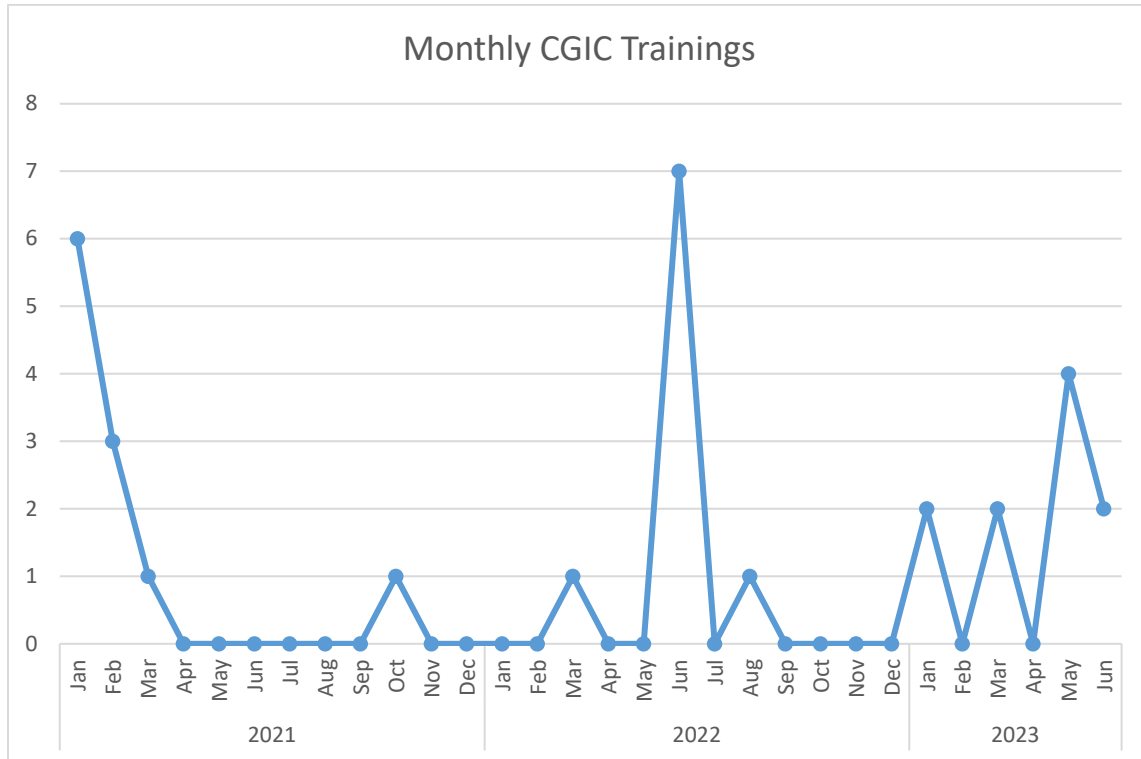


Figure 6. Training Sessions by CGIC Personnel, January 2021 – June 2023.

NIBIN Data

A second important source of information about the activity of CGIC comes from the NIBIN data provided by the ATF. In 30 months, January 1, 2021, to June 30, 2023, the BPD firearms crime lab produced 2,753 NIBIN leads. This number correlates with the number of lead reports produced in that time. A lead report is created when a new incident links to an existing NIBIN lead or incident. The NIBIN lead numbers are approximately the amount of incidents in which each firearm is involved, although consideration needs to be made to account for each original NIBIN lead, as they require two incidents. Figure 7 presents the number of lead reports generated by the BPD since the start of CGIC.

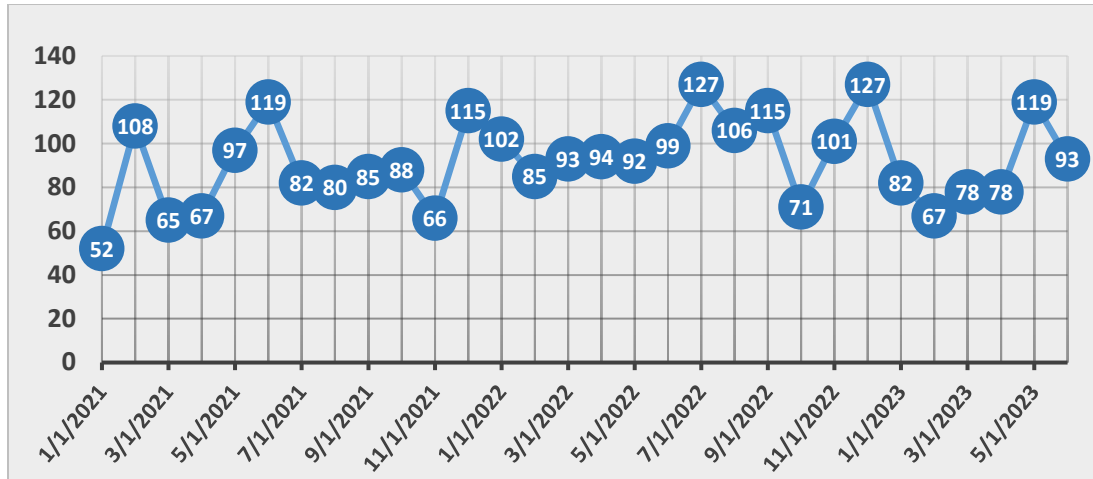


Figure 7. Total Baltimore NIBIN Leads, Jan 2021 to Jun 2023.

While this number depicts the work being produced by the lab and the volume of leads each year, NIBIN data can be summarized in an alternate way. In the same 30 months, BPD produced or updated 1,944 unique crime gun numbers. Each crime gun number correlates with a unique firearm. *This number means 1,944 firearms were active at least once in that time.* The number of unique leads produced by BPD is presented in Figure 8.

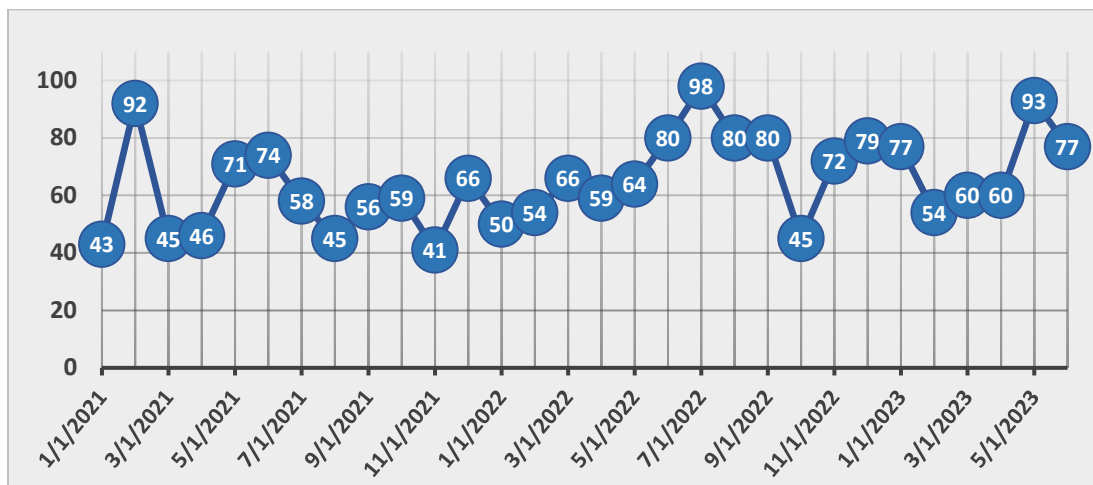


Figure 8. Total Unique Baltimore NIBIN Leads, Jan 2021 to Jun 2023.

The BPD CGIC program was piloted in the Western district, starting in January 2021, and in the Southwest district, starting in October 2022. As shown in Figure 9, the Western district was a part of 726 NIBIN leads during the project period, meaning at least one incident in the lead occurred in the Western district. Similarly, as shown in Figure 10, the Southwest district was a part of 685 NIBIN leads. The two pilot districts make up 51% of NIBIN leads.

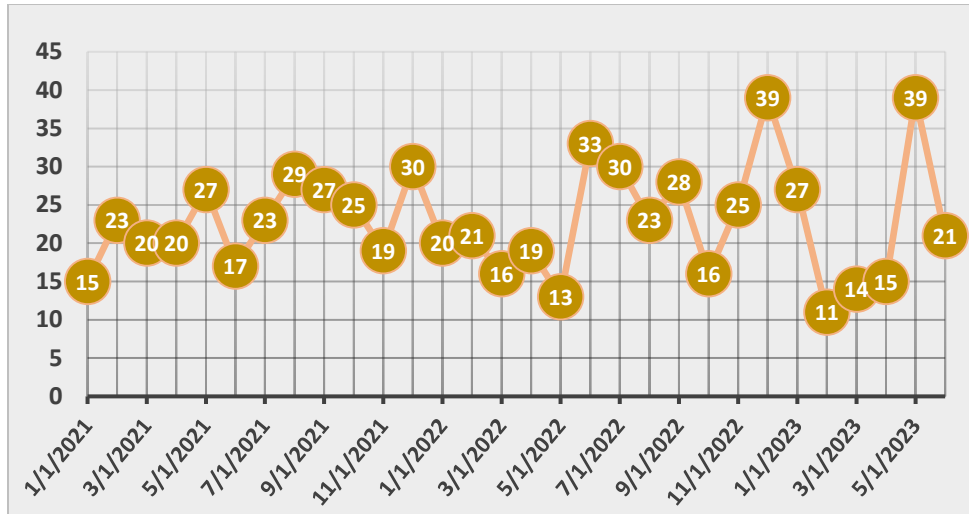


Figure 9. BPD Western District NIBIN Leads, January 2021 to June 2023.

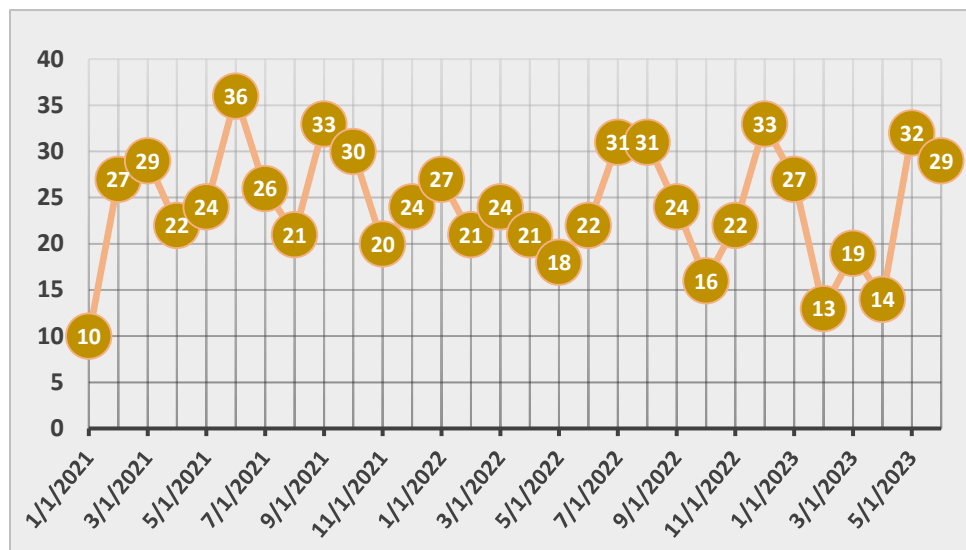


Figure 10. BPD Southwest District NIBIN Leads, January 2021 to June 2023.

An analysis was conducted on all 2,753 NIBIN leads recorded in the pilot/program period. As part of the CGIC program, leads were triaged as Tier 1, Tier 2, or Tier 3. These tiers are designed in a way that each tier should have less leads than the one before going from Tier 3 to Tier 1. Figure 11 shows that Baltimore's NIBIN leads follow the suggested pattern. BPD and ATF triaged 1,779 NIBIN leads as Tier 3, 773 NIBIN leads as Tier 2, and 193 NIBIN leads as Tier 1.

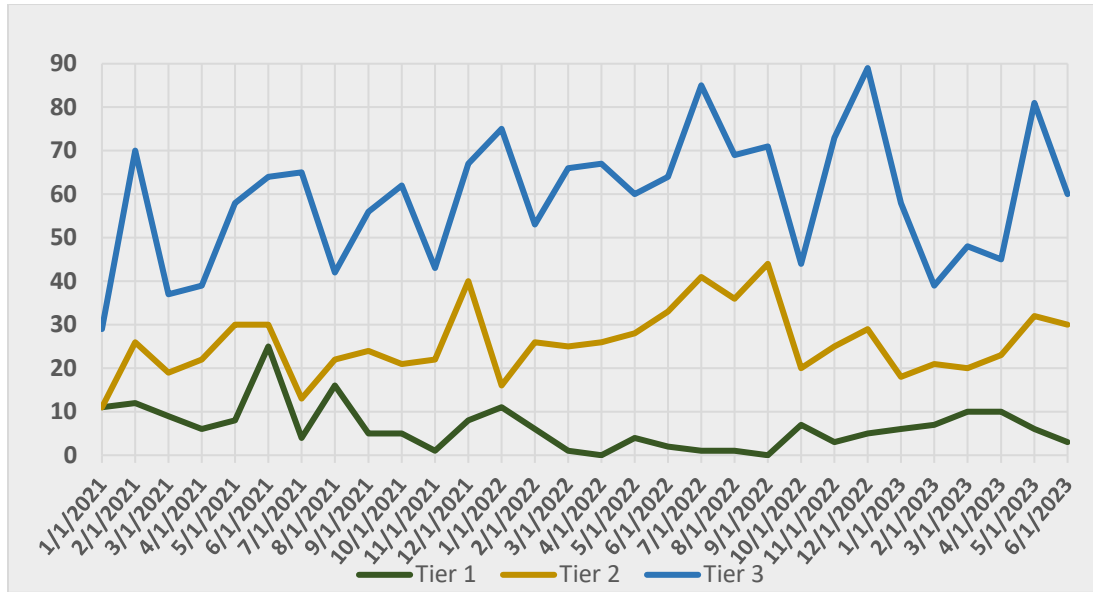


Figure 11. BPD NIBIN Leads by Tier.

Additionally, JSS looked at the number of incidents per NIBIN lead in Baltimore. As seen in Figure 12, the majority of NIBIN leads have only two incidents. However, it is worth noting that every NIBIN lead starts with two linked incidents, so if a lead later had more incidents correlated, there would still be an existing entry in the database that would not be deleted. Seven NIBIN leads had nine or more incidents linked through NIBIN with the most incidents being 14.

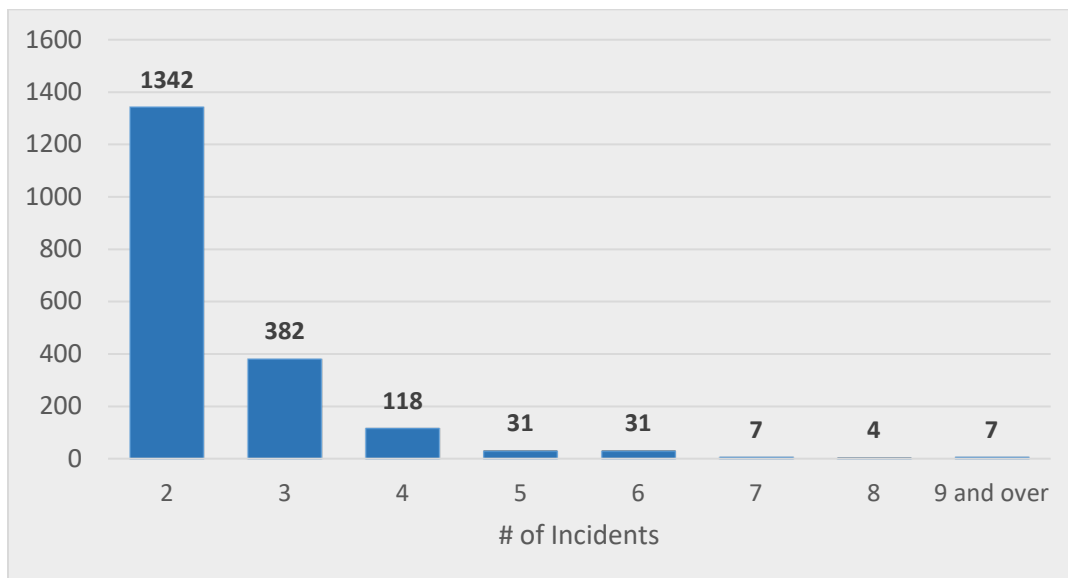


Figure 12. BPD Incidents per NIBIN Lead.

Figure 13 shows the NIBIN leads per offense over the study period. Out of the 2,743 NIBIN leads produced by BPD in 30 months, 868 involved incidents that were classified as homicides, 1,425 were classified as non-fatal shootings, and 753 were classified as handgun violations (handguns were recovered). The highest number of homicides, non-fatal shootings, and handgun violations with NIBIN leads were in 2022.

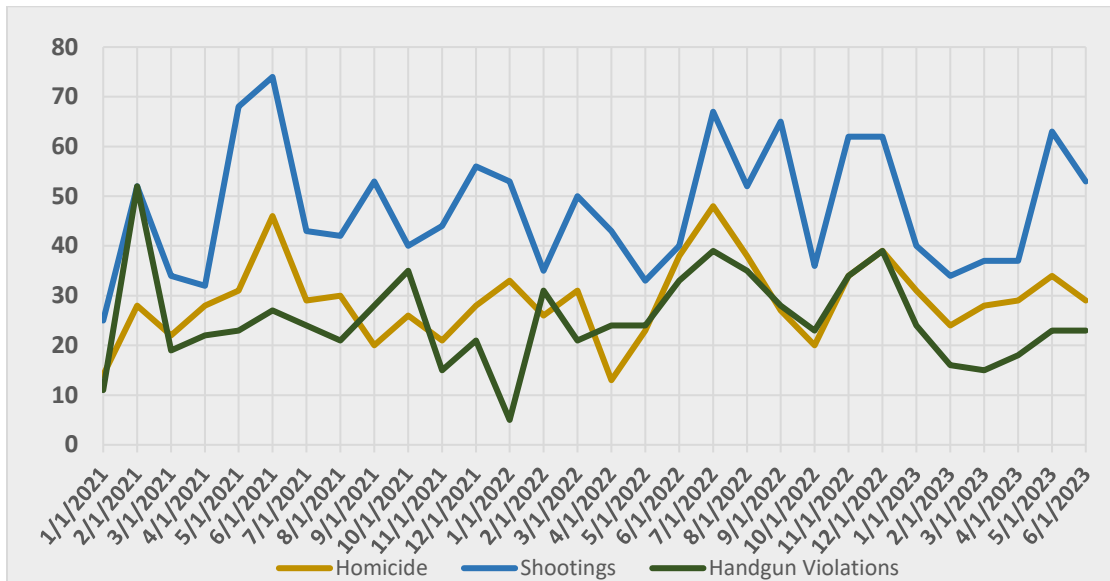


Figure 13. BPD NIBIN leads by Offense.

A number of Baltimore NIBIN leads link to incidents that occurred outside the city boundaries. Figure 14 shows the count of BPD NIBIN incidents linked to incidents involving other agencies. Baltimore County shares the most leads with BPD as 150 incidents correlated with various city cases. Washington D.C. Metro area shares the next most leads with 60 incidents correlating city NIBIN cases. Prince Georges County and Anne Arundel County also share NIBIN leads with Baltimore but at a smaller number, 23 and 27, respectively.

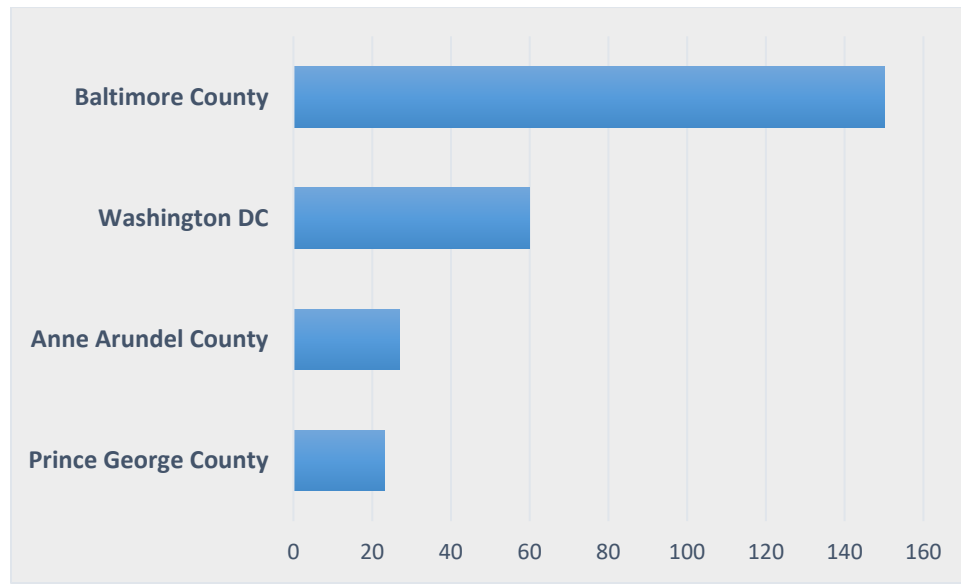


Figure 14. Top Outside Agencies Involved in BPD NIBIN Leads.

Weapons Recovered

Another data source associated with CGIC operations is the type and number of firearms recovered in the Western and Southwest districts. Firearm seizure records changed between 2021 and 2022. For data from 2017-2021, firearm types were not listed, but were included in later data using two letter designations. The first letter denoted if the firearm was a pistol, rifle, or shotgun with the second letter describing the type of each firearm. Because of the importance of this information, the firearm type variable was coded into 2017-2021 data based on available information. Gun types were based on the listed caliber of the seized gun, then the make and model of the gun. Gun types included semi-automatic pistol, revolver, rifle, shotgun, and other.

Figure 15 shows the guns seized by month in the Western district from 2017 through May 2023. The number of firearms seized in the Western varies considerably from less than five to nearly 35 per month across the series. There is a low point in July 2020 that occurred during the COVID-19 pandemic. In general, the number of guns seized appears slightly higher after the pandemic (during CGIC) than before the pandemic. This supports the contention that more guns were being seized due to CGIC, but the difference is neither considerable nor consistent. Semi-automatic pistols constitute the highest proportion of guns seized in the Western, far outpacing the seizures of revolvers, shotguns, and rifles (coded as other here).

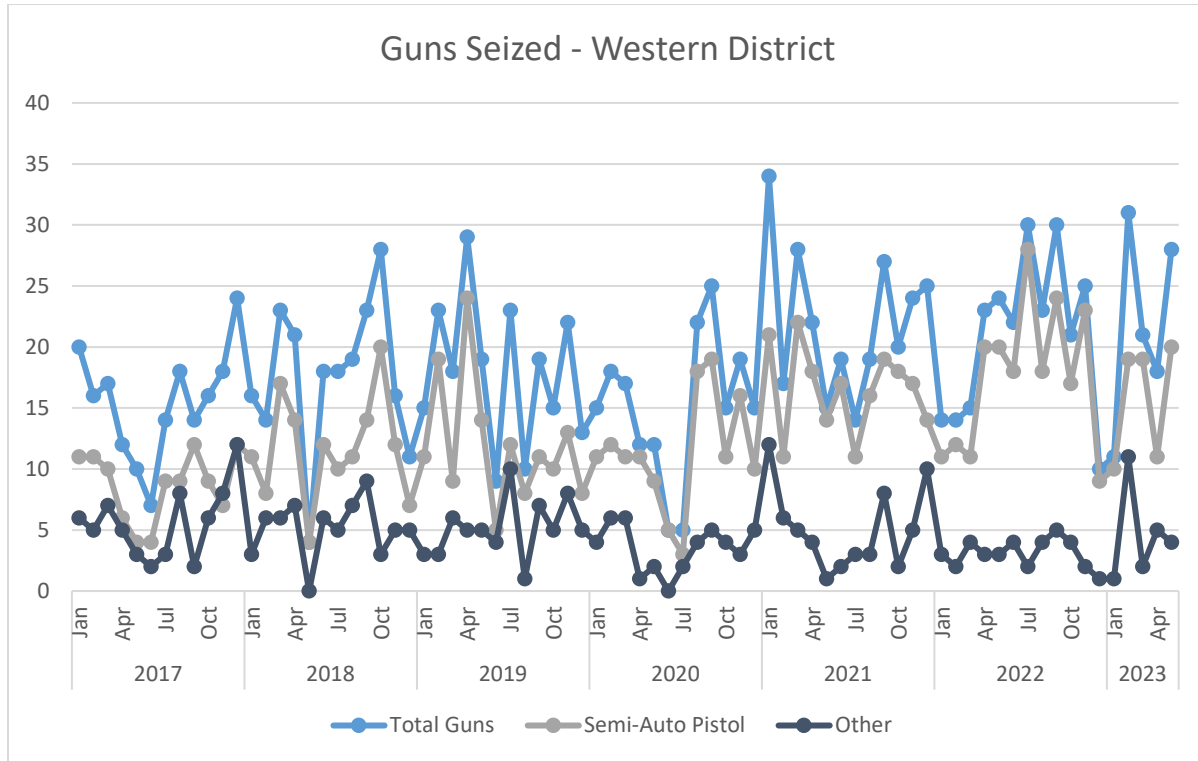


Figure 15. Guns Seized by Month and Type in the Western District.

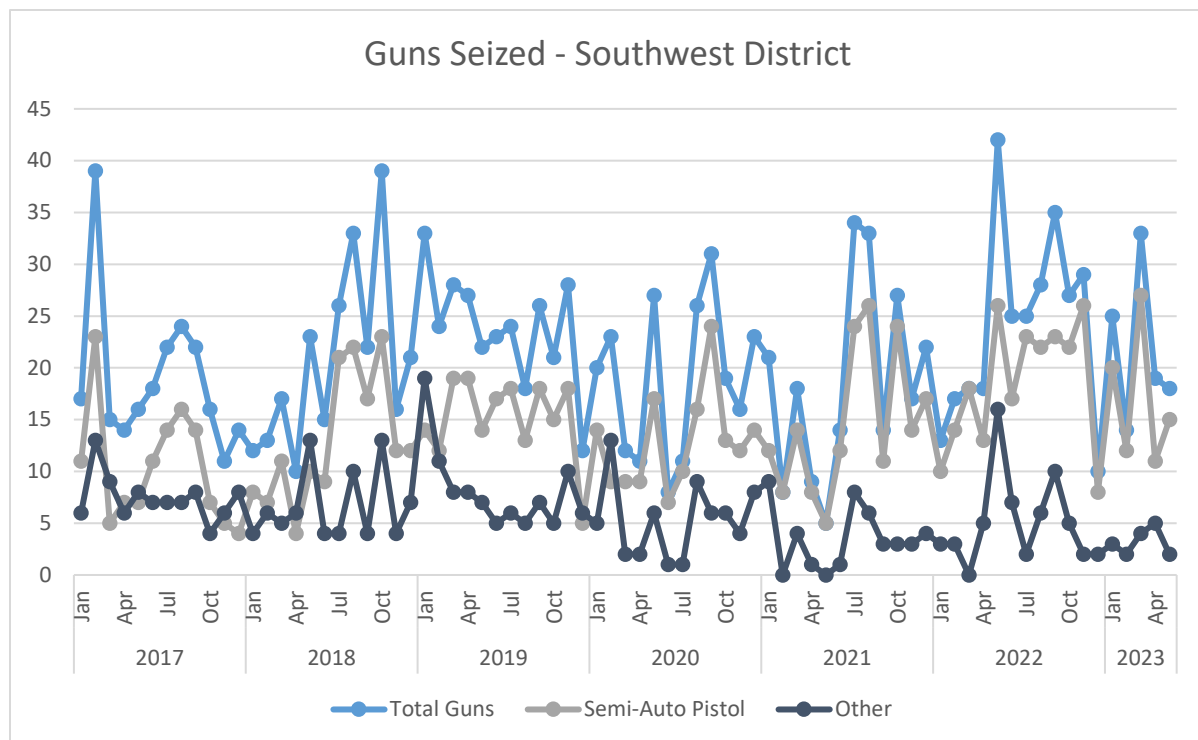


Figure 16. Guns Seized by Month and Type in the Southwest District.



Figure 16 shows the number of guns seized by month in the Southwest district. Again, the series shows considerable variability ranging from just over five to over 40 per month. A similar low point is observed around July 2020 coinciding with the COVID-19 pandemic. There also appears to be an increase associated with the start of CGIC in the Southwest, but again this is neither dramatic nor consistent. While semi-automatic handguns remain the most frequently seized type of firearm, this difference between these weapons and other firearm types is not as pronounced as observed in the Western.

In sum, the weapons seized data show that Baltimore has consistently taken a high number of weapons from the Western and Southwest districts. For both sites, these seized weapons tend to be semi-automatic pistols, rather than shotguns, revolvers, or rifles. There are some indications that the number of firearms seized increased after CGIC started, but the difference was not large. While CGIC may have resulted in more weapons seized, the differences were likely not enough to reduce crime gun availability. Importantly, it is still possible to achieve decreases in gun availability through other pathways, including seizing higher use guns, disrupting trafficking networks, and increasing deterrence for gun purchasing.

Officer Surveys

To assess officer awareness and support of CGIC, JSS conducted four self-administered surveys using the Qualtrics platform. Qualtrics allows for the completion of custom surveys through a web application or mobile device. Officers were surveyed from the Western and Southwest separately over two waves. The first wave of surveys in each district had a general distribution across the divisions encompassing patrol officers, detectives, supervisors, and other personnel identified by the CGIC coordinator. The second wave of surveys in each district was restricted to officers who responded from the first wave and were not reassigned to other divisions.

Wave 1 of the Western district survey was conducted between November 17, 2021, and February 22, 2022. The initial invitation was sent out via email and contained a personalized link for each officer, 110 total. Four reminders were sent via email as well. Due to low initial response rates, an additional method of distribution using the PowerDMS platform was adopted. In total, 20 officers completed the survey via email notifications and 25 officers completed the survey via PowerDMS invitation. Overall, approximately 41 percent of officers receiving the initial invitation responded to the survey. About 46.7 percent of the respondents were line officers, but a number of detectives (20 percent) and supervisors (33.3 percent) responded. Most responding officers (33.3 percent) reported working at BPD for between 5 and 10 years, but several officers reported working at BPD for less than 5 years (26.7 percent) or between 10 and 20 years (17.8 percent). A number of officers also reported working at BPD for over 20 years (22.1 percent).

Wave 2 of the Western district survey was conducted between February 8, 2023, and February 23, 2023. Surveys were distributed strictly to officers who completed the Wave 1 survey. Utilizing lessons learned in Wave 1, the initial survey invitation was sent via PowerDMS with an



anonymous survey link. Sixteen officers completed the Wave 2 survey, 35.6 percent of officers who received the initial invitation. Fifty percent of respondents were line officers, 12.5 percent were detectives and 37.5 percent were supervisors. Most responding officers reported working at BPD between 10 to 20 years (31.3 percent) or over 20 years (31.3 percent). A number of officers reported working at BPD for less than 5 years (12.5 percent) and several reported working at BPD between 5 and 10 years (25%).

Wave 1 of the Southwest district survey was conducted between May 16, 2022, and June 27, 2022. Invitations were sent through both email and PowerDMS. A list of 90 officers were included in the initial distribution. Three officers completed the survey using personalized email link and 40 officers completed the survey through PowerDMS link, totaling 43 surveys. Approximately 47.8 percent of invited officers responded to the survey. About 55.8 percent of the respondents were line officers, but a number of detectives (14 percent) and supervisors (30.2 percent) responded. Most responding officers (39.5 percent) reported working at BPD for less than 5 years, but a considerable number of officers reported working at BPD for between 10 and 20 years (37.2 percent). A number of officers reported working at BPD for between 5 and 10 years (11.6 percent), and several reported working at BPD over 20 years (11.6 percent).

Wave 2 of the Southwest district survey was conducted between June 14, 2023, and July 21, 2023. Surveys were disseminated strictly to officers who completed the Wave 1 survey. Survey invitations were sent through PowerDMS with an anonymous survey link. Eight officers completed the Wave 2 survey, 18.6 percent of officers who received the initial invitation. Most officers who completed the survey were either detectives (37.5 percent) or supervisors (37.5 percent). About 25 percent of respondents were line officers. Most responding officers reported working at BPD for either 10 to 20 years (37.5 percent) or over 20 years (37.5 percent). Several officers reported working at BPD for less than 5 years (25 percent).

Western District Findings

Figure 17 shows officer familiarity with the CGIC program in the Western District of the Baltimore Police Department in both Wave 1 and Wave 2 of the survey. The most common response in both Wave 1 (28.9 percent) and Wave 2 (50 percent) suggested that officers were familiar with CGIC but were not directly involved in cases where CGIC was involved. While the most common response was the same in both waves, 21.1 percent more officers chose the above listed option. In Wave 1, the second most common response suggested officers had heard of the program but were not familiar with what it does (24.4 percent). In Wave 2, the second most common response was that officers work with CGIC routinely (18.8 percent), a 7.7 percent increase from Wave 1. Approximately 11 percent more officers in Wave 1 had not heard of CGIC before the survey when compared to Wave 2.

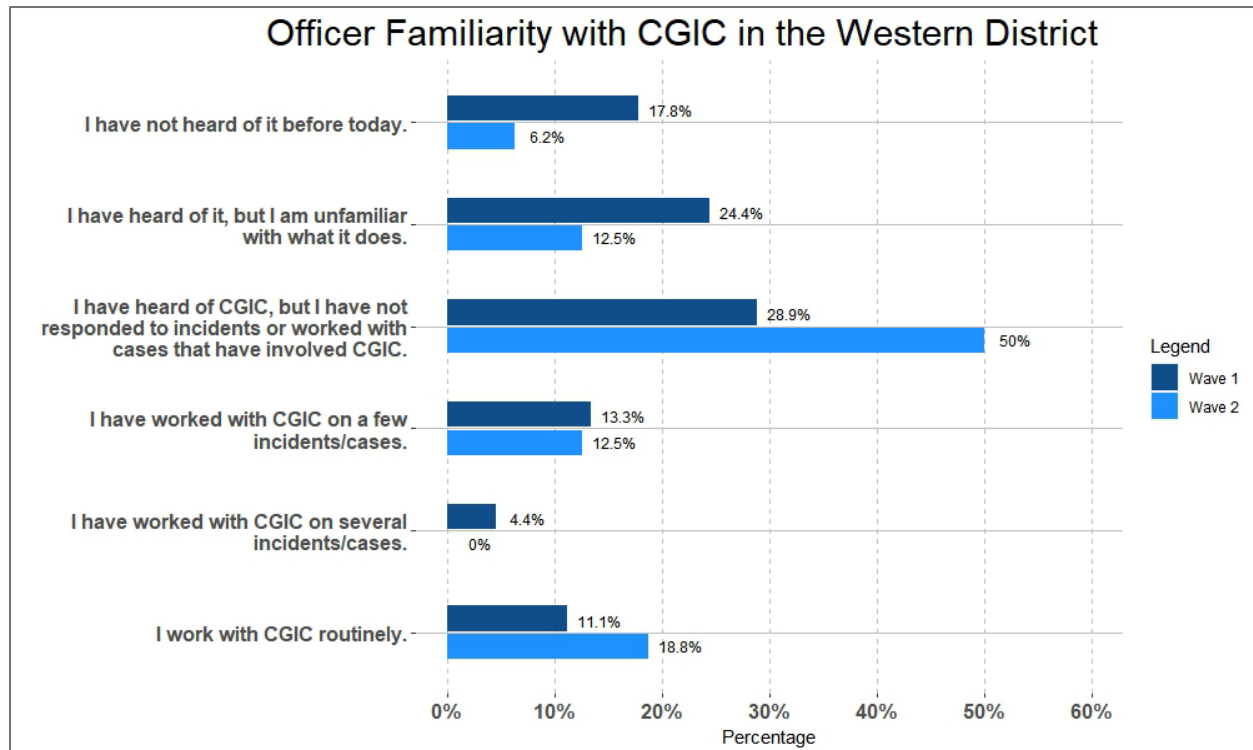


Figure 17. Officer Familiarity with CGIC Wave 1 and 2 in Western District

Of the 37 officers who had previously heard of CGIC in Wave 1, three officers chose more than one method when asked how they were informed about CGIC. All three officers chose a roll call briefing with Western district command as well as directly informed by a supervisor, BPD newsletter or pamphlet, informal conversations with other officers, or working on a CGIC-related case. Of the remaining 34 officers, 32.4 percent of them responded that they were informed about CGIC during a roll call notification. Additionally, 26.5 percent of respondents reported hearing about CGIC during informal conversations with other officers and 14.7 percent learned about CGIC by working on CGIC related cases. Few officers were informed about CGIC by their supervisor (8.8 percent), a BPD newsletter or pamphlet (2.9 percent), or a newspaper or online publication (2.9 percent).

Of the 15 officers who had previously heard of CGIC in Wave 2, three officers chose more than one method when asked how they were informed about CGIC, one officer chose four methods while two officers chose two methods. These officers stated they were informed by their supervisor, by a roll call notification, by a BPD newsletter or pamphlet, and by informal conversations with other officers. Out of the remaining 12 officers, 41.7 percent of them responded that they were informed about CGIC during a roll call notification. Additionally, 25 percent of respondents reported hearing about CGIC by working on a CGIC related case or incident. Few officers were informed about CGIC by their supervisor (8.3 percent), a BPD

newsletter or pamphlet (8.3 percent), BPD social media post (8.3 percent), or an informal conversation with other officers (8.3 percent).

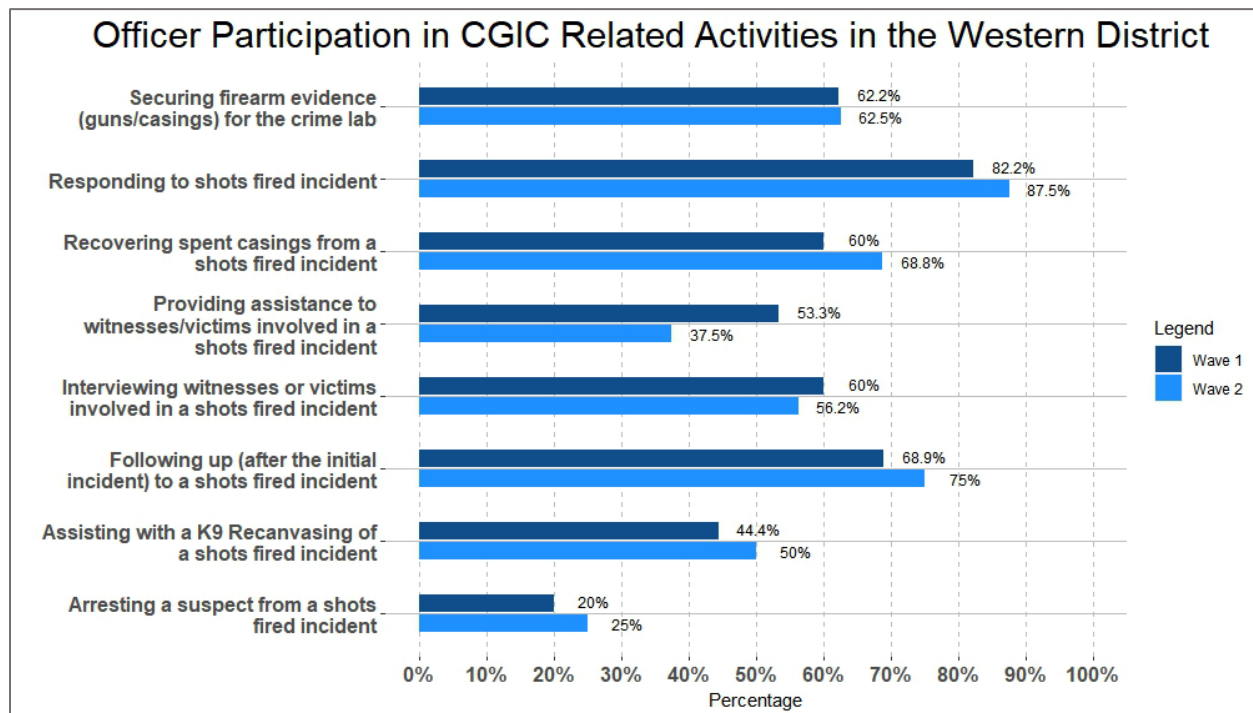


Figure 18. Western District Officers Self-Reported Familiarity with CGIC.

Officers were asked whether they participated in CGIC-related activities over the previous quarter. These results are presented in Figure 18. In Waves 1 and 2, nearly all officers reported responding to a shots fired incident (82.2 percent and 87.5 percent), while the majority of officers reported following up to a shots fired incident (68.9 percent and 75 percent). In most instances, more officers reported participating in each CGIC activity in Wave 2 when compared to Wave 1, with the exception of providing assistance to witnesses and victims involved in a shots fired incident and interviewing witnesses or victims involved in a shots fired incident. However, this difference may be due to the smaller number of officers responding to Wave 2 of the survey. All responding officers in both waves of results reported participating in at least one of the listed activities over the previous quarter.

Southwest District Findings

Figure 19 shows officer familiarity with CGIC in the Southwest district in both Wave 1 and Wave 2 surveys. The most common response in Wave 1 (46.5 percent) suggested that officers were familiar with CGIC but not directly involved in CGIC cases. In Wave 2, the most common response suggested that officers work with CGIC routinely (37.5 percent). In Waves 1 and 2, the second most common response suggested officers had heard of the program but were not familiar with what it does (23.3 percent and 25 percent). Approximately 11 percent more officers in

Wave 1 had not heard of CGIC before the survey when compared to Wave 2. The results show a clear shift in familiarization of the CGIC program between Waves 1 and 2 of the survey, even if officers have not directly worked with CGIC.

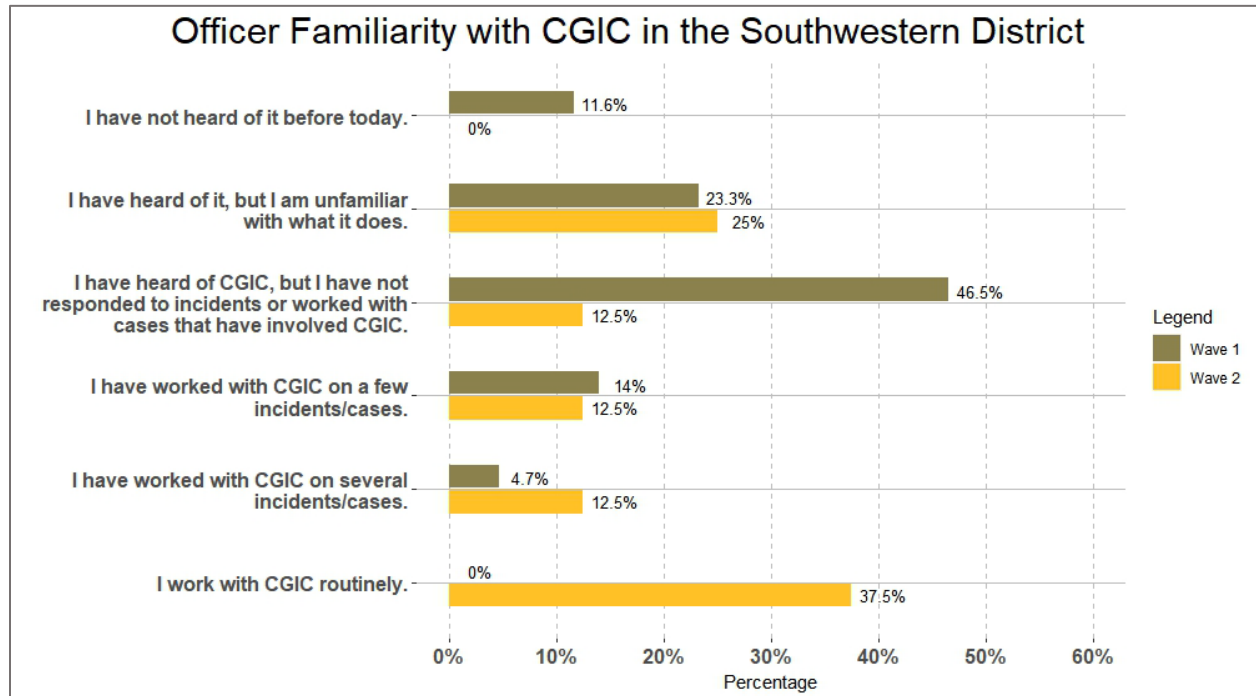


Figure 19. Officer Familiarity with CGIC Wave 1 and 2 in Southwest District.

Of the 38 officers who had previously heard of CGIC in Wave 1, three officers chose more than one method when asked how they were informed about CGIC. All three officers chose informal conversations with other officers as well as one of the following, directly informed by supervisor, roll call notification, or worked on a CGIC related case or incident. Of the remaining 35 officers, 48.6 percent responded that they were informed of CGIC by informal conversations with other officers. Additionally, 20 percent of officers responded they learned about CGIC through a roll call notification. Few officers were informed about CGIC by their supervisor (8.6 percent) or by a BPD newsletter or pamphlet (8.6 percent). Of the 8 officers who had previously heard of CGIC in Wave 2, 50 percent of them responded they were informed of CGIC through working on a CGIC related case or incident. Other officers reported they learned of CGIC through a BPD newsletter or pamphlet (25 percent).

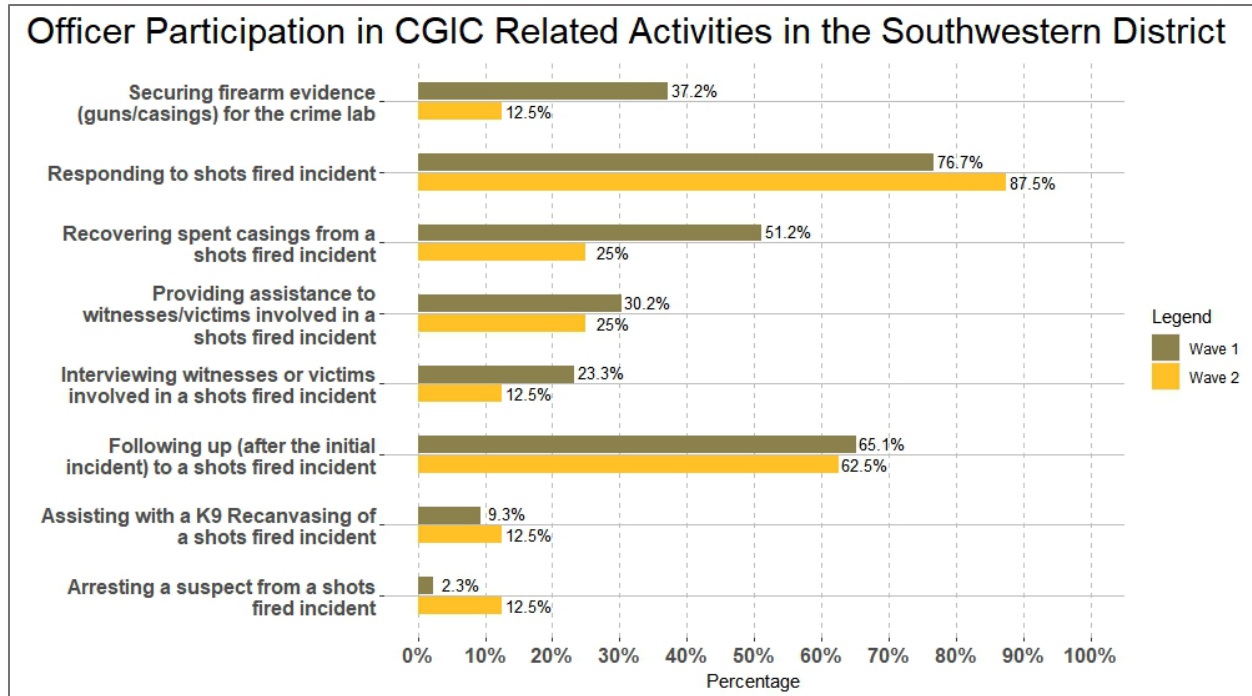


Figure 20. Southwest District Officers Self-Reported Familiarity with CGIC.

Officers were asked whether they participated in activities over the previous quarter that may be related to CGIC. These results are presented in Figure 20. Officers reported participating in three activities at a higher rate in Wave 2 than they did in Wave 1. These activities were: arresting a suspect from a shots fired incident, assisting with a K9 recanvassing of a shots fired incident, and responding to a shots fired incident. The five other listed activities did not show an increase in Wave 2 compared to Wave 1. All responding officers in both waves of results reported participating in at least one of the listed activities over the previous quarter.

Paired T-Test Results

We also examined the differences in officer responses between Wave 1 and Wave 2. A matched pairs T-test was conducted on the 15 respondents from the Western District surveys and 7 respondents from the Southwest district surveys that responded in both waves. Out of eight questions that were available for analysis, only one returned a statistically significant change between Waves 1 and 2. Officers were asked how familiar they are with BPD's Crime Gun Intelligence Center. In both the Western and Southwest districts, results showed a significant difference from Wave 1 to Wave 2. These results support the conclusion that officers in both target districts are more familiar with CGIC in Wave 2 than they were in Wave 1.

CGIC Social Media Presence

One of the innovative strategies that BPD CGIC employed is leveraging social media to communicate the activities of CGIC with the Baltimore community. BPD in general has an

extensive social media presence that spans a number of platforms, including Facebook, Twitter, Instagram, YouTube, LinkedIn, and other platforms. Since the beginning of the program, CGIC has developed and maintained a separate Facebook page that is associated with the BPD main page and the Western district page. Since the bulk of CGIC social media presence is on Facebook, we will only focus this platform when discussing CGIC's use of social media.

CGIC personnel regularly post information regarding gun-related incidents, gun seizures and gun-related arrests to the page. This page appears well received by the community and experienced considerable growth throughout the evaluation period. The CGIC page often provides updates about CGIC actions and pictures of recovered weapons. Figure 21 shows an example of a post from the CGIC page about a recovered weapon.



On May 11, 2022, officers were conducting a car stop for a traffic infraction. Officers noticed a strong smell of marijuana emanating from the vehicle, which prompted a car search. During the search of the vehicle, officers found a Remington .45 caliber handgun as well as a large amount of CDS. The suspect was prohibited from owning firearms.
Great job WD!

Figure 21. Example of Weapon Recovery Post.

In addition, the CGIC page also provided information about shooting- and weapons-related events to the community. An example of these posts is provided in Figure 22. These posts include the time and date of the incident as well as some details about the incident. These posts also include BPD contact information for individuals with knowledge about the incident. For individuals who wish to remain anonymous, Metro Crime Stoppers contact information is provided. These two types of posts are the most common types of posts by CGIC.



Figure 22. Example of Shooting Event Notification.

The CGIC page also posted a series called the “K-9 Spotlight” that provided pictures and information about the dogs in the K9 unit. These posts included a fact sheet about each dog as well as a picture. This series of posts for dogs in the Western district was posted in December 2021 through January 2022. Figure 23 shows an example of one of the K-9 spotlight posts.



Figure 23. Example of the K-9 Spotlight Post.

Figure 24 below shows the growth in the number of subscribers for the CGIC page. The initial growth in followers started slowly and then increased with a noticeable uptick in May 2022. This growth plateaued around October 2022 and then continued at a slow rate.

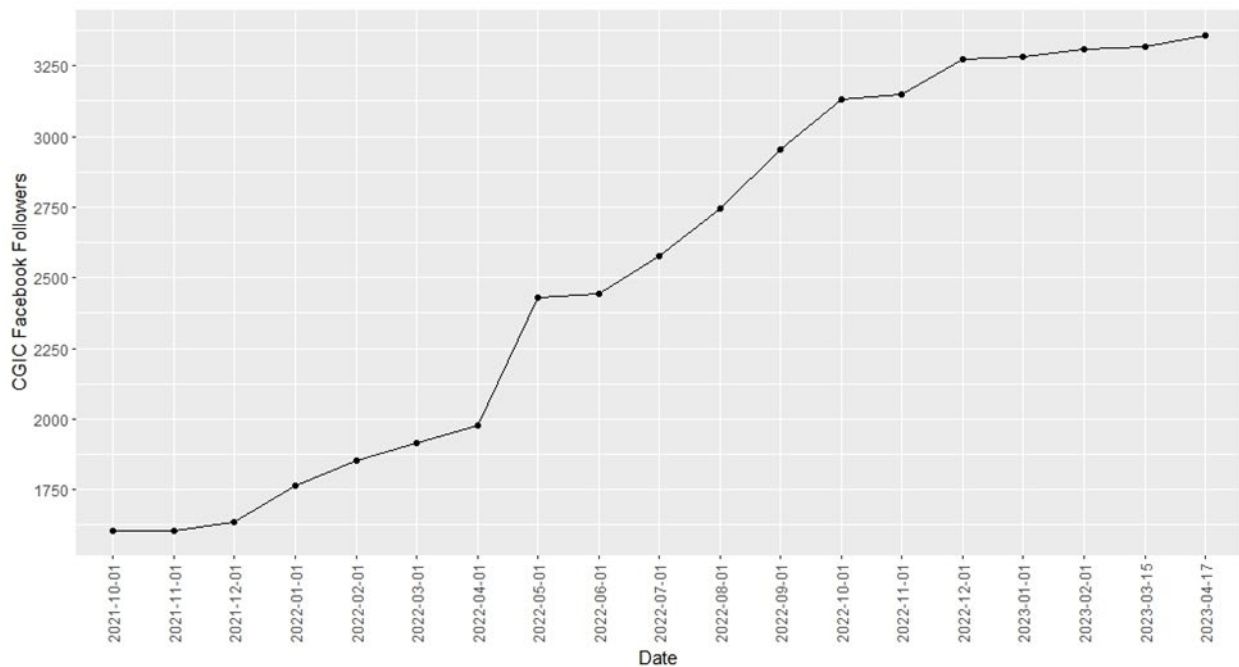


Figure 24. CGIC Facebook Followers over Time.

This growth in followers for the CGIC page can be compared to the growth in followers for the BPD main Facebook page over this period provided in Figure 25. The BPD main Facebook page showed a dramatic increase in followers in December 2021 and then experienced slow and steady growth after this. In general, there was a strong correlation ($r = 0.943$, $p < .001$) between the number of subscribers to the main BPD Facebook page and the CGIC Facebook page.

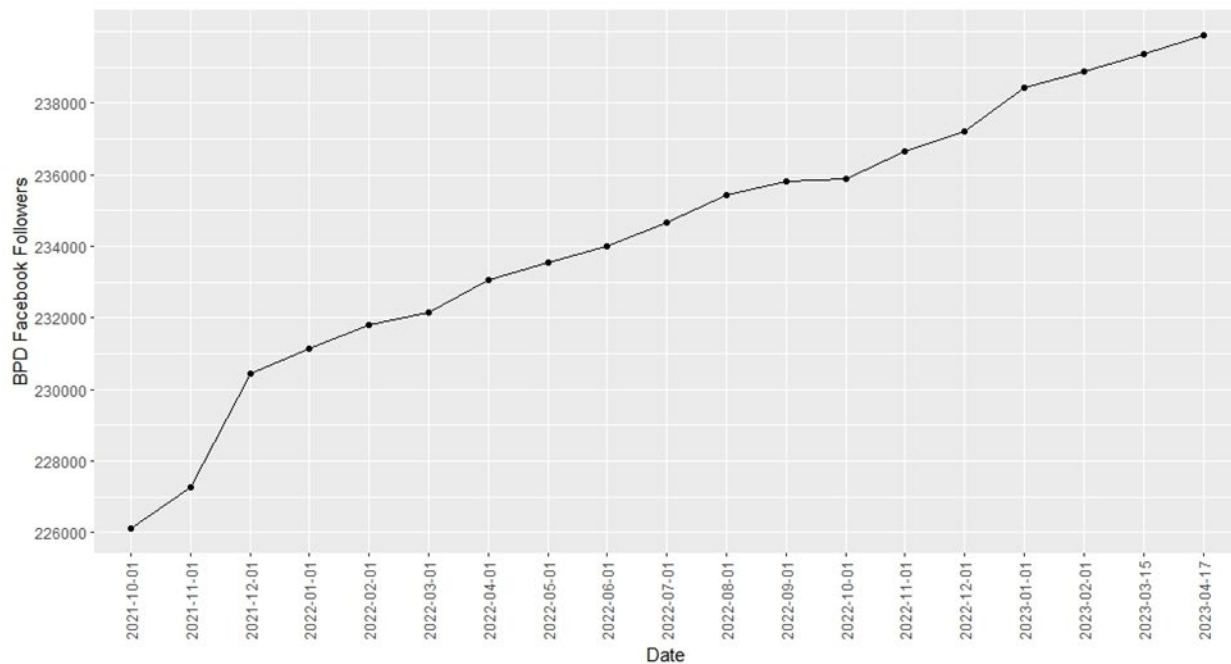


Figure 25. BPD Facebook Followers over Time.

The relative growth of these pages are difficult to compare based on the dramatically different scales of the number of followers. Figure 26 presents the percentage change in the number of followers for both pages over time. The red line represents the percentage monthly change in the number of followers for the BPD main Facebook page. This plot shows the slow and steady growth of the main page over time. In contrast, the CGIC page is shown in blue. There were a number of considerable increases at several points in the series. The number of followers grew by over 8 percent in January 2022 and September 2022. The largest spike in followers growth occurred in May 2022, when the number of followers increased by over 22 percent.

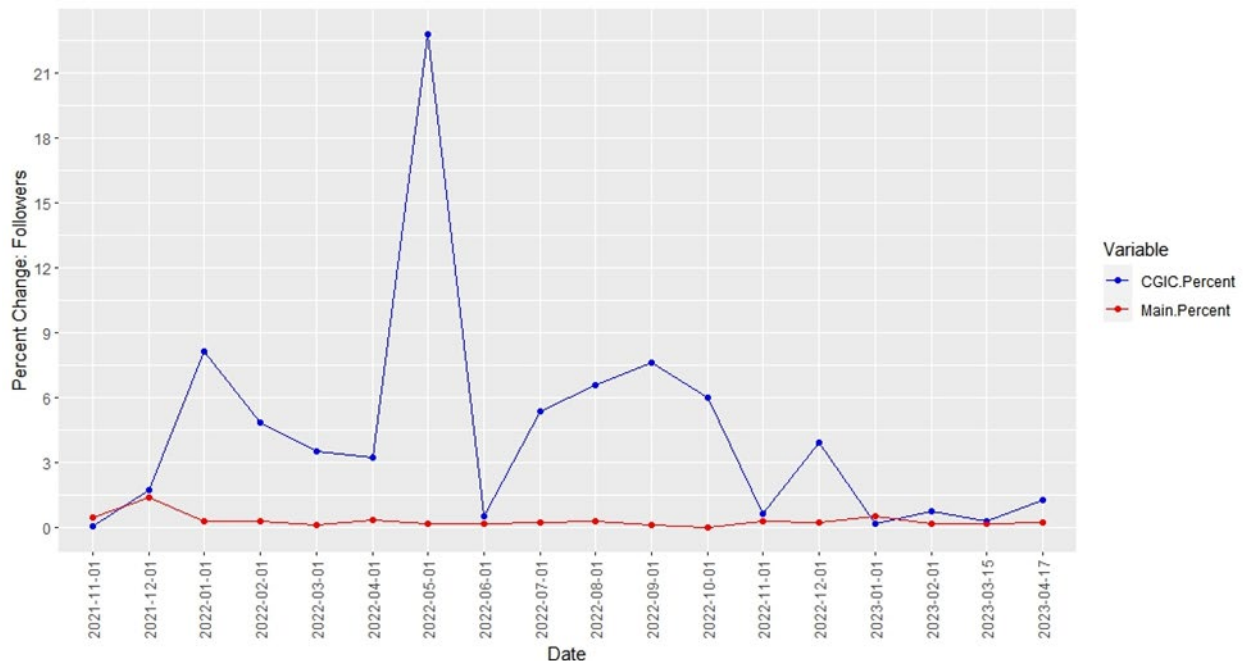


Figure 26. Percentage Change in BPD and CGIC Facebook Followers over Time.

We also examined the Facebook metrics for the CGIC page provided by the Facebook Insights tool provided to site owners/administrators. These metrics provide a measure of the activity around posts to the site. The first metric, presented in Figure 27, is “post engagement,” which occurs when users engage in any action with a post, including reactions (likes), comments, shares, saves, views, or clicking on a link. The largest periods of post engagement occurred in April 2022 and corresponded to a post about a handgun recovered from the Western district. The handgun appeared to be an antique and a number of the comments were humorous in nature regarding the age of the handgun. The second largest spikes in post engagement occurred in August 2022 and in January 2021. The December 2021 to January 2022 spike occurred during the K-9 Spotlights. The August spike again appeared to be associated with several posts about firearms and drugs seized in the Southwest and Western districts.

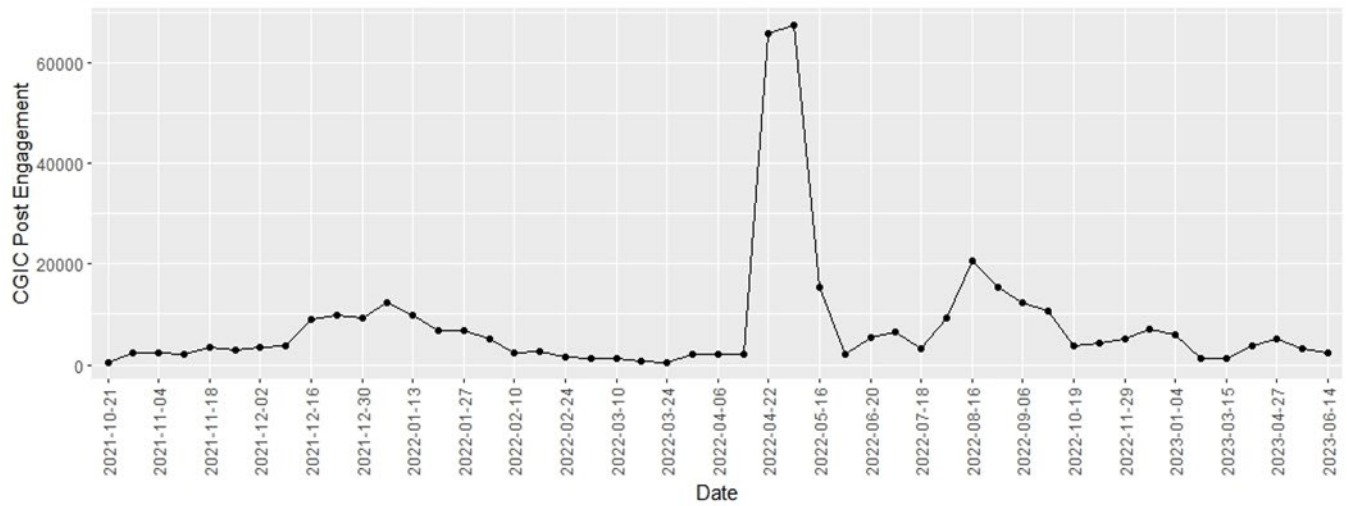


Figure 27. CGIC Facebook Post Engagement.

The second metric, displayed in Figure 28, consists of “shares,” which occurs when a visitor publishes a post on their own Facebook wall using the share button. Unsurprisingly, the peaks in shares correspond to the peaks observed earlier with post engagement. Interestingly, the January 2022 peak is higher than the August 2022 peaks.

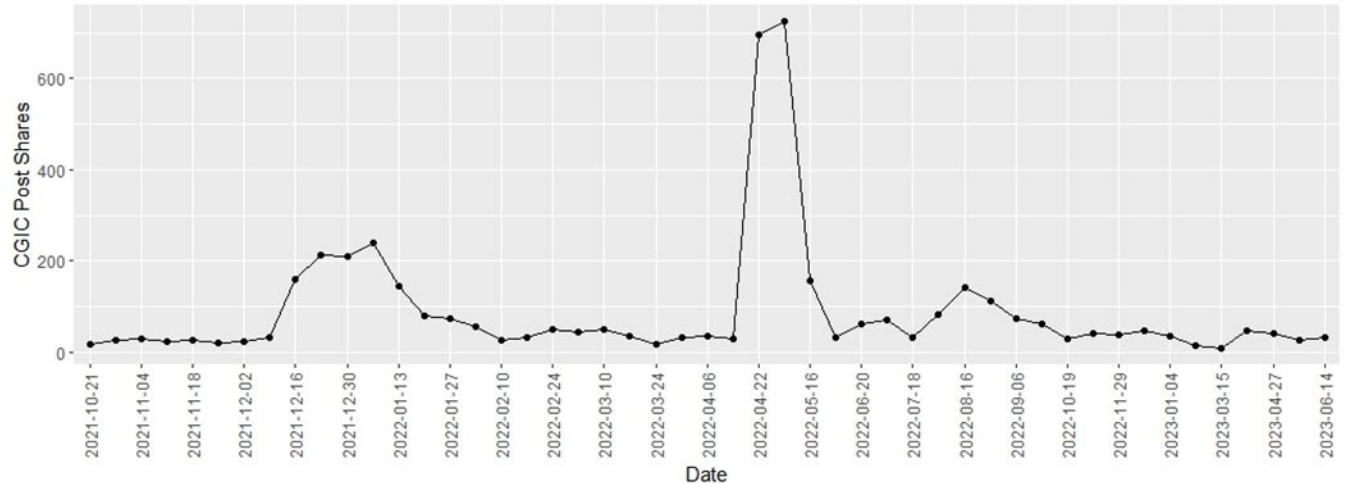


Figure 28. CGIC Facebook Post Shares.

The final metric from Facebook Insights is the “post reach” and is presented in Figure 29. Post reach is an estimate of the number of users that would have viewed the post. The largest spike from the CGIC page (the antique handgun) was seen by an estimated 300,000 users.

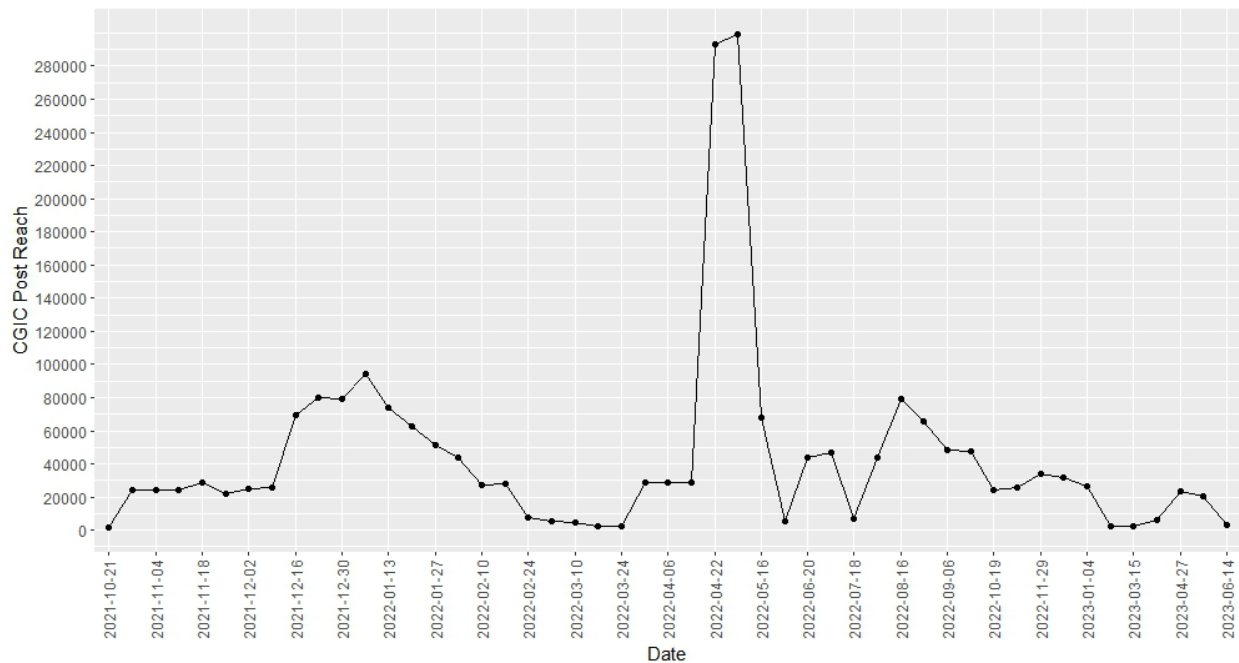


Figure 29. CGIC Facebook Post Reach.

We examined the relationship between Facebook followers and Metro Crime Stoppers tips as this provides a linkage between social media and crime-related intelligence. We found significant correlations between monthly CGIC Facebook followers and monthly Metro Crime Stoppers tips to the city ($r = 0.769, p < .001$) and monthly BPD Main Facebook page followers and monthly Metro Crime Stoppers tips to the city ($r = 0.692, p < .001$). This result, however, is only a preliminary analysis due to a small number of observations ($N = 20$). While a larger sample size would allow for more thorough analyses, the observed correlations do suggest that an expanded social media presence by CGIC may yield tangible benefits.

In sum, CGIC developed and maintained a social media presence via the Facebook platform and was successful at growing this page during the evaluation period. Social media posts generally consisted of guns seized through CGIC activity. On occasion interest in CGIC increased based on the “uniqueness” of the seized firearm. Unfortunately, CGIC has little control over what BPD officers recover and whether these posts capture the public attention. However, CGIC also posted the “K-9 Spotlight” series that highlighted the dogs used in canine recanvassing, which successfully drove traffic to the page. Preliminary analyses suggest that increasing social media presence may yield benefits in the form of increased Metro Crime Stopper tips.

Interviews and Site Visits

To examine the implementation of CGIC, JSS conducted 10 interviews with key personnel associated with CGIC in semi-structured interviews administered via zoom between November



12, 2021 and January 21, 2022. In addition, JSS staff conducted site visits on August 22 - 25, 2022 and May 29 - June 1, 2023 and conducted additional in-person interviews with BPD leadership and CGIC personnel. JSS personnel also accompanied BPD to CGIC site visits at Cincinnati, OH and Miami, FL and conducted additional interviews on these occasions. Finally, JSS conducted monthly check-in meetings with CGIC personnel. Through these sources, JSS was able to amass a large amount of qualitative information about the CGIC implementation. This information was summarized into a set of themes that provide additional insight regarding the CGIC implementation.

Collaboration/Communication

Interviewees spoke highly about the new sense of collaboration introduced by CGIC. Interviewees reported that internal cohesion for BPD and external communication with ATF and the State Attorney's Office have improved significantly at the start of the program. According to one BPD lieutenant, "One of the biggest benefits is that [CGIC] connects law enforcement officers to other law enforcement officers; it grows your network." Unfortunately, the collaboration with SAO through CGIC decreased as the program continued as the SAO remained focused on other internal priorities. With the election of the new SAO, there is optimism that the SAO will re-engage with CGIC.

At the beginning of the program, Baltimore CGIC personnel had some initial difficulty understanding their role within BPD. However, as the CGIC standards were further developed, CGIC personnel settled into their roles and began to communicate effectively. According to several interviewees, the intelligence packages put together by the CGIC analysts have been critical to keeping team members apprised about new cases, case statuses, and resolutions. One BPD sergeant stated, "I am 100% confident I would not have known all those cases were connected without the [CGIC Analyst] reports."

CGIC Successes

Interviewees spoke highly of the CGIC program and noted various ways in which it has helped with intelligence gathering, investigations, case resolution, and community engagement. All interviewees mentioned investigative improvement within their respective roles that they attributed to CGIC implementation. According to one BPD forensic scientist, "I like feeling that we have a role in helping the investigators close the cases successfully." A BPD lieutenant spoke highly about how investigative work has improved analytically compared to pre-CGIC operations. A BPD forensic scientist spoke about how CGIC has streamlined evidence management and testing. A CGIC analyst mentioned that community engagement has improved due to increased use of social media in conjunction with CGIC operations. Overall, the interviewees believe that CGIC benefited BPD on multiple fronts. An interviewee from the ATF stated that Baltimore is successful because, "Baltimore PD is one of the few [departments] that has been so receptive, so willing, and capable of benefiting from the program."

*Administrative Support of CGIC*

During discussions with the commanders and department heads in charge of overseeing CGIC, there was considerable command support for the CGIC program. Although there were challenges due to available resources, command staff appeared to be actively addressing the issues. For example, although BPD was having difficulty filling the position of CGIC coordinator, the Department was able to assign a temporary employee and an intern to CGIC to address some of the workload. Additionally, BPD quickly assigned an intern to the Firearm Analysis Laboratory when it was identified that the bulk upload eTrace process was interfering with the rapid turnaround of eTrace results. Further, a number of commanders expressed explicit support for the premise of CGIC and the products that CGIC was delivering. This is also evidenced by the active role taken by commanders during the weekly crime meeting observed by JSS staff. Commanders would directly question detectives about the progress in CGIC related cases.

Areas for Improvement

Interviewees agreed that BPD is short on personnel. Interviewees stated that CGIC provides quality intelligence, but that personnel are struggling with the workload. According to one BPD lieutenant, “The information is great; it's just unfortunate that some of the time that information is left uninvestigated.” One interviewee from forensic sciences is concerned that an increase in crime could be detrimental because staff are working at capacity. Some interviewees also mentioned that the Baltimore CGIC is not being fully utilized. Namely, CGIC operations are not fully understood by personnel within the department, and has led to personnel neglecting to use CGIC resources. One BPD sergeant believes that CGIC intelligence would not be used by Baltimore investigators if left to the investigators’ discretion. CGIC analysts similarly reported that investigators neglect to follow up with the analysts on intelligence packets. The analysts believe this is due to a lack of familiarity with the CGIC program among some BPD personnel.

In response to the difficulties faced by CGIC, BPD increased the personnel associated with CGIC. BPD hired a new CGIC coordinator as well as a CGIC detective specifically assigned to the unit. BPD also transferred a sergeant to assist with CGIC operations. Other communications suggest that BPD is considering hiring an additional analyst to address workload issues. Additionally, CGIC has conducted trainings in concert with the ATF to improve officers’ understanding about NIBIN evidence and the CGIC process.

The BPD CGIC team witnessed evidence during the Miami site visit that having a Brasstrax machine in a CGIC unit along with the capabilities to test fire crime guns and enter that evidence into the NIBIN system would be beneficial to their outcomes. The same process was seen during the Cincinnati site visit. BPD is planning to receive an additional Brasstrax machine and CGIC personnel hope to allocate the machine to the CGIC unit.



Evolving CGIC Operations

One of the challenges faced by CGIC is that the program continues to evolve over time. In some instances, this evolution has been positive as it generated the impetus towards innovation. For example, CGIC analysts developed a template for enhanced crime scene mapping with the locations of recovered casings and recommended alternative procedures for securing casing evidence to support more precise NIBIN-based crime scene reports.

Other changes were forced upon CGIC based on available resources and unrelated administrative changes. One example of this issue is the change in the dissemination of information about CGIC cases. Originally, CGIC was given an opportunity to present and discuss leads during weekly GVRs meetings with detectives. These meetings were then retooled to be more effective for GVRs and the format was changed to be in person, limiting the number of attendees. During this shift, it was also decided that these meetings would be specifically focused on GVRs cases and CGIC would not be provided an opportunity to discuss leads. CGIC was again given an opportunity to discuss leads at the beginning of the weekly crime strategy call attended by command staff. This appeared effective, but there was an administrative decision to rework the function, content, and attendance of this meeting and CGIC was omitted from the revised format. Finally, after the Cincinnati site visit, it was decided that the next evolution of the CGIC weekly meeting would be jointly hosted by CGIC and the ATF. The format for this meeting continues to evolve, but it is not attended by command staff, and it is not entirely clear how CGIC-related information is communicated to them.

Another example of forced implementation changes resulting from outside factors is the role of the lead CGIC analyst. Initially, intelligence packets were created and distributed to detectives for every Tier 1 and 2 lead. After some feedback, CGIC was able to change the distribution mechanism improve information delivery to detectives. While this strategy was functional for some time, after the CGIC coordinator left for another position, the workload on the remaining CGIC analyst became untenable. This forced an important change where instead of pushing out intelligence reports, the CGIC analyst began creating reports on request. Importantly, the analyst made a concerted effort to build relationships with detectives and most of the detectives found these intelligence reports to have considerable value. However, this role change does have some challenges, as some detectives may be less likely to engage with CGIC to receive these reports.

Complex Socioeconomic Problems

The site visits to Baltimore included tours around high crime areas in the Western and Southwest districts. These ride-along tours were conducted by BPD officers who also shared impressions and historical information about the violence problems in these communities. It was clear during these tours that the Western and Southwest districts were home to very serious community problems that were contributing to the violence in these areas.



One of the problems that was immediately apparent was the number of vacant and abandoned structures in the Western and Southwest districts. Many of the abandoned structures are also in a state of serious disrepair. Garbage, refuse, graffiti, and abandoned vehicles were also observed across both communities. A number of open-air drug markets were also observed during the ride-along. There was a lack of operating businesses in most of the problematic areas aside from local corner convenience and liquor stores and occasional restaurants. There were also a preponderance of criminogenic opportunities with overgrown empty lots, boarded up vacant buildings, and narrow alleys providing considerable opportunities for undetected criminal opportunity. In sum, this suggests that there are long-standing and severe problems of urban decay in these areas that are typically associated with high levels of violence. While CGIC can decrease gun crime, the elevated levels of crime and violence in these communities are unlikely to be resolved without additional investment and effort.

Summary

The process evaluation provided a considerable amount of information about BPD's CGIC. In this section, we summarize and re-examine some of this information in light of the questions previously raised in the chapter introduction.

What Were the Activities of the CGIC Program?

Based on the analysis of the performance metrics, the NIBIN and weapon seizure data, and the social media data, it is clear that the CGIC program was highly active. One of the main activities of the CGIC program was to process NIBIN lead information and to provide information to detectives in the form of leads and intelligence reports. All indications suggest that this was done consistently across the implementation period. It is important to note, however, that there are indications from interviews and discussions to suggest that the volume of information delivered to detectives has reached capacity and there is no additional ability to deliver more information without expanding capacity by adding additional analysts.

Another key activity of CGIC was to conduct weekly meetings with CGIC partners about NIBIN leads. Even though the form and locations of these meetings changed, CGIC was able to conduct meetings across the observational period. There were, of course, some interruptions to these meetings when they were shifted from one form or another, but CGIC managed to operate these meetings continually. During the meetings, CGIC was able to provide intelligence about leads and inquire about the detective follow-up on these leads.

Based on the social media information, CGIC was able to maintain and operate a community-facing social media platform via Facebook and share information using that venue. There are some indications that efforts to increase engagement using Facebook may have resulted in an increase in the number of Metro Crime Stoppers tips, but these indications are preliminary.



A final key activity of CGIC was to offer training and support for officers and detectives to understand the CGIC process. CGIC conducted a series of trainings during the roll out period for CGIC in the Western and Southwest districts. CGIC also offered additional trainings to interested officers and detectives a number of times throughout the program period.

What Were the Measurable Successes of CGIC?

One important success of CGIC was its ability to maintain CGIC operations in terms of processing NIBIN leads and providing intelligence reports. Despite difficulties, CGIC analysts were able to continue distributing intelligence reports to both the Western and Southwest districts. A number of detectives and supervisors complimented the quality and thoroughness of the information provided by CGIC and the CGIC processes appeared to improve the usefulness of ballistics evidence for detectives.

CGIC appeared successful at increasing officer awareness of CGIC processes. Based on interviews and discussions, CGIC also achieved considerable buy-in by supervisors and detectives. Perhaps the best illustration of this is that when the CGIC analyst changed from pushing-out intelligence reports to on-request reports, there were still considerable requests for information. This suggests that detectives saw value in the products produced by CGIC.

CGIC was also successful at building relationships across the department and across agencies. Several respondents felt this was an important benefit of CGIC as there was a key point of contact for ballistics information. CGIC was able to support a number of officer training initiatives that would not have happened without CGIC. Further, CGIC led to increased collaboration with the ATF and facilitated intelligence sharing between detectives and agents.

Another key success is the ability of CGIC to grow and maintain a social media presence as a method of community outreach. There was considerable growth in terms of the number of followers and engagement with the CGIC Facebook page. While some growth was organic from viral posts, other growth was deliberate (such as the dog profiles) and designed to increase the visibility of the page. Through this growth, CGIC was able to push out useful information to the community, including shooting alerts and information about providing tips to the BPD.

What Were the Challenges of CGIC?

The most pressing challenge faced by CGIC was the lack of resources in the form of additional analysts and assigned detectives. One of the common concerns with CGIC was the ability to manage the workload given the limited resources. CGIC was forced to compromise in a number of areas due to the lack of available staff. This included, limiting the number of Tier 2 intelligence reports and moving to on-request reporting. Due to the high workload, it was difficult for the analyst to follow-up with detectives. Additional follow-up was possible after hiring a CGIC detective, but the detective's workload remains very high.



The second most pressing challenge faced by CGIC was the dissolution of the relationship with the SAO. Several of the planned initiatives by CGIC either ceased or did not occur when the SAO liaison stopped participating with CGIC. Prosecutors under the CGIC model are involved with strategizing to target prolific shooters for prosecution, communicating with detectives and CGIC analysts, and providing feedback about the CGIC successes. Under the original plan, there was to be a co-located analyst from the SAO in CGIC. While the lack of participation from the SAO hampered these efforts, steps are currently underway to re-engage with the SAO.

A third challenge that discussed in Chapter 2 was the COVID-19 pandemic. As noted, the restrictions around global pandemic affected CGIC in a number of ways including prohibiting early site visits to other CGIC sites, requiring GVRs/CGIC weekly meetings to be virtual due to restrictions on the number of people attending in-person meetings, and necessitating work from home for civilians during peaks in COVID infection. Fortunately, these challenges occurred early during the implementation and CGIC was able to continue operations during the pandemic and return to standard operations as restrictions were lifted.

What Were the Lessons Learned from CGIC?

One of the lessons learned from BPD's CGIC implementation is that social media engagement with the community can be beneficial to CGIC operations. Social media represents a simple, but effective way that police departments can engage with community members and there are possible benefits in the form of increased use of tip lines that can assist police departments in meeting crime control objectives. CGIC demonstrated that a successful social media presence can be implemented and maintained by a specialized unit within the department and still regularly provide important information to the community on a regular basis. Further, through innovative strategies, it is possible to grow this social media presence over time. Other CGIC sites should consider similar efforts in the future.

A second lesson from this research is that in general CGIC results in tangible improvements to the procedures and use of ballistics evidence. These improvements were well received by commanders and investigators. Investigators also reported that timely NIBIN links were helpful in establishing investigative leads that would not have existed in the absence of NIBIN information. Further, CGIC demonstrated that dedicated analysts could innovate and develop new uses for these data, such as the crime scene NIBIN maps. Further, the CGIC emphasis on the timeliness of evidence processing forces agencies to re-evaluate operating procedures and increase efficiencies. These clear benefits suggest that agencies would be well served to adopt CGIC and possibly consider ways that these strategies could be incorporated to other types of forensic evidence processing such as fingerprints, DNA, or other physical evidence.

A final lesson learned is that a gradual, phased implementation of CGIC can provide time to adjust operations and accommodate difficulties with resource allocation. At the beginning of the CGIC program, there were unforeseen difficulties and challenges despite the creation of a strategic plan. A phased implementation as adopted here allowed BPD to address some of these



difficulties early and avoid them when introducing CGIC to the Southwest. Further, a phased implementation allows for an assessment of workload for CGIC staff. Since many agencies are facing hiring difficulties, it is sensible to add additional capacity when available and avoiding amplifying problems associated with the inability to deliver timely information.



Impact Evaluation

JSS conducted an impact evaluation of the CGIC program in the Western and Southwest districts. For this impact evaluation, the key question is: What is the effect on gun crime in the Western and Southwest districts following the start of the CGIC program?

Data

BPD provided JSS with extensive access to official data to conduct the impact evaluation. BPD provided calls for service (CFS) and police report data spanning 2017 through June 2023. All of these records included date, time, address, and X, Y coordinates allowing for spatial analyses.

We specifically examine the impact of CGIC on gun crime. Within BPD incident data, gun crime is defined as any non-sexual serious violent crime (homicide, aggravated assault – shooting, aggravated assault – other, robbery – commercial, robbery – carjacking, and robbery - other) where the incident report indicates that a gun was involved.¹² Importantly, this measure is not restricted to firearm discharges, as merely the presence of a firearm during the incident is sufficient to establish the incident as a gun crime. This general definition is used because non-discharge incidents may include guns that can be seized and traced during CGIC operations.

For CFS data, we used calls that involved shots fired or aggravated assault with a firearm. While both the Western and Southwest districts have some ShotSpotter coverage for automatic detection of firearm incidents, this source of data is excluded from the analysis. This was done for several reasons: 1) ShotSpotter coverage across the Western and Southwest districts is not complete and the resulting hotspots would be misleading, 2) Other districts do not have the same coverage for ShotSpotter, and 3) ShotSpotter was not installed for the entire control period (Jan. 2017 through Dec. 2020) which would generate an artificial increase in shots fired calls for service when the system came online. Citizen CFS should not be similarly affected, but it is worth acknowledging the possibility that citizens may be less likely to initiate a call for service in areas with ShotSpotter.¹³

Design

CGIC was implemented in the Western district on January 2021 and then in the Southwest district on June 2022. The clear start date for the Western and Southwest district allows for an

¹² Based on a preliminary review of the data, rapes with firearms did not appear to be consistently coded as none of these was reported from 2017 to 2019. These were coded more consistently after 2020 but appear to be infrequent. Given the reluctance of many rape victims to contact the police and the likelihood that this crime would be underreported, we decided to omit this category from further analysis.

¹³ If citizens understand that the ShotSpotter system automatically alerts police to a shooting event, they may feel as additional calls are unnecessary. Without a considerable media campaign describing ShotSpotter, where it is located, and how police use the system, it seems unlikely that citizens would simply rely on this system rather than calling the police in response to gunfire discharges.

interrupted time series with control groups research design. The interrupted time series design with control groups is a strong quasi-experimental design and is generally free from many of the threats to internal validity that are common to other research designs (see Campbell & Stanley, 1963; Cook & Campbell, 1979; Shadish, Cook, & Campbell, 2002).

This design is illustrated in Figure 30 below. The symbol “O” represents an observation, here a monthly count of incidents, while “X” represents the administration of the treatment (*i.e.*, the start of CGIC). Importantly, the timing of the treatments differs between the Western and Southwest allowing for comparisons of the treatment effect for both groups. Further, CGIC was not implemented in the remaining districts providing for comparisons between the treatment and control groups.

Western	O	O	O	X	O	O	O		O	O	O
Southwestern	O	O	O		O	O	O	X	O	O	O
Other Districts	O	O	O		O	O	O		O	O	O

Figure 30. Representation of Research Design.

One important complication of this design was the implementation of the Group Violence Reduction Strategy (GVRS). In the Western district, GVRS began implementing detective team meetings on shooting events coinciding with the start date of CGIC. While the community component of GVRS did not begin until later, any treatment effect for the Western would necessarily be comprised of both the effects from CGIC and GVRS interventions. In the Southwest district, however, the CGIC implementation preceded the GVRS expansion by a period of six months. This allows for separate estimates of the impact of CGIC and GVRS.

Plan of Analysis

In order to determine whether CGIC reduced violent gun crime, we first examine descriptive statistics for these variables across the available years of data. Following this, we examine how these offenses were distributed spatially in the Western and Southwest districts before and after CGIC was implemented. Third, we use trajectory analysis to further drill down and identify the most chronically violent street segments. Finally, we use segmented regression models to evaluate if changes in key outcomes are associated with the implementation of CGIC in the Western and the Southwest districts.

Descriptive Statistics

Table 6 presents yearly counts for each of the key outcomes. The first five variables (violent gun crime, gun homicide, gun aggravated assault, gun robbery, and burglary) come from the crime

report data. These data are organized by victim and crimes with multiple victims listed in multiple rows. BPD counts homicide, rape, and shootings by victims and all other crimes by incident. To avoid the inconsistencies, we adopted the BPD convention of counting victims for the most serious types of crimes for all crime categories. For this reason, the counts of gun aggravated assaults (combining shootings and other aggravated assaults with a gun), gun robbery (combining carjackings, commercial, and other robberies with a gun), and burglary may not match BPD official counts. The last two variables (shots fired calls and aggravated assaults with a firearm calls) come from the CFS data provided by BPD. Each row in these data corresponds to a citizen call or officer-initiated action. Importantly, it is possible (and likely) that there are multiple calls for the same event in these data.

Table 6. Yearly Counts for Outcome Variables from 2017-2023 YTD for the Western, Southwest, and Other Districts.

District	Variable	2017	2018	2019	2020	2021	2022	2023 YTD
Western	Violent Gun Crime	555	516	545	460	471	398	198
	Gun Homicide	47	44	52	44	49	30	17
	Gun Agg. Assault	319	290	283	280	298	251	115
	Gun Robbery	188	176	205	130	121	115	63
	Burglary	482	526	402	352	281	315	121
	Shots Fired Calls	165	306	348	307	292	252	94
	Agg. Assault w Firearm Calls	769	794	649	649	568	586	297
Southwest	Violent Gun Crime	611	603	576	572	519	494	220
	Gun Homicide	41	49	46	53	45	41	15
	Gun Agg. Assault	275	300	267	365	297	283	134
	Gun Robbery	291	253	260	149	170	166	69
	Burglary	869	749	684	438	427	489	191
	Shots Fired Calls	249	524	569	687	568	439	228
	Agg. Assault w Firearm Calls	984	983	803	809	792	697	387
Other Districts	Violent Gun Crime	4,394	4,188	3,987	3,372	3,421	3,717	1,772
	Gun Homicide	212	180	211	198	201	228	99
	Gun Agg. Assault	1,553	1,549	1,688	1,657	1,762	1,750	856
	Gun Robbery	2,592	2,430	2,060	1,489	1,429	1,714	804
	Burglary	6,687	4,904	4,297	3,235	2,849	3,045	1,256
	Shots Fired Calls	1,807	2,570	3,140	3,337	2,579	2,957	1,379
	Agg. Assault w Firearm Calls	6,400	6,397	5,984	5,313	5,182	5,302	2,639

Across Baltimore, there has been a general decreasing trend in violent gun crime. For the Western, Southwest, and the other districts, violent gun crime is considerably lower in 2022 compared to 2017. This trend, however, was not uniform across crime types, as gun homicide and gun robbery peaked in 2019 in the Western district. Gun aggravated assaults spiked in 2021



in the Western as well. Gun homicide and gun aggravated assaults peaked in 2020 in the Southwest, but gun robbery was down considerably. For the other districts, gun homicide peaked in 2022 and gun aggravated assault peaked in 2019. Gun robbery, on the other hand, decreased across years until an increase in 2022.

Regarding CFS, shots fired calls from 2017 appear to be incomplete as the number of calls appears to be about half of the 2018 total. This problem was observed in other CFS categories (but not aggravated assault with a firearm calls), and for this reason, 2017 data was omitted from later time series analyses. Shots fired CFS were the highest in 2019 for the Western and 2020 for the Southwest and other districts. Generally, aggravated assault with a firearm calls appear to decrease in the Western, Southwest, and other districts, with a slight increase in 2022 for the Western and other districts.

Hot Spot Analysis

To assess the changes in the spatial distribution of CFS and crime incidents, we generated crime hot spot maps for 2020 and 2022. Kernel density estimation was used to interpolate a spatial surface that reflects the density of crime events over the Western and Southwest districts. The year 2020 was selected as a baseline as this was prior to the implementation of CGIC in both districts. This map was compared to crime in 2022, as this was the last complete year of data available. Further, the color ramp was preserved between maps allowing for changes in the color and intensity to be directly interpreted as increases or decreases in the density of crime. Importantly, while CGIC was operational in the Western by this time, it was implemented in the Southwest in June 2022. Therefore, these hot spot maps do not provide a clear before and after picture of crime in the Western, but these differences are still informative.

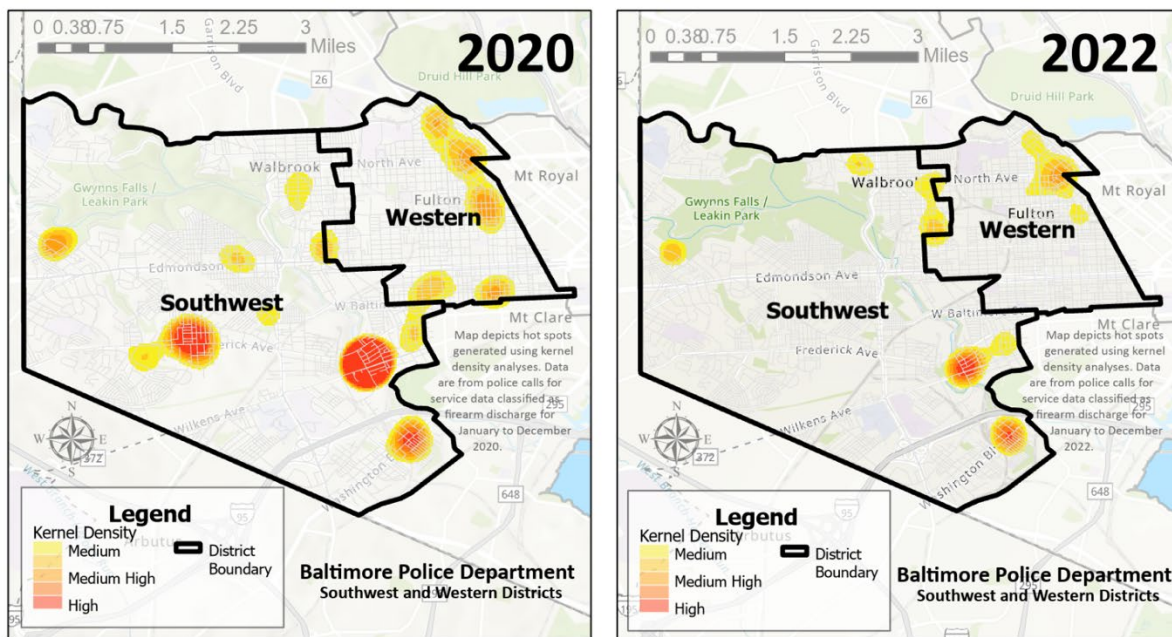


Figure 31. Shots Fired Hot Spot Map for Years 2020 and 2022.

Figure 31 provides the hot spot maps for shots fired CFS. These maps suggest that the intensity of some hot spots, particularly in the southeast and center of the Southwest district, decreased from 2020 to 2022. Further, many hot spots disappeared between 2020, particularly those in the center of the Southwest district and along the Western district southern border. These maps suggest few, if any, displacement effects as the remaining hot spots in 2022 largely conform to the locations seen in 2020. There is one possible exception, where the hot spots along the border between the Western and Southwest districts may have shifted to the north, but these are comparatively mild hot spots.

The hot spots for aggravated assault with a firearm are shown in Figure 31. Again, there are clear indications that these calls have decreased from 2020 to 2022 with many areas, particularly in the northeast of the Western district decreasing in intensity. There are also notable decreases in intensity across the eastern section of the Southwest district along the border with the Western and to the south as a number of these hot spots have disappeared. There no evidence for displacement effects as nearly all of the hot spots observed in 2022 remain in the same locations.

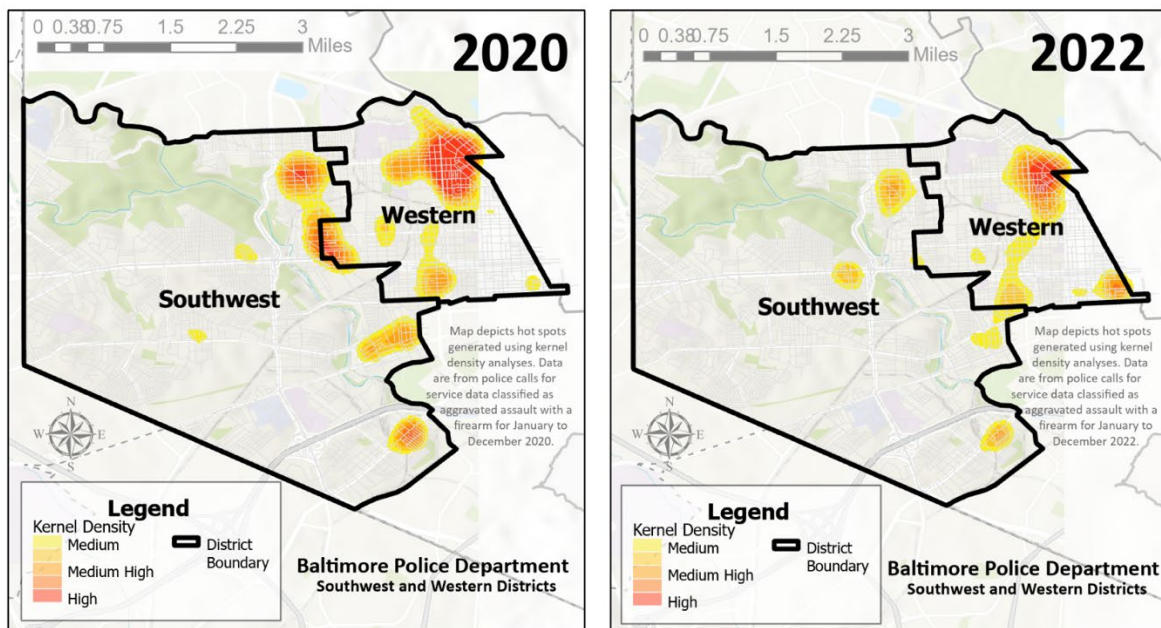


Figure 31. Aggravated Assault with a Firearm Hot Spot Map for Years 2020 and 2022.

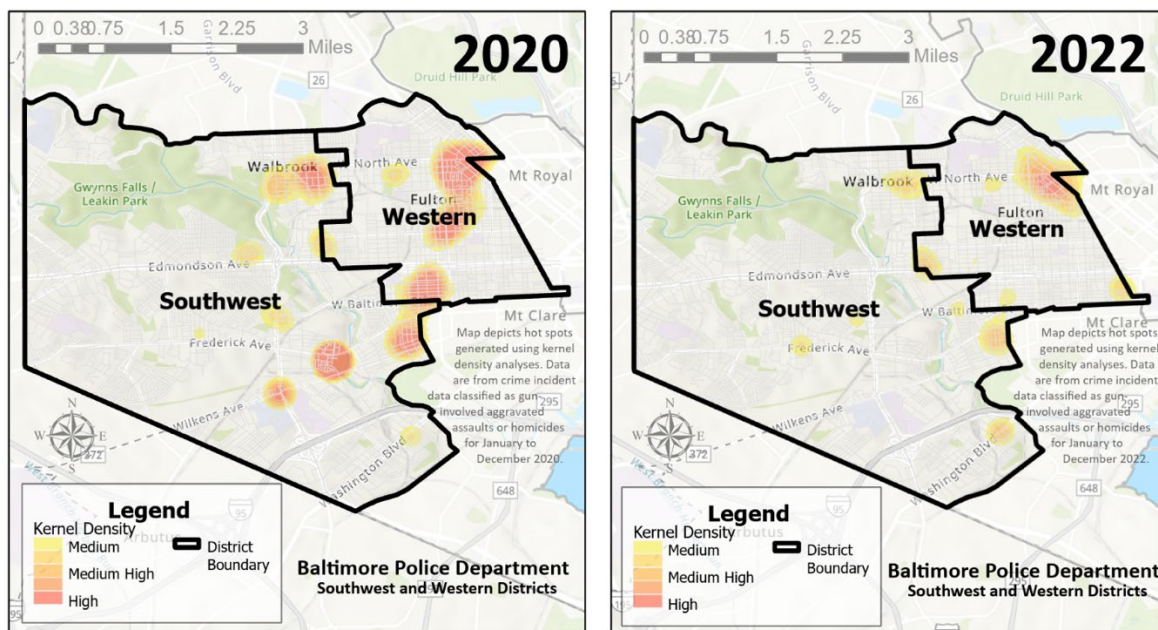


Figure 32. Gun-Involved Aggravated Assaults and Homicides Hot Spot Map for Years 2020 and 2022.

The hot spot maps for gun-involved aggravated assault and homicide crime incidents are presented in Figure 32. Homicides were combined with aggravated assault as the number of events is low and hot spot maps would be misleading. There is a stark difference between the

maps for 2020 and those for 2022. There were several very pronounced hotspots in the east of the Western district and along the southern border between the Western and Southwest districts. While the locations of these hot spots remain the same in 2022, the hot spots are considerably less intense and much smaller. This is consistent with a substantial reduction in gun-involved aggravated assault and homicide between these years. While the hot spot in the east of the Western remains problematic, there is a clear reduction in intensity. Similarly, the hot spots along the border of the Southwest and Western are considerably smaller and in many cases appear to have disappeared.

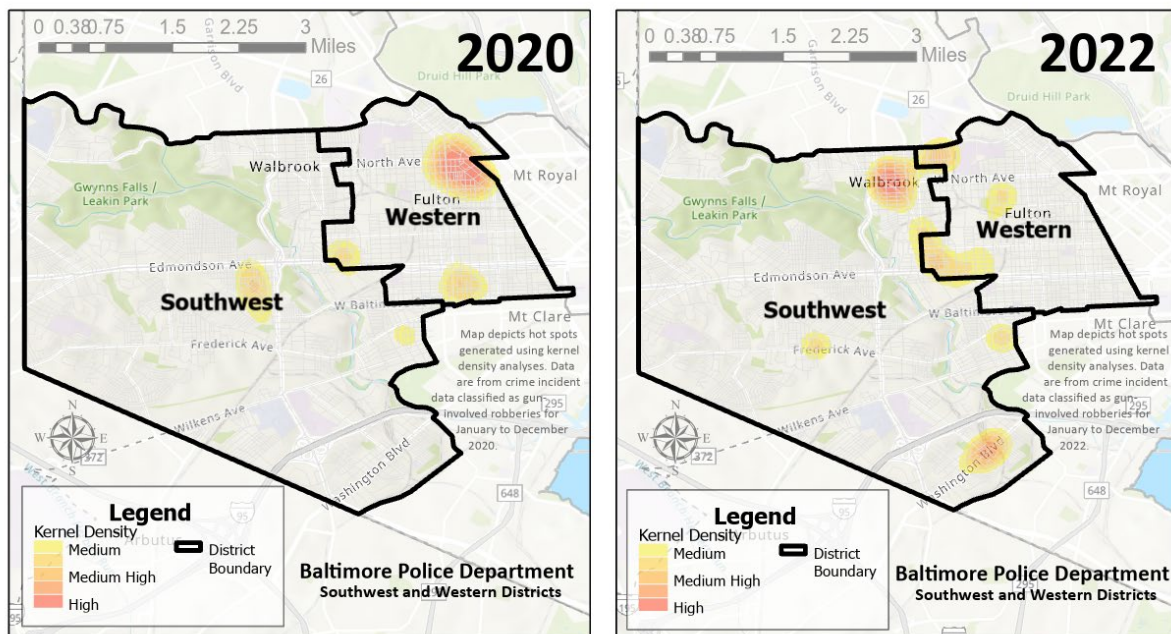


Figure 33. Gun-Involved Robbery Hot Spot Map for Years 2020 and 2022.

The final hot spot maps for gun-involved robbery are presented in Figure 33. These maps again suggest that many of the hot spots observed in 2020 have diminished considerably. Specifically, the persistent hot spot in the east of the Western district has completely disappeared. In contrast to the other maps, however, there is evidence for displacement effects. New hot spots appear to have emerged in 2022, including a hotspot in the southeast of the Southwest district, the middle of the Western district, and along the Southwest and Western district borders. Seeing that robbery is often an instrumental crime, this apparent displacement may reflect offenders selecting areas with more opportunity for the successful completion of crime when the traditional hot spots for gun crime came under more scrutiny.

Trajectory Analysis

To investigate the spatial distribution of crime further, we conducted trajectory analysis to identify the street segments experiencing the most persistent amount of crime. Due to the high



data demands of this technique, we restrict the analysis to using only calls for service involving shots fired and aggravated assault with a firearm. These measures have sufficient crime density to enable the identification of the most problematic street segments within the Western and Southwest districts. Calls generated from the acoustic detection equipment (*i.e.*, ShotSpotter calls) were removed from the analysis.

Trends in shots fired and gun-involved aggravated assaults were examined across the Western and Southwest. The analysis relied upon CFS data from January 2017 to June 2023 in 6-month intervals (13 time points in total). The call types examined were shots fired and aggravated assault involving a handgun.¹⁴

The focus of the analysis is street segments, which is defined as a portion of a street from intersection to intersection. All CFS were mapped directly to the street they occurred on, which allowed for counts of CFS to be tabulated for each street segment in Baltimore.¹⁵ There are 5,387 street segments in the two police districts. A statistical technique, group-based trajectory modeling, is used to explore differences between streets in crime trends over time. This technique categorizes street segments into groups, referred to as trajectories, which have similar trends in crime. It is useful for identifying streets in these districts that have chronically high levels of shots fired and gun-involved assaults or streets that have had a steady increase in crime over time. Three trajectory analyses were conducted: shots fired only, gun-involved aggravated assaults only, and shots fired/gun-involved aggravated assaults combined.

Trends in Shots Fired

The line graph in Figure 34 displays average counts of shots fired CFS by police district at the street segment level. Across years, the Western and Southwest districts had some of the highest averages in comparison to other police districts. Overall, there appears to be a general decline in the trend of shots fired over the last few years across Baltimore police districts.

Next, trajectory analysis was conducted for shots fired CFS using street segments in the Western and Southwest districts. Six unique trajectories of shots fired were identified. Figure 35 presents the mean number of shots fired over a 6-month period for each of the six groups of street segments. The majority of trajectory groups are either free of shots fired CFS or have very few (a given street has less than one on average for the 6-month period). Trajectory group 6, which comprises eight street segments, has notably higher shots fired CFS than other groups. This group had a general decline in shots fired since January-June 2021, but had a slight increase in

¹⁴ Firearm discharge is where CALL_TYPE_FINAL_D is equal to DISCHRG FIREARM (exclusive of ShotSpotter since those calls do not extend for the entire time period examined). Aggravated assault with a handgun is where CALL_TYPE_FINAL is equal to 4D.

¹⁵ Of the 2,093,486 CFS (crimes only), 89.17% was geocoded directly to the centerline. This is an acceptable hit rate (Ratliffe, 2004). CFS at intersections were tied to the street segment, which slightly inflates the total number of CFS (e.g., 1 crime at a cross-street is associated with each 4 street segments it touches so each segment would have 1 crime, a total of 4 would represent the 1 CFS).

shots fired for January-June 2023. Trajectory group 5 had the next highest level of shots fired CFS but comprises relatively few segments (n=37) and the average number of shots fired CFS in January-June 2023 were less than two on a given segment over the 6-month period.

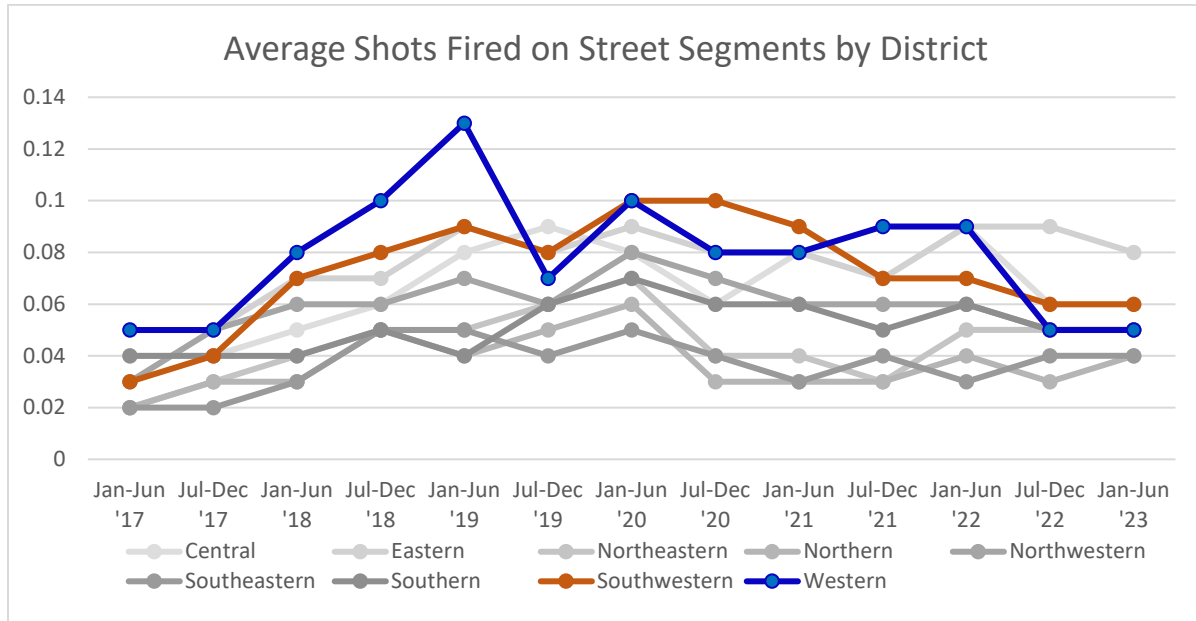


Figure 34. Average Shots Fired Calls for Service on Street Segments by District.

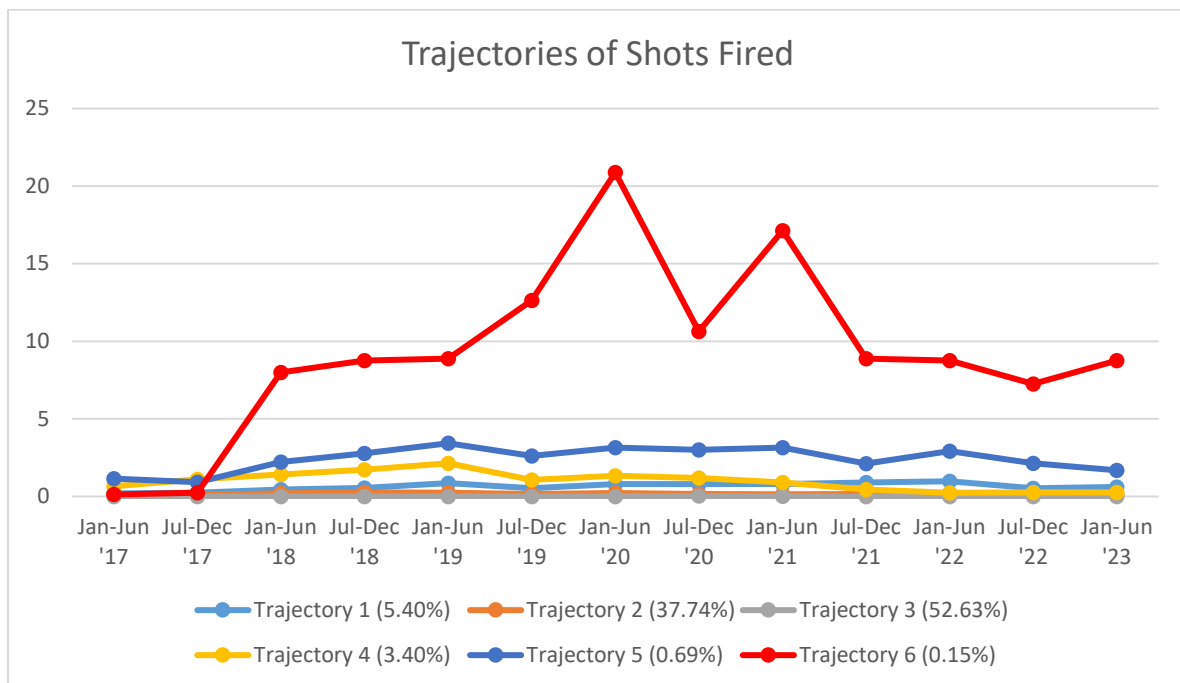


Figure 35. Street Segment Trajectories for Shots Fired Calls for Service in Western and Southwest Districts.

Table 7 provides descriptive statistics for the six identified trajectory groups. The majority of the street segments in the two police districts, such as those streets in group 1 (n=291), group 2 (n=2,033), group 3 (n=2,835) and group 4 (n=184), have little to no shots fired CFS. In January-June 2023, the segments in these four trajectory groups had an average of less than one shot fired CFS on a given street segment during the 6-month period. Only group 2 had an increase in average shots fired CFS between January-June 2021 versus January-June 2023, but the difference is minor (+6.67%). Trajectory group 3 experienced a decline in shots fired CFS during the observation period, from 0.91 to 0.26 shots fired CFS on average for January-June 2021 and January-June 2023 (71.43%).

Table 7. Descriptive Statistics for Shots Fired Trajectory Groups.

Group	# of Segments	% of Segments	Cumulative Shots Fired				% Change In Avg.
					Avg. Shots Fired		
			Jan-Jun '21	Jan-Jun '23	Jan-Jun '21	Jan-Jun '23	
1	291	5.40	229	181	0.79	0.62	-21.51
2	2,033	37.74	297	327	0.15	0.16	6.67
3	2,835	52.63	64	0	0.02	0.00	-
4	183	3.40	166	48	0.91	0.26	-71.43
5	37	0.69	117	62	3.16	1.68	-46.83
6	8	0.15	137	70	17.13	8.75	-48.92

Trajectory group 6, depicted in red in Figure 35, had a considerable decline as well, having respectively 17.13 shots fired CFS and 8.75 shots fired CFS for January-June 2021 and January-June 2023. This group only contains 0.15% of the street segments in the two divisions, but accounted for 10.17% of all shots fired CFS. The highest average for group 6 occurred January-June 2021; with these street segments having an average of over 22 shots fired CFS for the six-month period.

The street segments that fall into group 6 are depicted in red on the map in Figure 36. They are as follows: 500-800 blocks of Brunswick St, Brunswick St at Wilkens Ave, 1300 block of Laurens St, 900 block of Nottingham Rd, 2600 block of Saint Benedict St, 4800 block of Sideleigh Rd, and 2600-2700 blocks of Wilkens Ave.

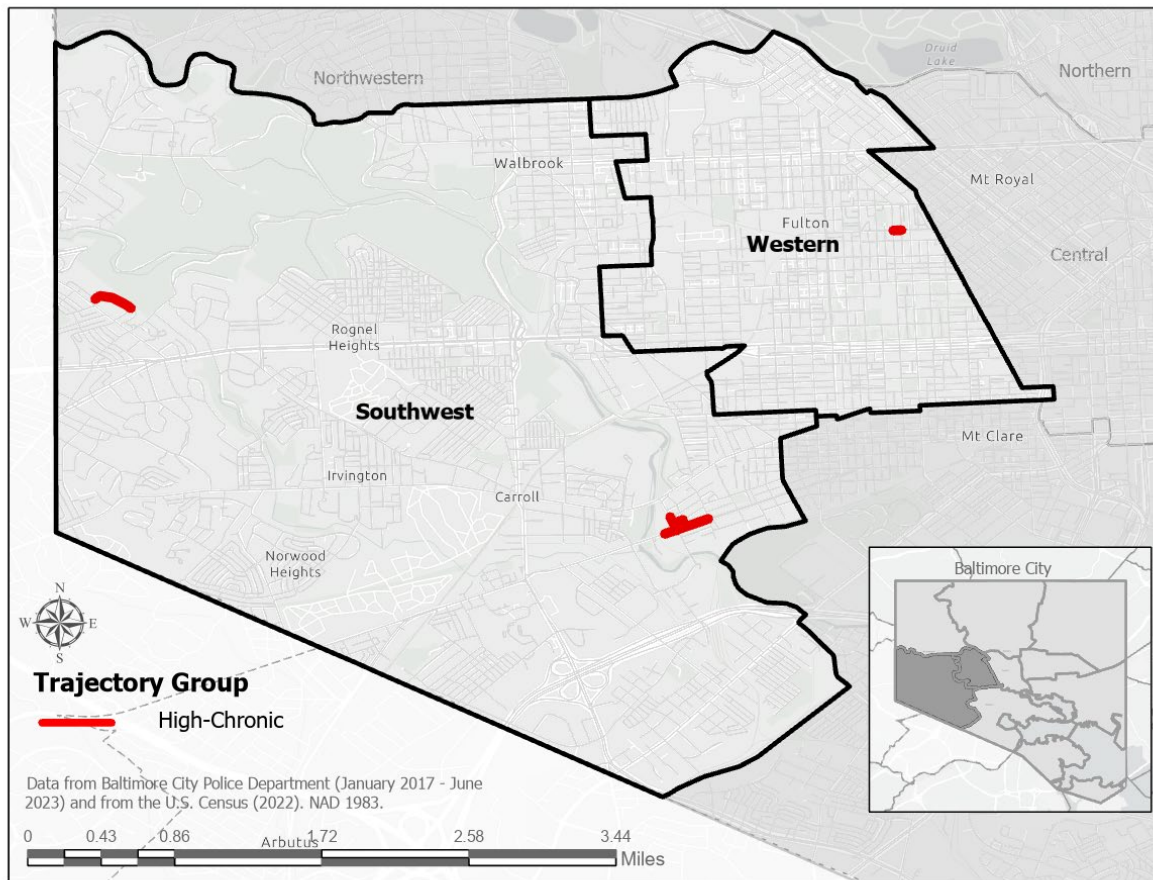


Figure 36. Location of Shots Fired Trajectory Group 6 (High-Chronic) Segments.

In Figure 37, we examined all crime-related CFS among the same groupings of streets from the shots fired trajectory analysis discussed above. Trajectory group 6 (chronic-high shots fired) had a steadily decreasing level of overall crime, and the average crime level even fell below trajectory group 5 (moderate-level shots fired CFS) in late 2021. At the highest in January-June 2018, street segments in trajectory group 6 were averaging 159.63 CFS compared to January-June 2023, where the average was 28.75 CFS. Street segments in trajectory group 5 had 46.62 CFS on average for the same period in 2023.

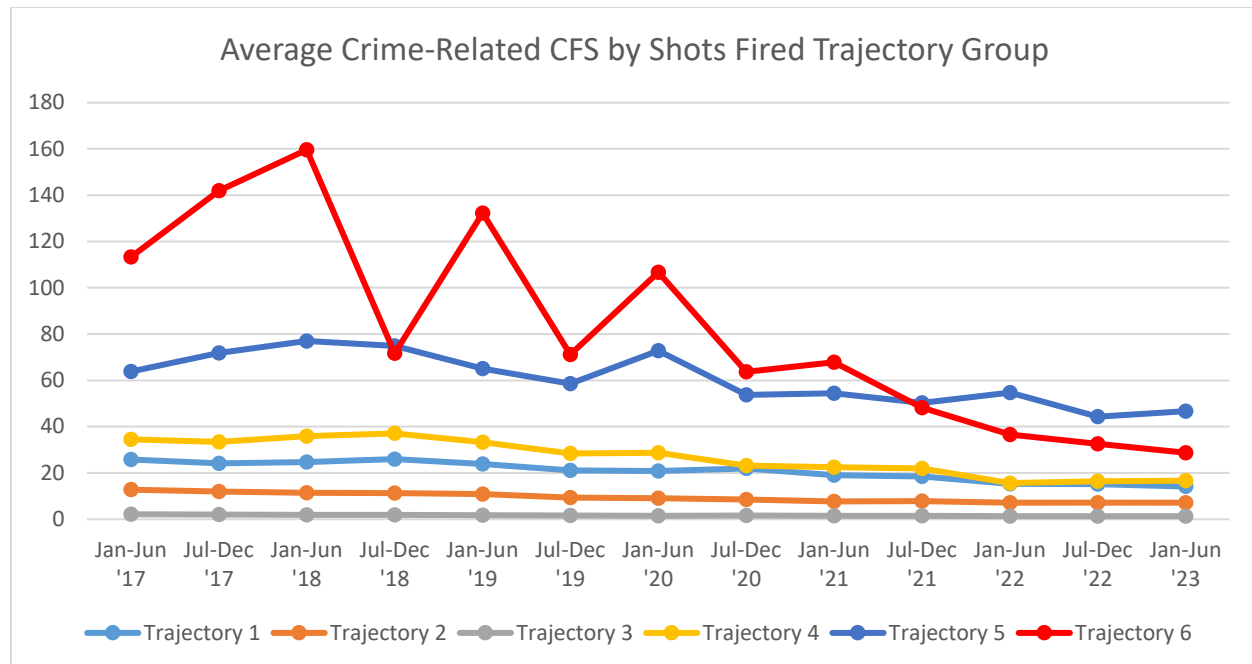


Figure 37. Average Crime-Related Calls for Service by Shots Fired Trajectory Groups.

Trends in Aggravated Assault with a Firearm

Aggravated assault involving a firearm was examined next. Trends in this crime type at the street segment level are presented by district in Figure 38. Along with Central and Eastern districts, the Western and Southwest Districts had some of the highest averages. As shots fired CFS, there was a downward trend in aggravated assault with a firearm CFS across districts from 2017 to 2023. However, the Western district experienced a notable decline in shots fired CFS when comparing January-June 2022 to July-December 2022, but the district experienced a slight increase in gun-involved aggravated assault CFS during the same time period. The Southwest district had trends similar to Western district.

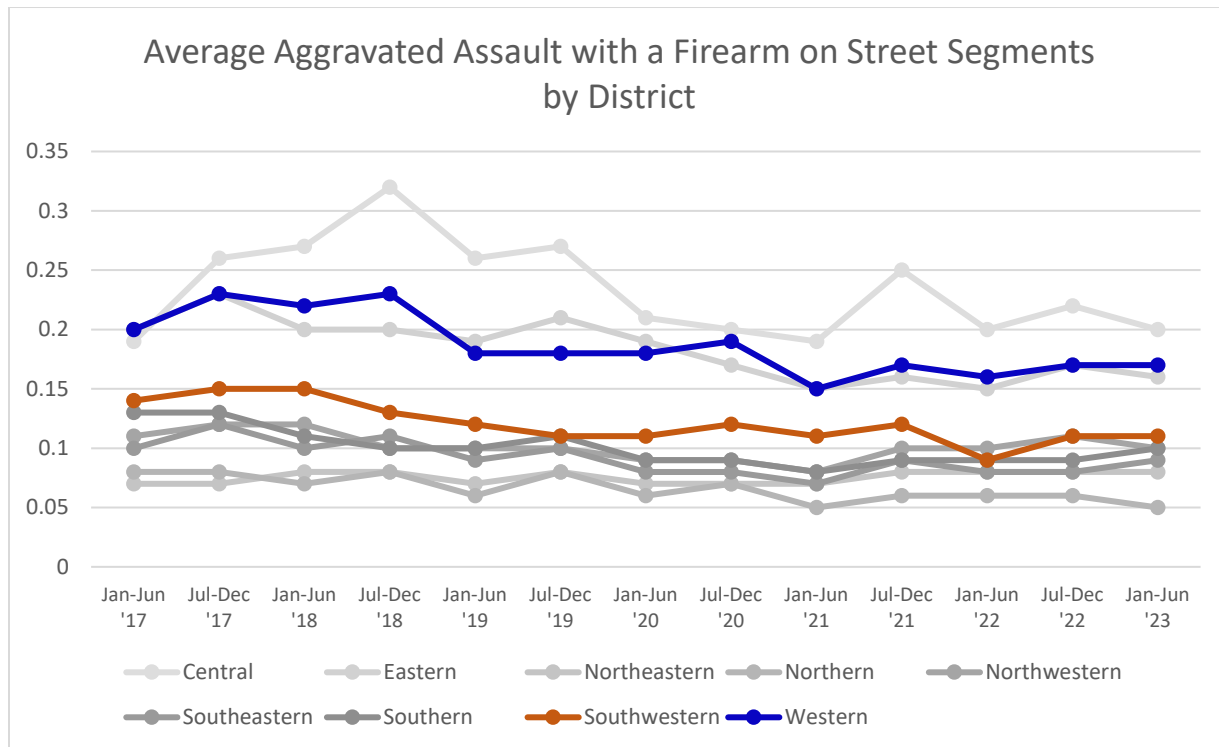


Figure 38. Average Aggravated Assault with a Firearm Calls for Service on Street Segments by District.

Next, trajectory analysis was conducted for aggravated assaults with a firearm CFS using street segments in the Western and Southwest districts. A six-group solution was the best model fit. The average number of aggravated assault with a firearm CFS at the street segment level is presented by trajectory group in Figure 39. The mean number of gun-involved aggravated assault CFS on street segments for each 6-month period tended to be lower on average than the mean number of shots fired. Across trajectory groups, aggravated assaults with a firearm CFS tended to decline or remain stable. Additional information on the trajectory groups is provided in Table 7. Most street segments fall into trajectory group 3 ($n=3,269$; 60.68%), which had little to no gun-involved aggravated assault CFS. Trajectory group 2 had the next highest number of street segments ($n=1,360$; 25.25%), but the average number of gun-involved aggravated assault CFS was still very low—the average on a given street segment in that group for January-June 2023 was 0.21 CFS.

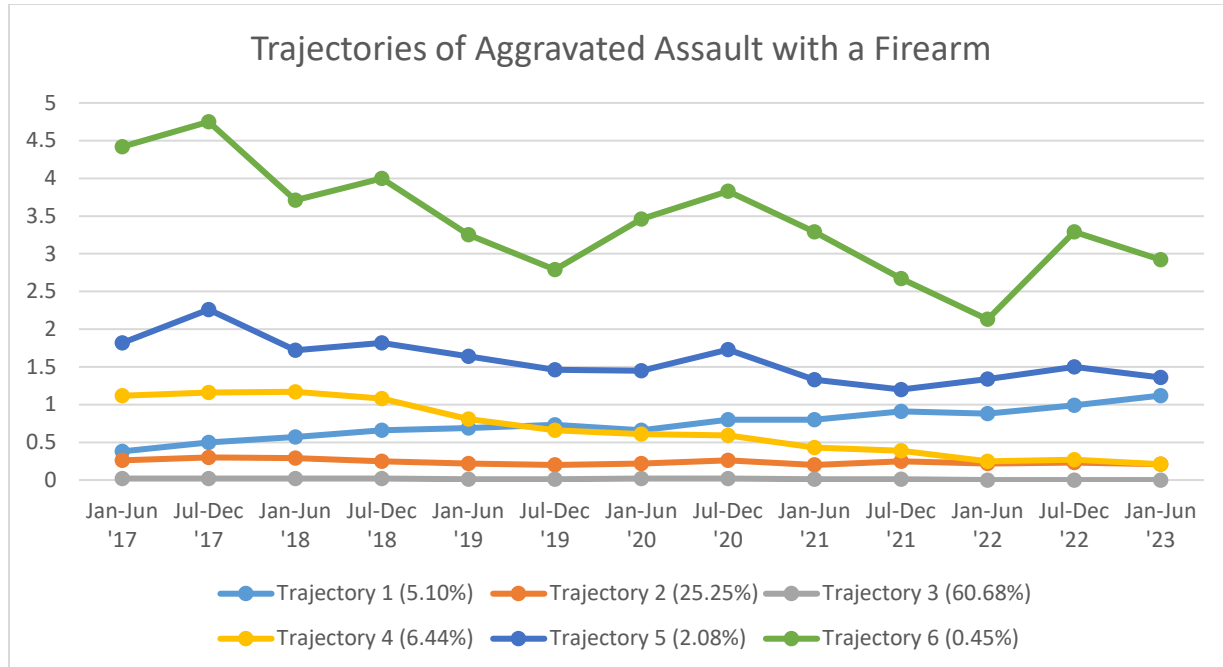


Figure 39. Street Segment Trajectories for Aggravated Assault with a Firearm Calls for Service in Western and Southwest Districts.

Trajectory group 6 comprised 24 street segments (0.45% of all segments) and had the highest overall gun-involved aggravated assault CFS. While this group had an overall decreasing trend, the mean number of CFS was slightly higher in the last two periods (July-December 2022 and January-June 2023). As such, the chronic-high trajectory groups for both shots fired and gun-involved aggravated assault CFS both experienced an increase in the January-June 2023 period with respect to prior trends. Although, the average number of CFS on street segments in group 6 was slightly higher in January-June 2021 as compared to January to June 2023 (3.29 versus 2.92; a 11.24% decrease).

While the incidence of gun-involved aggravated assault CFS on street segments in group 1 was low in comparison to other trajectories, this group was the only one to have an increasing trend over the observation period. This group comprises 275 street segments (5.10% of all segments). The average in January-June 2017 was 0.38, whereas it was 1.12 in January-June 2023. When comparing January-June 2021 to the same period in 2023, there was a 40% increase (0.80 versus 1.12). The average gun-involved assault CFS increased to the point that the mean was similar to that of trajectory group 5 (n=112; 2.08%), which was the group that tended to have the second highest level of CFS.

Table 7. Descriptive Statistics for Aggravated Assault with a Firearm Trajectory Groups

Group	# of Segments	% of Segments	Cumulative Assaults		Avg. Assaults		% Change In Avg.
			Jan-Jun '21	Jan-Jun '23	Jan-Jun '21	Jan-Jun '23	
1	275	5.10	219	307	0.80	1.12	40.0
2	1,360	25.25	273	285	0.20	0.21	5.0
3	3,269	60.68	45	0	0.01	0.00	-
4	347	6.44	148	72	0.43	0.21	-51.16
5	112	2.08	149	152	1.33	1.36	2.26
6	24	0.45	79	70	3.29	2.92	-11.24

The map in Figure 40 depicts all the high-chronic segments that fall into group 6. These street segments fall within the Western and Southwest police districts. The segments in the Western district were concentrated in the northeast section of the area. One of these segments also fell into chronic-high trajectory from the shots fired CFS analysis—2600 block of Wilkens Ave.

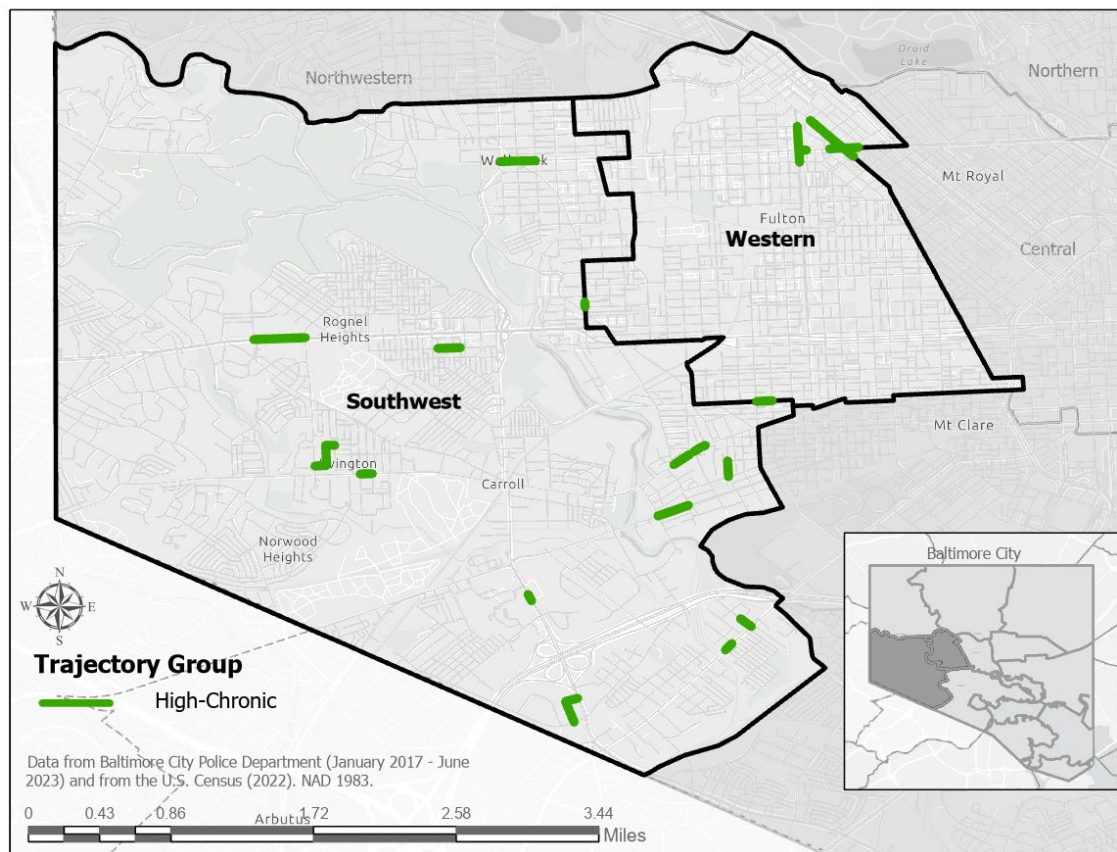


Figure 40. Location of Aggravated Assault with a Firearm Calls for Service Trajectory Group 6 (High-Chronic) Segments.

The trends in crime-related CFS are presented in Figure 41 for the same groupings of streets from the gun-involved aggravated assault CFS trajectory analysis, discussed above. Crime on street segments in group 6 had a decrease in crime-related CFS over the observation period. At its high in July-December 2017, street segments in group 6 had 165.13 crime-related CFS for the 6-month period. The average for the prior three 6-month periods ranged from 83.92 to 85.71 CFS on average. Since January-June 2022, calls for service remained relatively stable on these segments. The other trajectory groups experienced slight declines in CFS or remained relatively stable across the period.

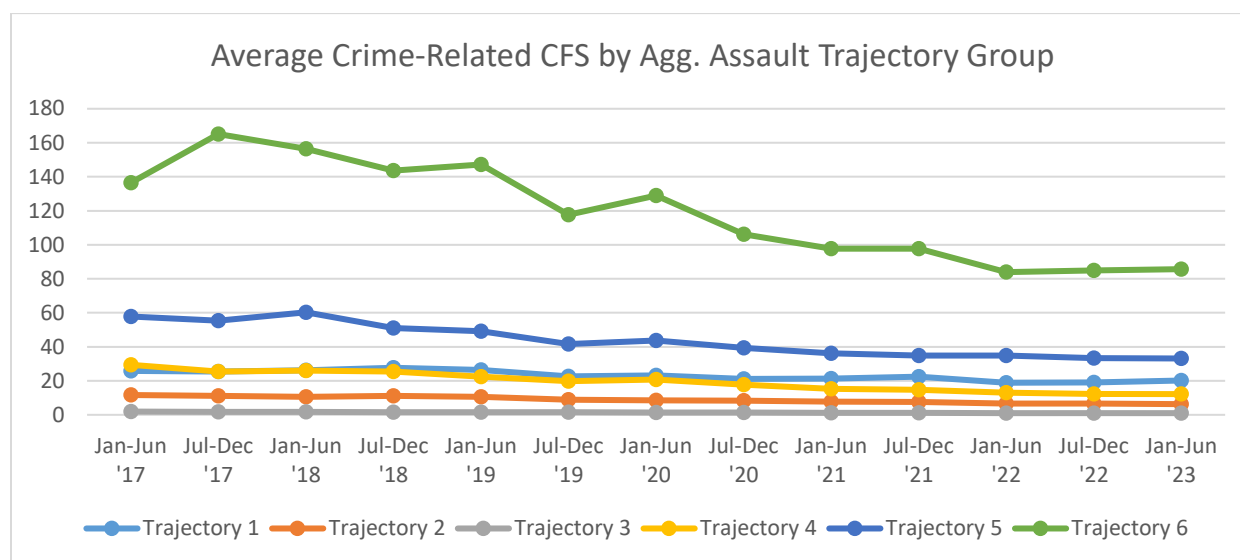


Figure 41. Average Crime-Related Calls for Service by Aggravated Assault with a Firearm Trajectory Groups.

Trends in Shots Fired and Aggravated Assault with a Firearm (Combined)

Trajectory analysis was conducted for gun-involved aggravated assaults and shots fired CFS combined using street segments in the Western and Southwest districts. Figure 42 presents the mean number of gun-involved assault and shots fired CFS at the street segment level over a 6-month for each of the nine trajectory groups. Table 8 provides descriptive statistics of segments presented in Figure 42. Four of the trajectory groups, which represent most street segments in these districts, experienced on average fewer than one assault/shots fired CFS in the 6-month period.

Trajectory group 9, which had only 7 segments (0.13% of total segments), had the highest average across the time period. The highest mean for this group occurred in January-June 2020; with these segments having 22.86 assaults/shots fired CFS on average for the 6-month period. Overall, this group experienced a downward trend over the prior few years; however, the segments had an increase in January-June 2023 as compared to the same period in 2022.

Trajectory group 8, which has 13 segments (0.24% of total segments), had a moderate-high trend. This group remained stable across the observation period.

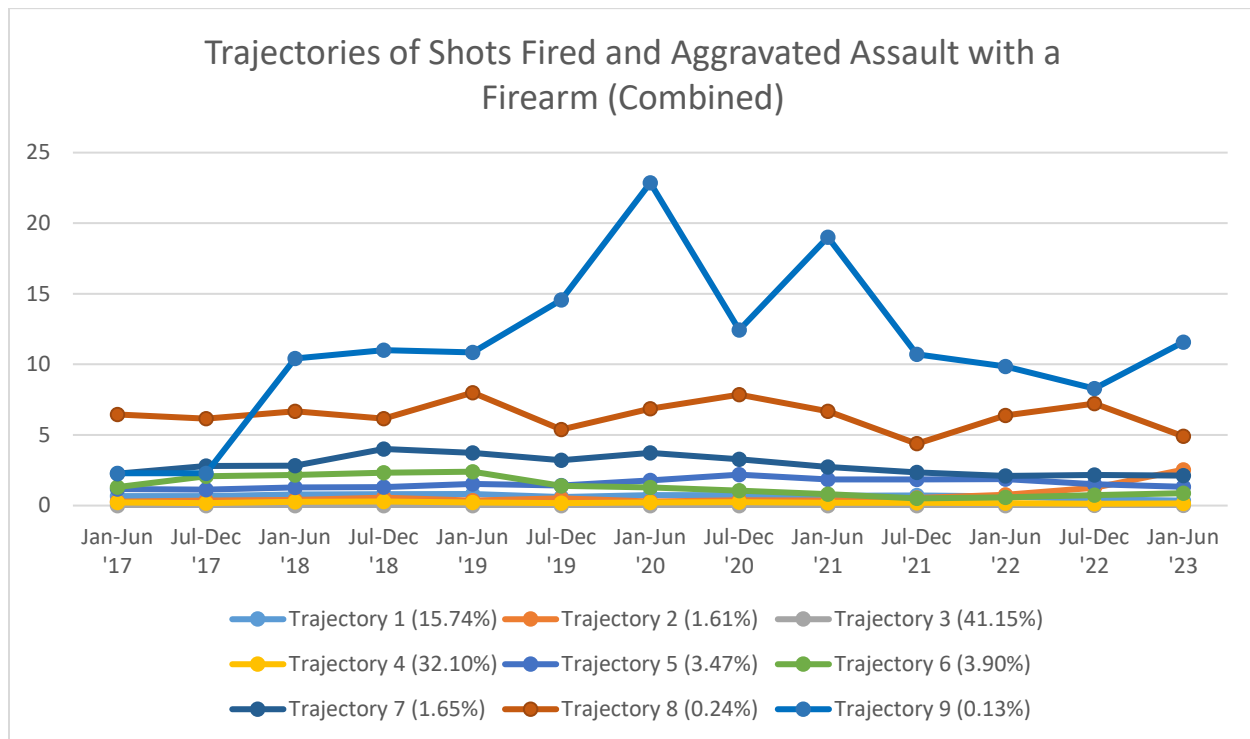


Figure 42. Average Shots Fired and Aggravated Assault with a Firearm Calls for Service on Street Segments by District.

Trajectory group 5 (n=187 segments), group 7 (n=89), group 8 (n=13), and group 9 (n=7) had greater than one assault/shot fired CFS on average during the January-June 2021 and January-June 2023 period. All these groups experienced a decline on average between the two time periods, ranging from a 22.06% to 39.10% decrease.

However, trajectory group 2 experienced an increase from 0.36 on average in January-June 2021 to 2.54 in January-June 2023. A total of 87 segments fell into this group, which was only 1.61% of segments in total. This represents a 605.56% increase. Street segments in group 2 accounted for 14.0% of total assaults/shots fired CFS in January-June 2023, up from 1.6% for the same period in 2021. Street segments in two other trajectory groups also experienced increases between January-June 2021 and 2023, but these increases were negligible. Trajectory group 3 (n=2,217) and group 6 (n=210) went from 0 to 0.02 and 0.80 to 0.88 CFS, respectively.

Table 8. Descriptive Statistics for Shots Fired and Aggravated Assault with a Firearm Calls for Service Trajectory Groups.

Group	# of Segments	% of Segments	Cumulative Assaults/Shots		Avg. Assaults/Shots Fired		% Change In Avg.
			<i>Jan-Jun '21</i>	<i>Jan-Jun '23</i>	<i>Jan-Jun '21</i>	<i>Jan-Jun '23</i>	
1	848	15.74	588	295	0.69	0.35	-49.27
2	87	1.61	31	221	0.36	2.54	605.56
3	2,217	41.15	0	38	0.00	0.02	-
4	1,729	32.1	324	252	0.19	0.15	-21.05
5	187	3.47	348	250	1.86	1.34	-27.96
6	210	3.9	168	184	0.80	0.88	10.0
7	89	1.65	244	189	2.74	2.12	-22.06
8	13	0.24	87	64	6.69	4.92	-26.46
9	7	0.13	133	81	19.00	11.57	-39.10

Segments in the chronic-high (group 9) and moderate-high (group 8) trajectories are depicted on the map in Figure 43. All the segments in the chronic-high trajectory group fall within the Southwest district. One of the segments falls in the western part of the district, while the rest are clustered together in the eastern section. The segments in the moderate-high trajectory group are spread throughout the Southwest district, while the segments in the Western district are clustered in the northwest section of the district.

The street names and address ranges of the street segments by trajectory group and analysis are provided in Table 9. Three segments in the Western and Southwest districts were in the moderately or chronically high trajectories for the shots fired CFS, aggravated assaults with a firearm CFS, and the combined CFS analysis: 1300 block of Laurens St, 900 block of Nottingham Rd, and 2600 block of Wilkens Ave. Two segments were not in the chronically high trajectory for the shots fired CFS and aggravated assaults with a firearm CFS analyses, but did fall in the moderately high trajectory group for the combined CFS analysis: 1300 block of Calhoun St and 2400 block of Washington Blvd.

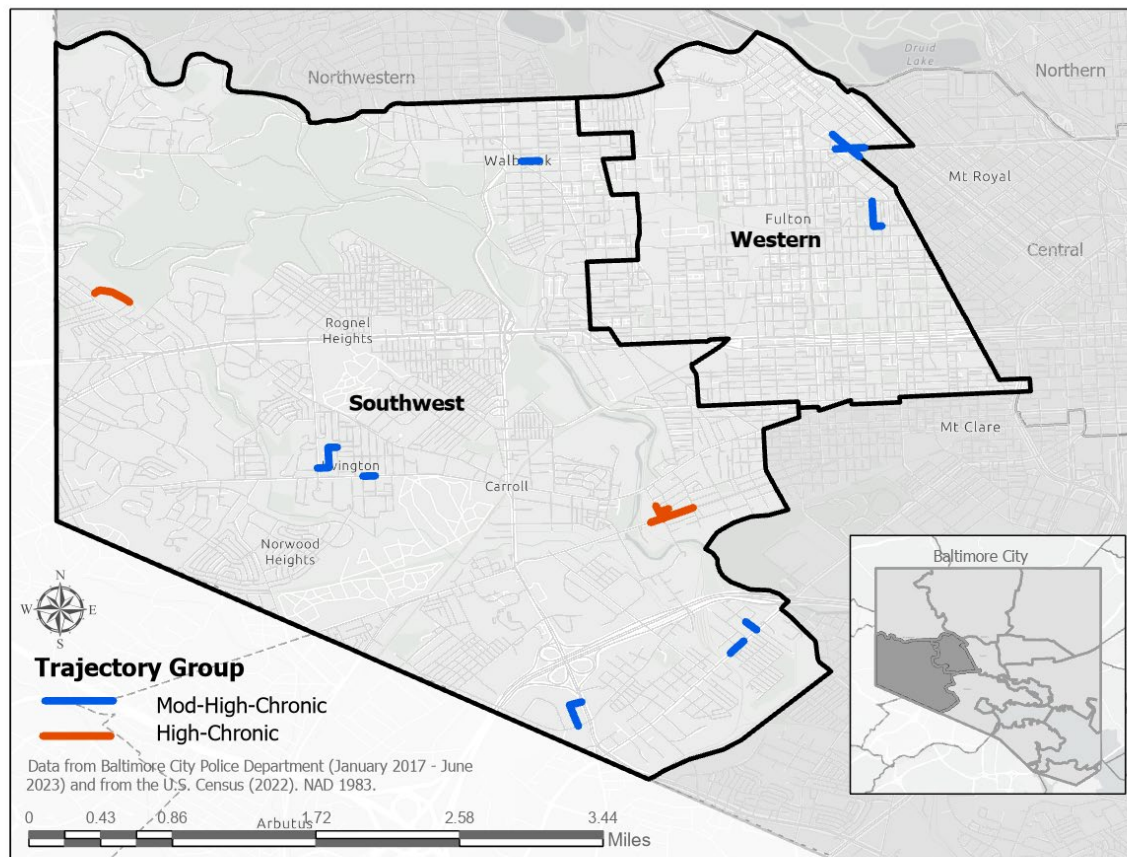


Figure 43. Location of Shots Fired Aggravated Assault with a Firearm Calls for Service Trajectory Group 8 (Mod-High) and Group 9 (Chronic-High) Segments.

Table 9. Streets and Address Ranges by Trajectory Analysis.

Street	Block	Trajectory Analysis		
		<i>Shots Fired</i>	<i>Agg. Assault</i>	<i>Combined</i>
Adelle Ter	4300			
Bloede Ave @ Bloomfield/S Caton				
Bloomfield Ave	1500			
Brunswick St	500-800			
Brunswick St @ Wilkens Ave				
Connecticut Ave	4300			
Diener Pl	100			
Edmondson Ave	4400-4500			
Frederick Ave	4100			
Frederick Ave	2400-2500			
Laurens St	1300			
N Calhoun St	1300			
N Fulton Ave	1800-1900			
Nottingham Rd	900			
Pennsylvania Ave	2400-2500			
Pennsylvania Ave	2600			
Poplar Grove St	700			
S Bentalou St	400			
S Caton Ave	900			
S Caton Ave	1000			
Saint Benedict St	2600			
Sideleigh Rd	4800			
Spence St	1800			
W Baltimore St	2000			
W Franklin St	3500			
W North Ave	1500-1700			
W North Ave	3100-3200			
Washington Blvd	2400			
Washington Blvd	2600			
Wilkens Ave	2600			
Wilkens Ave	2700			

Time Series Analysis for Crime Incidents.

To examine the trends in gun crime for the Western and Southwest districts, as well as for the rest of the city, a series of non-parametric local polynomial graphs of the monthly counts against time were examined.¹⁶

¹⁶ See Appendix A for a fuller discussion of polynomial regressions.

Figure 44 presents the local polynomial trend in violent gun crime in the Western district from Jan 2017 through June 2023. The solid black line represents the interpolated trend, and the circular markers reflect monthly counts. The grey area surrounding the solid line is the 95% confidence interval for the trend. The solid black vertical line shows the start date of CGIC and GVRs in the Western district. Importantly, the confidence interval is considerably larger at the beginning and end of the series due to the lack of observations prior to the start and after the end of the series. It is common to see increases or decreases either at the beginning or at the end of the series; however, these often reflect statistical artifacts rather than real increases or decreases.

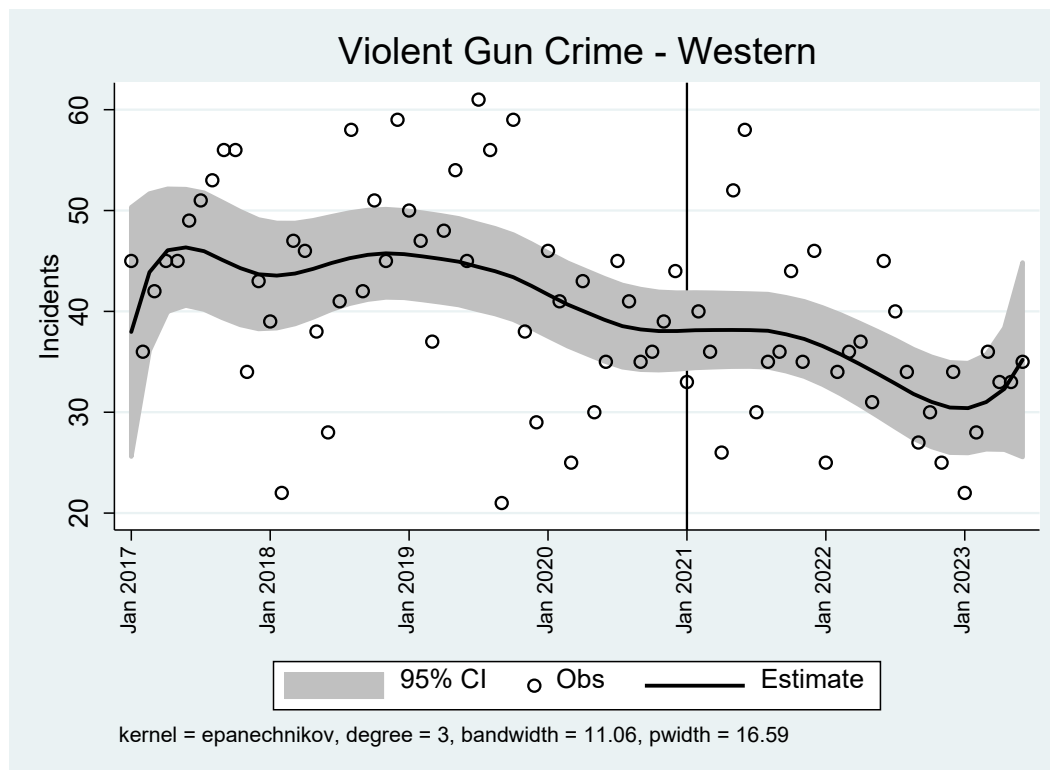


Figure 44. Local Polynomial Estimates for Violent Gun Crime in the Western District, Jan 2017 – June 2023.

Between the beginning of the series and the middle of 2019, it appears that violent gun crime remained at a fairly stable high level. After this, violent gun crime decreased until the end of 2020, when it stabilized again until the end of 2021. After this, it decreased for the remainder of the series, with a possible uptick at the middle of 2023. However, this uptick may be a statistical artifact and not reflect a true increase in violent gun crime.

Figure 45 shows similar local polynomial graphs for gun homicide (top left), gun aggravated assault (top right), gun robbery (bottom left), and burglary (bottom right) for the Western district, from Jan 2017 through June 2023. The trend in gun homicide appears to be stable with a possible

drop occurring around January 2022. The trend in gun aggravated assault also appears stable for most of the series, but shows a possible decrease starting at the beginning of 2022. Gun robbery remains stable until 2020, after which there is a slight decrease until the middle of 2021, where it appears to stabilize at a lower level for the remainder of the series. Finally, burglary increases until the middle of 2018, after which it drops through the beginning of 2021. It appears to stabilize at a lower level with a slight increase after this. There is a possible drop near the middle of 2023, but this may be a statistical artifact.

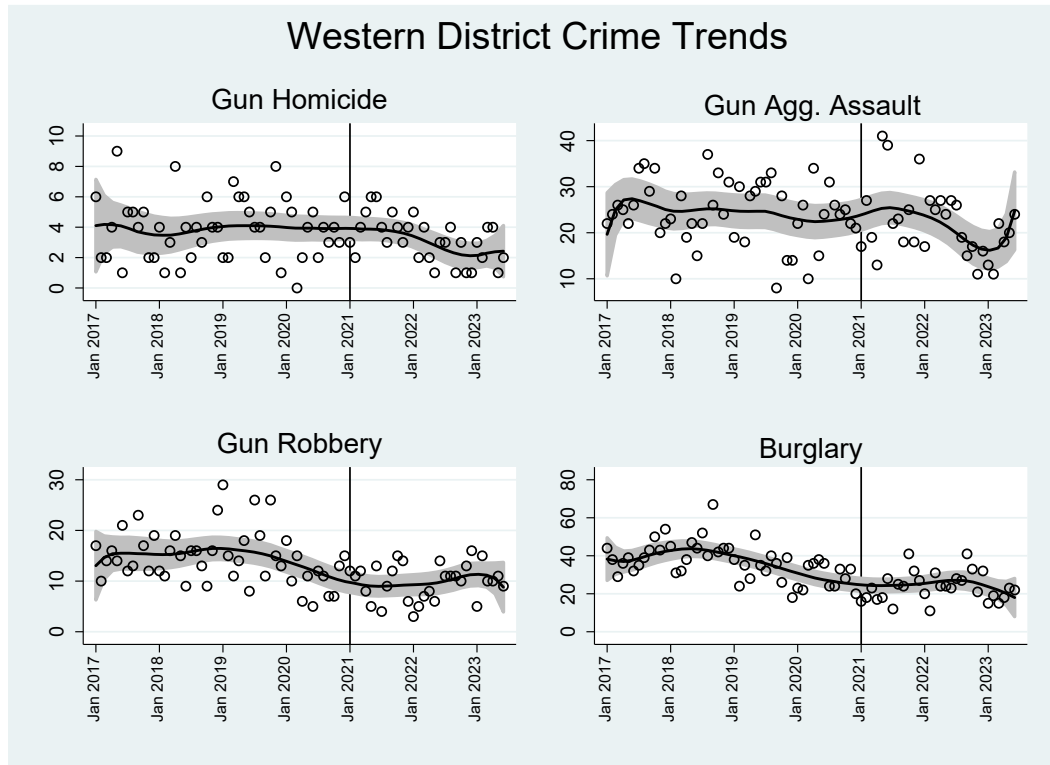


Figure 45. Local Polynomial Estimates for Gun Homicide, Gun Aggravated Assault, Gun Robbery, and Burglary in the Western District, Jan 2017 – June 2023.

Figure 46 shows the local polynomial trends for violent gun crime in the Southwest district. The vertical black line here represents the start date for CGIC in the Southwest. At the beginning of the series, around mid-2017, there is a slowly increasing trend in violent gun crime. Near the middle of 2019, however, this trend reversed and began to slowly decline for the remainder of the series with a possible accelerating decline after the intervention.

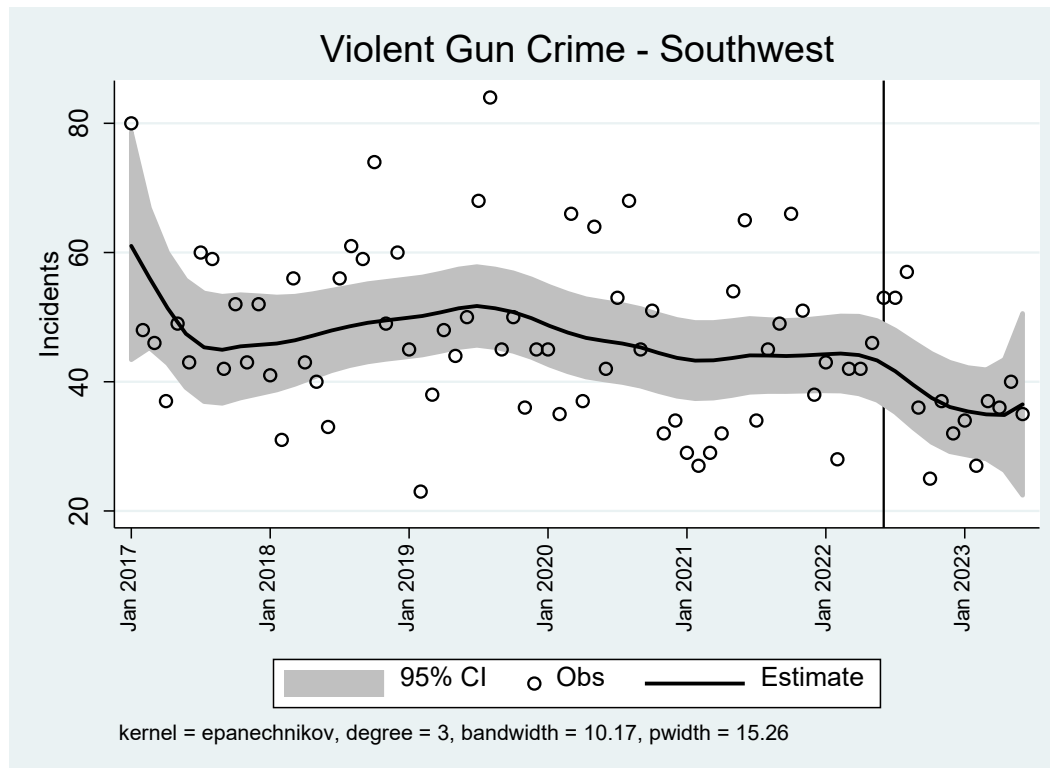


Figure 46. Local Polynomial Estimates for Violent Gun Crime in the Southwest District, Jan 2017 – June 2023.

Figure 47 shows local polynomial trends for gun homicide (top left), gun aggravated assault (top right), gun robbery (bottom left), and burglary (bottom right) for the Southwest district. For gun homicide, the trend appears flat for most of the series, with a possible decrease starting around the beginning of 2022. Gun aggravated assault shows a slightly increasing trend through the beginning of 2021, after which the trend shifts to a slight decline. Gun robbery shows a more complicated trend. The steep drop at the beginning may be a statistical artifact linked to what appears to be a couple of outliers. There appears to be a slowly increasing trend at the beginning of the series, but then a steep decline from mid-2019 through the beginning of 2021, which appears to coincide with the COVID-19 pandemic. After this, there is a slight increase from 2021 through mid-2022, after which it appears to decrease for the remainder of the series. Finally, burglary appears to have steadily declined from the beginning of the series until 2021, after which there is a slight increase followed by a possible decrease starting mid-2022.

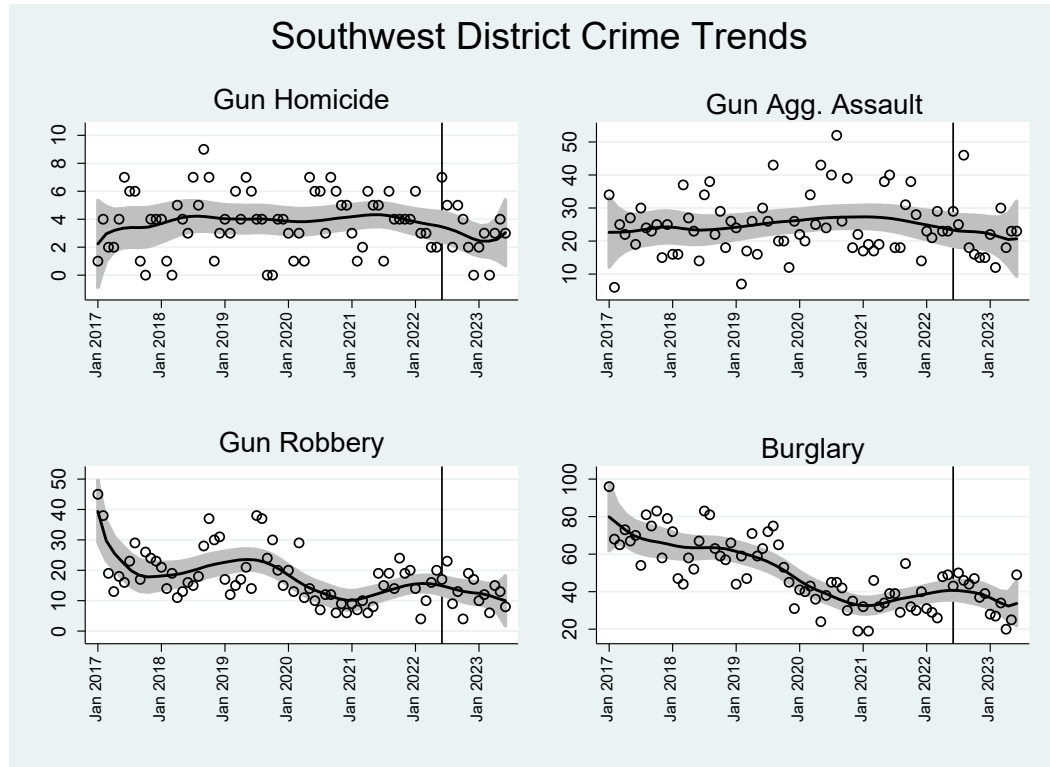


Figure 47. Local Polynomial Estimates for Gun Homicide, Gun Aggravated Assault, Gun Robbery, and Burglary in the Western District, Jan 2017 – June 2023.

Figure 48 presents the trends in violent gun crime for the remainder of the districts in BPD. The first vertical black line represents the start date of CGIC in the Western district and the second vertical black line represents the start date of CGIC in the Southwest district. For the remainder of BPD districts, violent gun crime slowly decreased from 2017 to 2019 and then began decreasing at a slightly higher rate after 2019. The decline appears to stop around the beginning of 2021 and remains stable until the middle of 2022, where it starts increasing again. Near the middle of 2022, violent gun crime again begins decreasing with a slight increase at the end of the series that is a likely statistical artifact.

Finally, Figure 49 shows the trends in gun homicide (top left), gun aggravated assault (top right), gun robbery (bottom left), and burglary (bottom right) for the remaining districts. Gun homicide appears to increase starting in early 2018 until the middle of 2022, and decrease afterwards. Gun aggravated assault shows a very gradual increase across most of the series with a possible decrease corresponding to the middle of 2022. Gun robbery, on the other hand, dropped dramatically from the end of 2017 through the beginning of 2021 and then gradually increased through 2022 with a possible decrease at the end of 2022 through the end of the series. Finally, burglary decreased from the end of 2017 to the beginning of 2021, after which the trend appears flat or slightly decreasing for the remainder of the series.

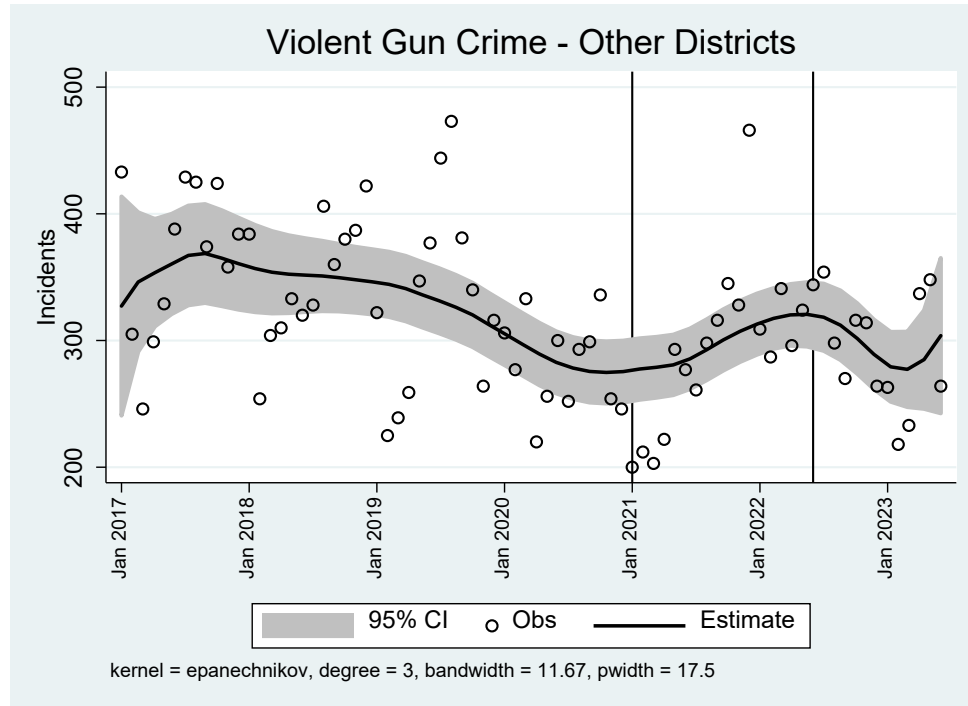


Figure 48. Local Polynomial Estimates for Violent Gun Crime in Other Districts, Jan 2017 – June 2023.

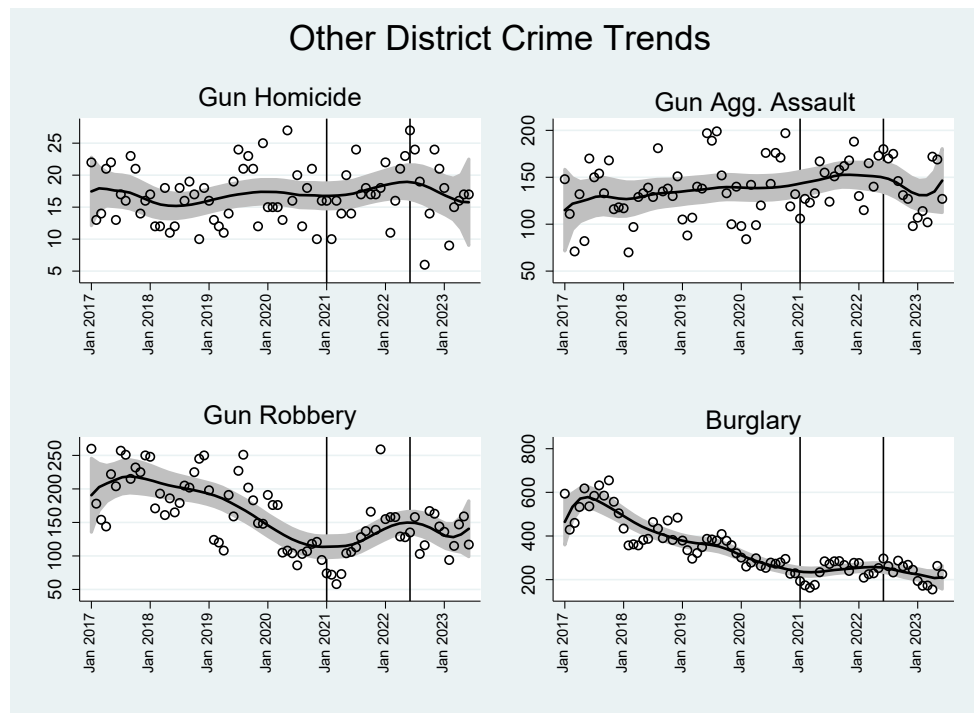


Figure 49. Local Polynomial Estimates for Gun Homicide, Gun Aggravated Assault, Gun Robbery, and Burglary in Other Districts, Jan 2017 – June 2023.

To assess whether the interventions were associated with decreases in gun crime, we conducted a series of segmented regression models. Details about the methods used for these models are available in Appendix A. We created two variables to represent the intervention effect, the CGIC and CGIC x time interaction effect, which captures the change in the level and trend in the outcome respectively. These variables were created separately for the Western and Southwest districts as the timing of their implementations differ. We also included dichotomous controls for season (winter is left as the reference group) and a control for the COVID-19 pandemic (given a value of 1 between March 2020 and July 2021).

Table 10 presents the results of models for the Western district. The top right panel provides results for the model on violent gun crime. The joint test for the intervention variables is statistically significant ($\chi^2(2) = 7.970, p < .05$) showing that violent crime decreased after CGIC was implemented. This model shows a significant interaction effect, suggesting that violent gun crime decreased by 1.43 percent per month after the intervention began. While this may seem like a small amount, this reduction compounds and equates to about 225 fewer violent gun crime incidents across the two and a half years of the intervention.

The model for gun homicide (in the middle left panel) shows a statistically significant effect of CGIC on gun homicide. Again, the joint test is statistically significant ($\chi^2(2) = 12.010, p < .01$), indicating that gun homicides decreased after CGIC was implemented. The interaction effect is significant indicating that gun homicide dropped by 4.47 percent per month after the intervention. This equates to a reduction of 61 gun homicide incidents over the intervention period. The joint tests in models for gun aggravated assault, gun robbery, and burglary are not significant.

To visualize the intervention effect, Figure 50 shows a plot of the predicted values from the model (solid line) for violent gun crime against the “counterfactual,” or the expected level of violent gun crime based on the pre-existing trend. This counterfactual is what would be expected if the intervention had not occurred. The difference between the two lines represents the “treatment effect” or the impact of the intervention on violent gun crime. From this plot, it is apparent that there was a considerable change in the trend in violent gun crime. While we would expect that given the pre-existing trend we would observe around 45 violent gun crimes per month near the end of the series, the actual amount that we observe is closer to 30.

Table 10. Negative Binomial Newey-West Models for Violent Gun Crime, Gun Homicide, Gun Aggravated Assault, Gun Robbery, and Burglary for the Western District.

Variable	b	Robust SE	Variable	b	Robust SE
Violent Gun Crime			Gun Robbery		
Time	-0.001	(0.002)	Time	-0.001	(0.004)
CGIC Western	0.026	(0.073)	CGIC Western	-0.273	(0.156)
CGIC Western x Time	-0.014 **	(0.005)	CGIC Western x Time	-0.004	(0.010)
Spring	0.057	(0.059)	Spring	-0.077	(0.117)
Summer	0.164 **	(0.064)	Summer	-0.031	(0.126)
Fall	0.030	(0.060)	Fall	0.014	(0.143)
COVID-19	-0.147 *	(0.069)	COVID-19	-0.306 *	(0.142)
Constant	3.744 ***	(0.075)	Constant	2.778 ***	(0.113)
Model			Model		
Dispersion	0.016		Dispersion	0.033	
Log Likelihood	-273.419		Log Likelihood	-255.485	
Joint Test: $\chi^2(2)$	7.970 *		Joint Test: $\chi^2(2)$	5.160	
Gun Homicide			Burglary		
Time	0.006	(0.005)	Time	-0.007	(0.004)
CGIC Western	0.180	(0.194)	CGIC Western	-0.216 *	(0.103)
CGIC Western x Time	-0.046 ***	(0.013)	CGIC Western x Time	0.005	(0.009)
Spring	0.297	(0.164)	Spring	0.117	(0.090)
Summer	0.191	(0.112)	Summer	0.140	(0.081)
Fall	0.147	(0.118)	Fall	0.312 ***	(0.083)
COVID-19	-0.301	(0.182)	COVID-19	-0.138	(0.114)
Constant	1.099 ***	(0.153)	Constant	3.655 ***	(0.089)
Model			Model		
Dispersion	0.000		Dispersion	0.021	
Log Likelihood	-150.326		Log Likelihood	-262.409	
Joint Test: $\chi^2(2)$	12.010 **		Joint Test: $\chi^2(2)$	4.770	
Gun Agg. Assault					
Time	-0.002	(0.003)			
CGIC Western	0.165	(0.108)			
CGIC Western x Time	-0.015	(0.008)			
Spring	0.099	(0.076)			
Summer	0.269 ***	(0.076)			
Fall	0.022	(0.089)			
COVID-19	-0.059	(0.097)			
Constant	3.142 ***	(0.089)			
Model					
Dispersion	0.033				
Log Likelihood	-255.485				
Joint Test: $\chi^2(2)$	4.280				

* $p < .05$, ** $p < .01$, *** $p < .001$

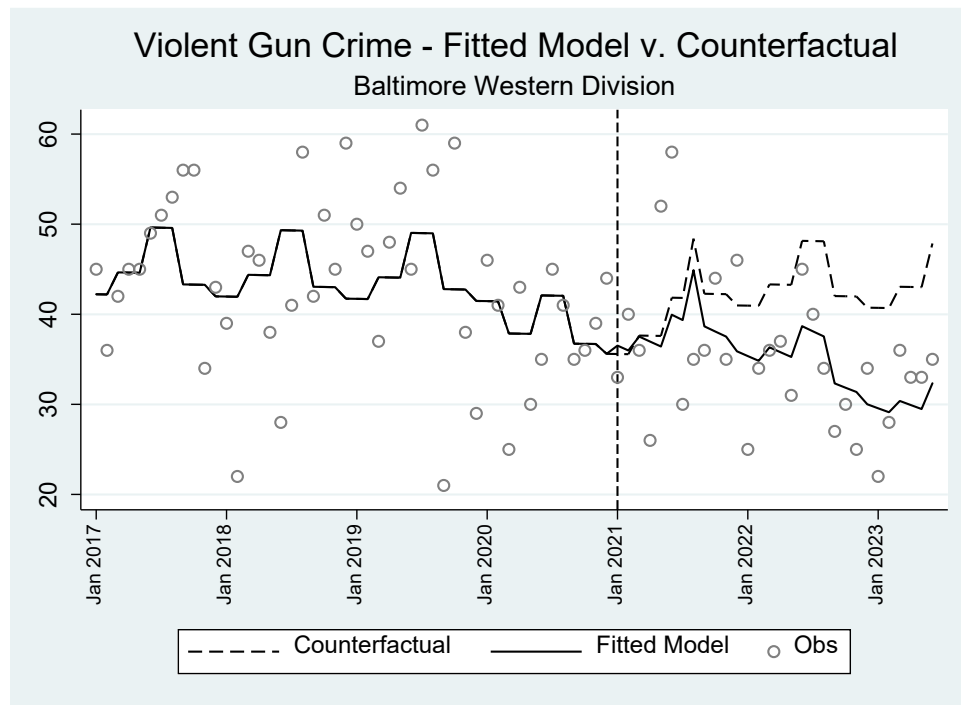


Figure 50. Fitted Model vs. Counterfactual Plot for Violent Gun Crime in the Western District.

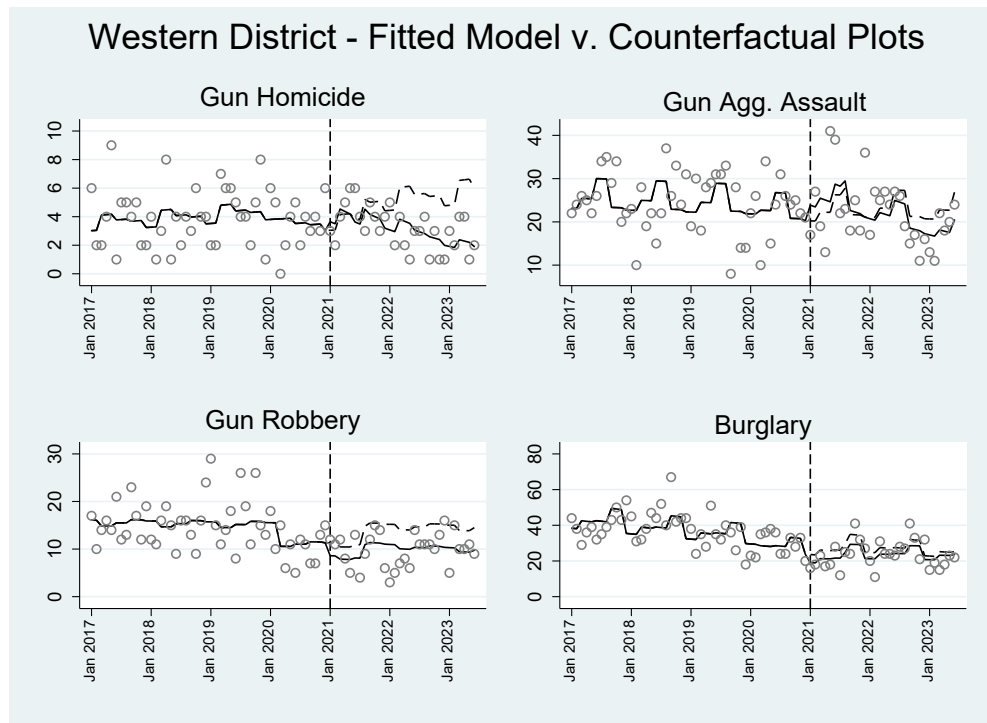


Figure 51. Fitted Model vs. Counterfactual Plots for Gun Homicide, Gun Aggravated Assault, Gun Robbery, and Burglary in the Western District.

Similar plots were produced for gun homicide (top left), gun aggravated assault (top right), gun robbery (bottom left), and burglary (bottom right) in Figure 51. For gun homicide, the counterfactual indicates that we would expect nearly six gun homicides per month near the end of the series, but after the intervention, we observe around two gun homicides per month. For gun aggravated assaults, gun robbery, and burglary the intervention effects are not statistically significant and the differences between the observed and the counterfactual model were negligible.

These results provide support for a reduction in violent gun crime and gun homicide in the Western district. While the decreases seen in gun aggravated assault and gun robbery are not statistically significant, the coefficients are negative, suggesting that these crimes were decreasing after the intervention as well. Burglary was examined along with gun crimes, as CGIC is not expected to affect burglary trends.¹⁷ Since the variables for CGIC is not significant in this model, it is likely that the drop in violent gun crime and gun homicide was restricted to these crimes and not part of an overall decrease in crime in the Western district.

Table 11 presents the results from the negative binomial Newey-West regression models for violent gun crime, gun homicide, gun aggravated assault, gun robbery, and burglary for the Southwest district. In these models, the start date of CGIC in the Southwest was used to define the treatment and treatment x time interaction variable. Since there was an approximate six-month difference in the start date for CGIC and GVRs, we could assess the impact of CGIC and GVRs separately. Seeing that the start date of GVRs was near the end of the series, only a dichotomous treatment indicator was included in the model.

None of the joint tests for the intervention variables is statistically significant in the models for any outcome examined. This suggests that CGIC had no impact on gun crime in the Southwest. Further, the indicator for GVRs is not statistically significant either, suggesting that GVRs also had no impact on gun crime in the Southwest.

Figure 51 presents the fitted model against the counterfactual for violent gun crime in the Southwest. While there is a notable difference between the fitted model and the counterfactual, this difference is not statistically significant. Interestingly, this difference is significant at the $p > 0.1$ level and it is likely that if the trend were to continue for additional months it would reach statistical significance.

¹⁷ CGIC may indirectly affect burglary trends as research indicates that offenders do not specialize in crime types and arresting gun offenders removes active offenders from the community. However, the size of the reductions in burglary would likely be considerably less than for gun crimes.

Table 11. Negative Binomial Newey-West Models for Violent Gun Crime, Gun Homicide, Gun Aggravated Assault, Gun Robbery, and Burglary for the Western District.

Variable	b	Robust SE	Variable	b	Robust SE
Violent Gun Crime			Gun Robbery		
Time	-0.002	(0.002)	Time	-0.007 *	(0.003)
CGIC Southwest	-0.022	(0.094)	CGIC Southwest	-0.017	(0.174)
CGIC Southwest x Time	-0.044 *	(0.020)	CGIC Southwest x Time	-0.067	(0.039)
GVRs	0.232	(0.162)	GVRs	0.451	(0.309)
Spring	0.137	(0.079)	Spring	-0.043	(0.158)
Summer	0.322 ***	(0.089)	Summer	0.145	(0.157)
Fall	0.183 *	(0.084)	Fall	0.192	(0.128)
COVID-19	-0.064	(0.081)	COVID-19	-0.462 **	(0.178)
Constant	3.789 ***	(0.100)	Constant	3.151 ***	(0.162)
Model			Model		
Dispersion	0.031		Dispersion	0.082	
Log Likelihood	-292.399		Log Likelihood	-251.275	
Joint Test: $\chi^2(2)$	5.550		Joint Test: $\chi^2(2)$	3.490	
Gun Homicide			Burglary		
Time	0.001	(0.003)	Time	-0.012 ***	(0.002)
CGIC Southwest	-0.084	(0.278)	CGIC Southwest	0.146	(0.109)
CGIC Southwest x Time	0.012	(0.061)	CGIC Southwest x Time	0.003	(0.024)
GVRs	-0.572	(0.509)	GVRs	-0.163	(0.174)
Spring	0.132	(0.149)	Spring	0.061	(0.080)
Summer	0.451 ***	(0.121)	Summer	0.249 ***	(0.073)
Fall	0.168	(0.239)	Fall	0.128 *	(0.061)
COVID-19	0.076	(0.149)	COVID-19	-0.265 ***	(0.067)
Constant	1.105 ***	(0.119)	Constant	4.247 ***	(0.074)
Model			Model		
Dispersion	0.001		Dispersion	0.017	
Log Likelihood	-162.652		Log Likelihood	-284.527	
Joint Test: $\chi^2(2)$	0.090		Joint Test: $\chi^2(2)$	2.970	
Gun Agg. Assault					
Time	0.001	(0.002)			
CGIC Southwest	-0.008	(0.109)			
CGIC Southwest x Time	-0.049 *	(0.022)			
GVRs	0.264	(0.186)			
Spring	0.288 ***	(0.075)			
Summer	0.440 ***	(0.093)			
Fall	0.180	(0.111)			
COVID-19	0.118	(0.087)			
Constant	2.904 ***	(0.086)			
Model					
Dispersion	0.054				
Log Likelihood	-266.155				
Joint Test: $\chi^2(2)$	5.250				

* $p < .05$, ** $p < .01$, *** $p < .001$

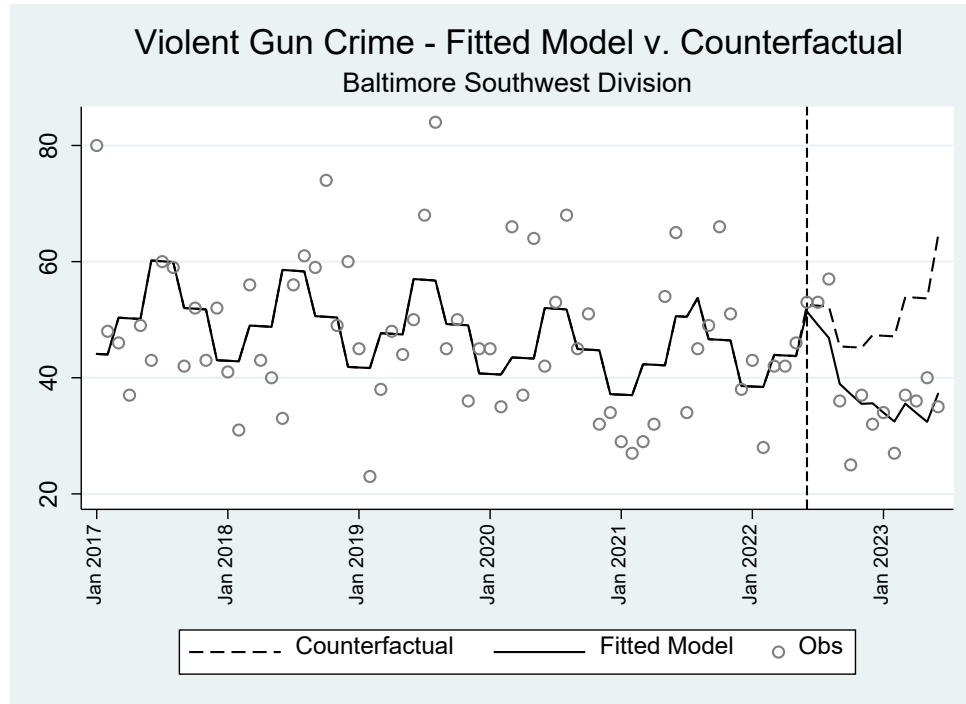


Figure 51. Fitted Model vs. Counterfactual Plot for Violent Gun Crime in the Southwest District.

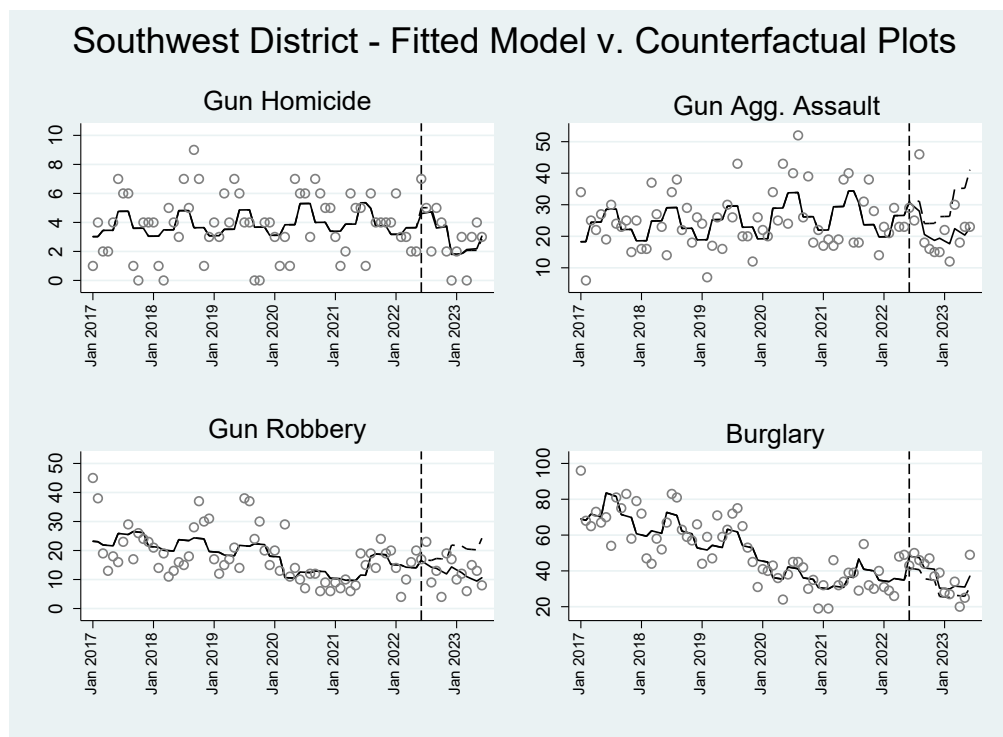


Figure 52. Fitted Model vs. Counterfactual Plots for Gun Homicide, Gun Aggravated Assault, Gun Robbery, and Burglary in the Southwest District.

Figure 52 shows the same plots for gun homicide (top left), gun aggravated assault (top right), gun robbery (bottom left), and burglary (bottom right). Here, there are some differences between the counterfactual and fitted models for these plots. As with total gun violence, the drop in gun aggravated assaults is significant at the $p < 0.1$ level and may reach significance with additional observations. For the other crimes, however, these observed differences are much smaller.

These results indicate that both CGIC and GVRS had little impact on violent gun crime in the Southwest district. While the trends do appear to be in the correct direction, none of the intervention variables reached statistical significance in any of the models. It is worth noting that the lack of statistical significance may be due to the short post-intervention observational period. However, the evidence thus far suggests that the benefits seen in the Western district was not repeated in the Southwest district at this time.

Table 12 provides the results for the models for the remainder of the districts. The intervention variables for both the Western and Southwest were included in the models. Ideally, there should be no significant effects for these variables, as this would suggest that at least some of the reductions might be attributed to citywide changes in violent gun crime.

The top left panel presents the results for violent gun crime. In this model, the joint test for the intervention variables for the Western ($\chi^2(2) = 12.670, p < .01$) and the Southwest ($\chi^2(2) = 11.160, p < .01$) CGIC are significant, suggesting that violent gun crime decreased in the remaining districts at the same time that the CGIC/GVRS intervention began in the Western district and when CGIC began in the Southwest. This suggests that at least some of the decline in violent gun crime may be due to citywide decreases in gun violence.

The middle left panel presents results for gun homicide. Here the joint test for the coefficients for the Western CGIC was not significant ($\chi^2(2) = 5.220, n.s.$) suggesting that a citywide decrease in gun homicides does not explain the reduction of gun homicide observed in the Western. Interestingly, the joint test for the Southwest was statistically significant ($\chi^2(2) = 6.340, p < .05$) indicating that a citywide drop in gun homicide began around the same time as CGIC began in the Southwest. Similar results were observed for the Southwest intervention variables for gun aggravated assault ($\chi^2(2) = 9.490, p < .01$), gun robbery ($\chi^2(2) = 6.570, p < .05$), and burglary ($\chi^2(2) = 22.190, p < .01$) suggesting a general citywide drop in crime (violent and possibly property) near the start of Q2 of 2022. A drop in gun robbery was also observed citywide near the start of the CGIC intervention in the Western ($\chi^2(2) = 7.800, p < .05$). *Taken as a whole, these results suggest that at least the drop in gun homicide in the Western may be due to the CGIC/GVRS interventions in the Western district.*

Table 12. Negative Binomial Newey-West Models for Violent Gun Crime, Gun Homicide, Gun Aggravated Assault, Gun Robbery, and Burglary for the Remaining Districts.

Violent Gun Crime			Gun Robbery		
Time	-0.003	(0.002)	Time	-0.008 **	(0.003)
CGIC Western	-0.172 ***	(0.052)	CGIC Western	-0.314 **	(0.122)
CGIC Western x Time	0.025 **	(0.010)	CGIC Western x Time	0.038 *	(0.015)
CGIC Southwest	-0.273 **	(0.092)	CGIC Southwest	-0.361 *	(0.142)
CGIC Southwest x Time	-0.020	(0.011)	CGIC Southwest x Time	-0.022	(0.015)
Spring	-0.032	(0.049)	Spring	-0.136 *	(0.062)
Summer	0.150 **	(0.051)	Summer	0.003	(0.063)
Fall	0.108 **	(0.036)	Fall	0.050	(0.049)
COVID-19	-0.146 *	(0.070)	COVID-19	-0.340 ***	(0.107)
Constant	5.851 ***	(0.054)	Constant	5.446 ***	(0.069)
Model			Model		
Dispersion	0.018		Dispersion	0.030	
Log Likelihood	-407.938		Log Likelihood	-373.309	
Western Joint Test: $\chi^2(2)$	12.670 **		Western Joint Test: $\chi^2(2)$	7.800 *	
SW Joint Test: $\chi^2(2)$	11.160 **		SW Joint Test: $\chi^2(2)$	6.570 *	
Gun Homicide			Burglary		
Time	0.000	(0.004)	Time	-0.018 ***	(0.001)
CGIC Western	-0.128	(0.068)	CGIC Western	-0.135	(0.072)
CGIC Western x Time	0.021	(0.014)	CGIC Western x Time	0.032 ***	(0.007)
CGIC Southwest	-0.038	(0.146)	CGIC Southwest	-0.107	(0.068)
CGIC Southwest x Time	-0.045 *	(0.021)	CGIC Southwest x Time	-0.030 **	(0.010)
Spring	0.021	(0.070)	Spring	-0.039	(0.036)
Summer	0.106	(0.067)	Summer	0.143 ***	(0.037)
Fall	0.033	(0.074)	Fall	0.168 ***	(0.039)
COVID-19	0.023	(0.113)	COVID-19	-0.044	(0.043)
Constant	2.773 ***	(0.072)	Constant	6.332 ***	(0.045)
Model			Model		
Dispersion	0.003		Dispersion	0.010	
Log Likelihood	-223.030		Log Likelihood	-392.463	
Western Joint Test: $\chi^2(2)$	5.220		Western Joint Test: $\chi^2(2)$	22.190 ***	
SW Joint Test: $\chi^2(2)$	6.340 *		SW Joint Test: $\chi^2(2)$	10.400 **	
Gun Agg. Assault					
Time	0.003	(0.003)			
CGIC Western	-0.087	(0.068)			
CGIC Western x Time	0.014	(0.010)			
CGIC Southwest	-0.243 **	(0.094)			
CGIC Southwest x Time	-0.018	(0.013)			
Spring	0.090	(0.060)			
Summer	0.336 ***	(0.063)			
Fall	0.196 ***	(0.048)			
COVID-19	0.001	(0.082)			
Constant	4.657 ***	(0.073)			
Model					
Dispersion	0.024				
Log Likelihood	-358.804				
Western Joint Test: $\chi^2(2)$	3.020				
SW Joint Test: $\chi^2(2)$	9.490 **				

* $p < .05$, ** $p < .01$, *** $p < .001$

Time Series Analysis for Calls for Service.

Since CFS represent different measures of criminal activity, we examined CFS measures in a separate section. For both of these measures, the time series analysis was similar to the analysis of crime incidents. First, we examined local polynomial models to assess the trends in these measures over time. After this, we used negative binomial Newey-West segmented regression models to assess whether CGIC was associated with a statistically significant intervention effect. Finally, we examined the observed vs. expected counterfactual plots to illustrate the size and extensiveness of these intervention effects.

Figure 52 shows the local polynomial regression models for shots fired and aggravated assault with a firearm CFS for the Western district. In both graphs, the observations from 2017 are considerably lower than observations from 2018. Further investigation suggested that data from 2017 might be problematic as this difference was present across several crime types. Given the sensitivity of time series models to this type of distortion, data from 2017 were removed from all subsequent models for shots fired and aggravated assault with a firearm CFS. For the shots fired CFS data for the remaining months, there appears to be an increase in shots fired calls from 2018 until a peak in early 2019. After this, shots fired CFS decreased until about the start of 2021 and remained flat for the following year. The number of shots fired calls appears to have decreased considerably after the start of 2022 through the end of the series.

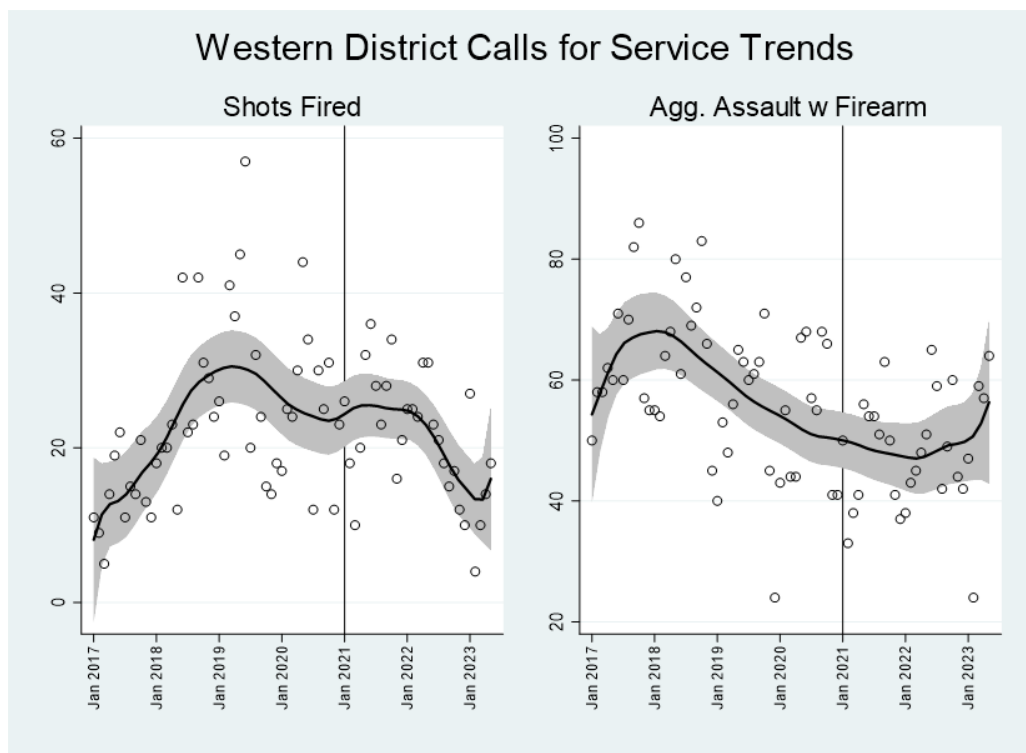


Figure 52. Shots Fired and Aggravated Assault with a Firearm Calls for Service for the Western District, 2017 through May 2023.

The trend for aggravated assault with a firearm calls in the Western district is presented in the second panel of Figure 52. Again, there appeared to be a jump in CFS between 2017 and 2018, which is likely due to data issues. These calls appear to hit a high point around the beginning of 2018 and then steadily declined until about the end of 2021. After this, there appeared to be a slight increase at the end of the series.

The trends for shots fired calls and aggravated assault with a firearm calls for the Southwest district is presented in Figure 53. Interestingly, a large increase in shots fired calls appeared to have occurred between 2018 and 2019. After this, the increase continued, but at a slightly slower rate until the beginning of 2021. Then, there was a dramatic decrease in shots fired CFS until the middle of 2022, which happened to coincide with the start of CGIC in the Southwest. Finally, the calls appeared to increase through the end of the observation period.

For aggravated assault with a firearm calls, the peak level appeared to be at the beginning of 2018. After this, there appeared to be a strong decline until the beginning of 2020. The trend appeared to be mostly flat and then a slow decrease until the middle of 2022. Again, coinciding with the start of CGIC in the Southwest, there appeared to be an increase in these calls that continue throughout the rest of the data series.

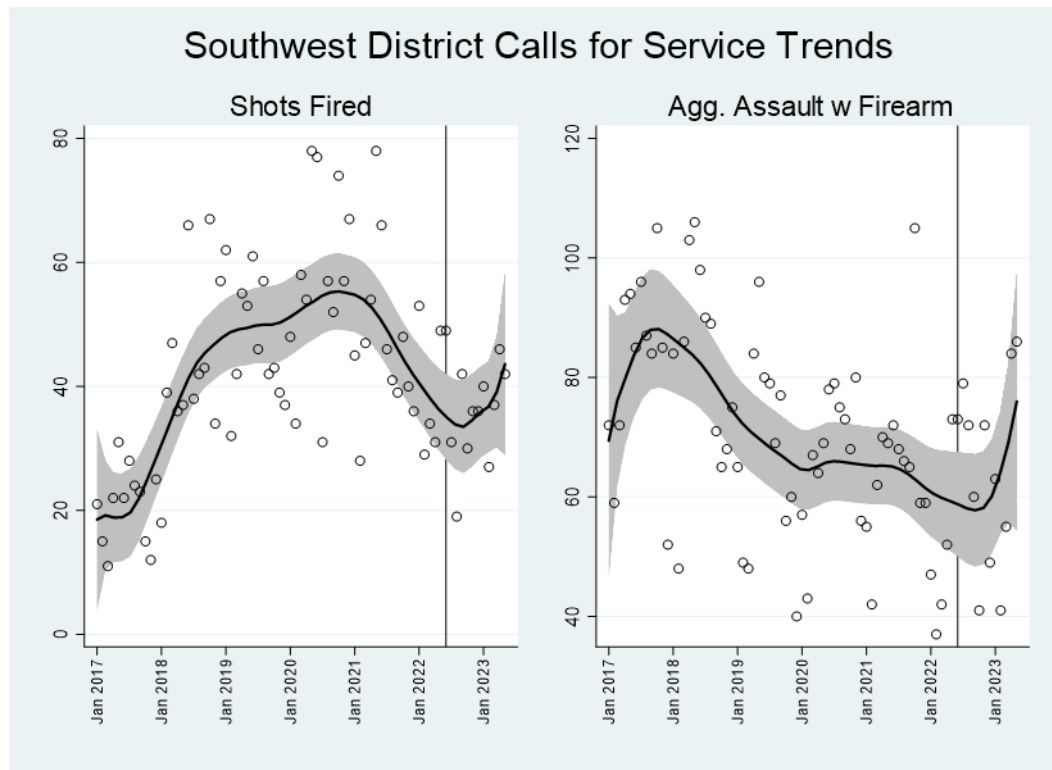


Figure 53. Shots Fired and Aggravated Assault with a Firearm Calls for Service for the Southwest District, 2017 through May 2023.

Figure 54 presents the trends for shots fired and aggravated assault with a firearm calls for the remaining BPD districts. Across the rest of the BPD, shots fired calls for service increased steeply through the beginning of 2021. After this, there appeared to be a slight decrease until the middle of 2022, where the trend flattened out for the rest of the series. For aggravated assault with a firearm, the peak year appeared to be 2018, after which there was a large decline until the beginning of 2020. After this, the trend appeared flat with another decrease occurring in the middle of 2021 and continuing through the end of the series. A spike occurred near the end of the series, but this was likely to be a statistical artifact.

The trends in shots fired and aggravated assault with a firearm calls for the remaining districts are presented in Figure X. For shots fired calls, an increasing trend runs from the beginning of the series to the start of 2020. After this, the shots fired calls for service appeared to decline through the middle of 2021 and fluctuate around a stable level after that. For aggravated assault with a firearm calls for service, there was a considerable decrease from the start of 2018 through the beginning of 2021. After this, the trend appeared to increase at a rate much slower than the decrease through the end of the series.

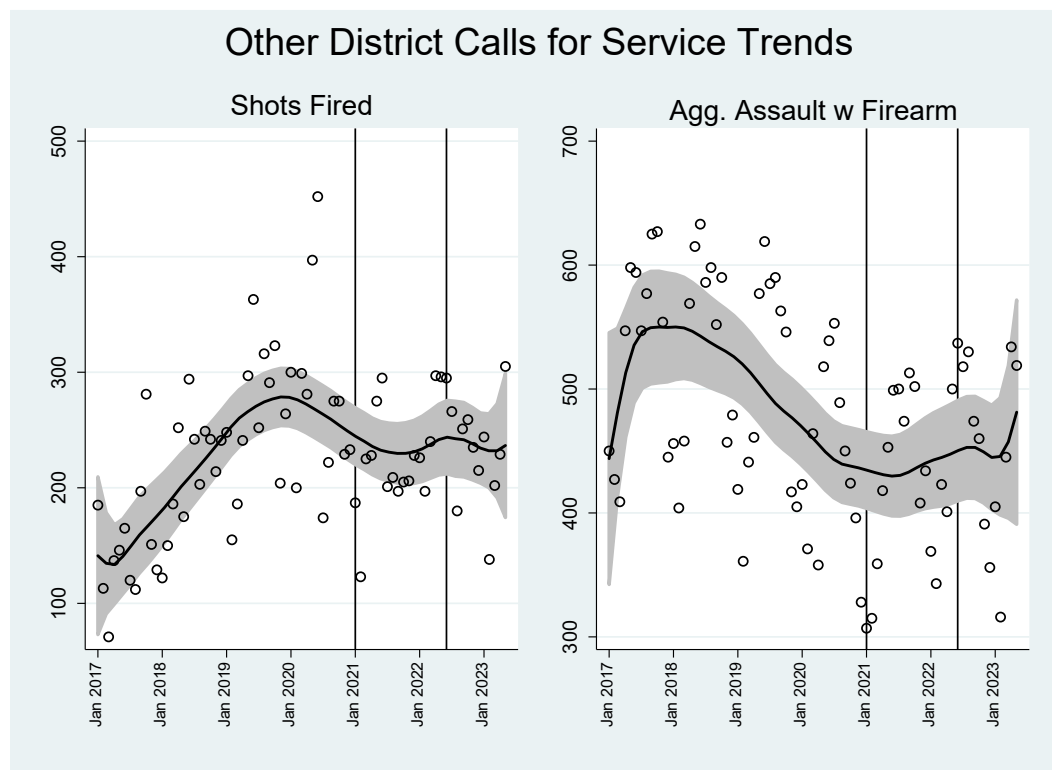


Figure 54. Shots Fired and Aggravated Assault with a Firearm Calls for Service for Other Districts, 2017 through May 2023.

The results for the negative binomial Newey-West models for the Western district are presented in Table 12. The joint test for the intervention effects of CGIC in the Western are statistically significant ($\chi^2(2) = 8.220, p < .05$) and indicate that shots fired CFS decreased after CGIC was implemented. This suggests a 3.94 percent decrease in shots fired CFS per month after the intervention. Strangely, the joint test for aggravated assaults with a firearm are also statistically significant but positive. This indicates that these calls increased by 1.94 percent per month after the intervention. This could mean that aggravated assaults with a firearm increased after the intervention or seeing that the police reports show inconsistent results it could also suggest that citizens were more willing to call the police in response to shooting events after the intervention.

For both variables, the predicted vs. counterfactual plots are presented in Figure 54. Near the end of the observational period, if CGIC was not implemented we would expect to see over 40 shots fired calls for service per month, but actually observed less than 20. For aggravated assault with a firearm calls, we would have expected to see a little over 30 calls per month, but instead observed around 50 per month by the end of the observational period.

Table 12. Negative Binomial Newey-West Models for Shots Fired and Aggravated Assault with a Firearm Calls for Service for the Western District.

Variable	b	Robust SE	Variable	b	Robust SE
Shots Fired Calls			Agg. Assault w Firearm Calls		
Time	0.008	(0.009)	Time	-0.012 ***	(0.002)
CGIC Western	0.064	(0.170)	CGIC Western	-0.043	(0.060)
CGIC Western x Time	-0.040 **	(0.016)	CGIC Western x Time	0.019 ***	(0.006)
Spring	0.300 **	(0.116)	Spring	0.242 ***	(0.053)
Summer	0.316 ***	(0.083)	Summer	0.333 ***	(0.039)
Fall	0.107	(0.110)	Fall	0.341 ***	(0.052)
COVID-19	-0.241	(0.169)	COVID-19	0.082	(0.059)
Constant	2.927 ***	(0.223)	Constant	4.160 ***	(0.055)
Model			Model		
Dispersion	0.078		Dispersion	0.005	
Log Likelihood	-227.662		Log Likelihood	-230.902	
Western Joint Test: $\chi^2(2)$	8.220 *		Western Joint Test: $\chi^2(2)$	11.960 **	

* $p < .05$, ** $p < .01$, *** $p < .001$

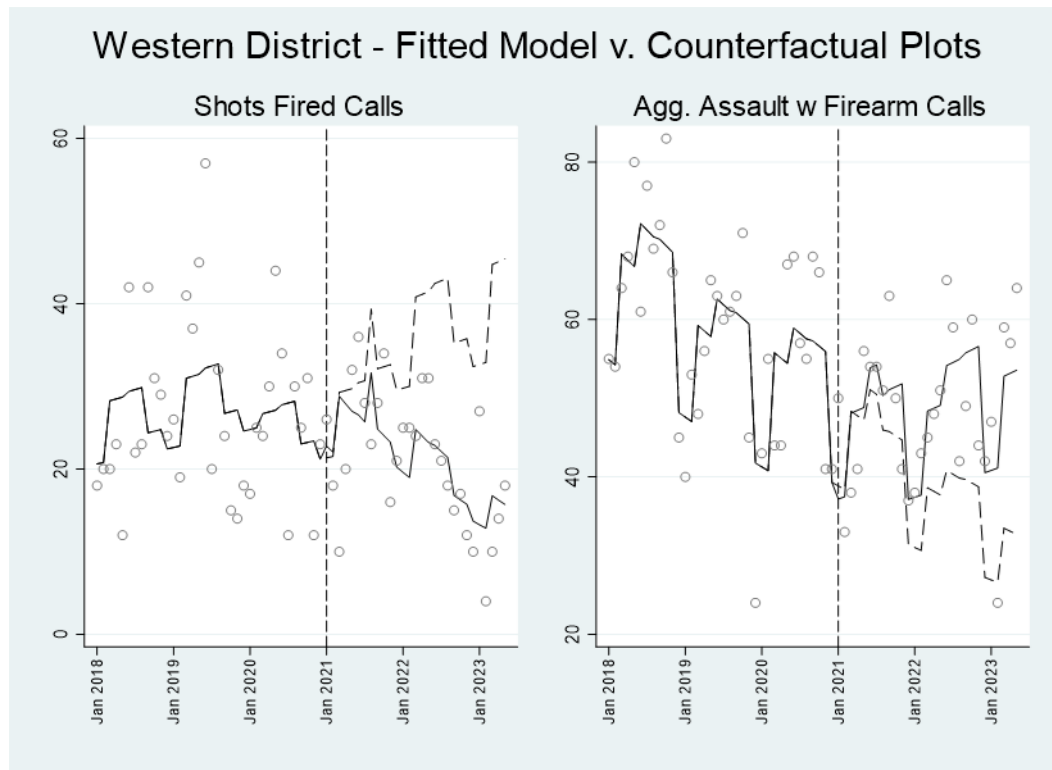


Figure 54. Fitted Model vs. Counterfactual Plots for Shots Fired and Aggravated Assault with a Firearm for the Western District.

The results of the negative binomial Newey-West models for shots fired and aggravated assaults with a firearm CFS for the Southwest district are presented in Table 13. The joint test for both models is not statistically significant, indicating that CGIC did not have an impact on these calls. The intervention variable for GVRS is also not statistically significant. Figure 55 shows the predicted vs. counterfactual plots for these models. While the directions of the effects are consistent with the patterns observed in the Western, the magnitude of these differences is considerably less as the differences were not significant in the Southwest.

Table 13. Negative Binomial Newey-West Models for Shots Fired and Aggravated Assault with a Firearm Calls for Service for the Southwest District.

Variable	b	Robust SE	Variable	b	Robust SE
Shots Fired Calls			Agg. Assault w Firearm Calls		
Time	-0.002	(0.002)	Time	-0.007 **	(0.002)
CGIC Southwest	-0.182	(0.131)	CGIC Southwest	0.052	(0.115)
CGIC Southwest x Time	-0.011	(0.027)	CGIC Southwest x Time	0.011	(0.026)
GVRs	0.260	(0.170)	GVRs	0.084	(0.175)
Spring	0.143	(0.085)	Spring	0.311 ***	(0.060)
Summer	0.161	(0.094)	Summer	0.387 ***	(0.046)
Fall	0.153	(0.086)	Fall	0.271 ***	(0.075)
COVID-19	0.272 ***	(0.056)	COVID-19	0.011	(0.059)
Constant	3.753 ***	(0.139)	Constant	4.229 ***	(0.081)
Model			Model		
Dispersion	0.036		Dispersion	0.017	
Log Likelihood	-246.969		Log Likelihood	-253.240	
SW Joint Test: $\chi^2(2)$	4.410		SW Joint Test: $\chi^2(2)$	0.560	

* $p < .05$, ** $p < .01$, *** $p < .001$

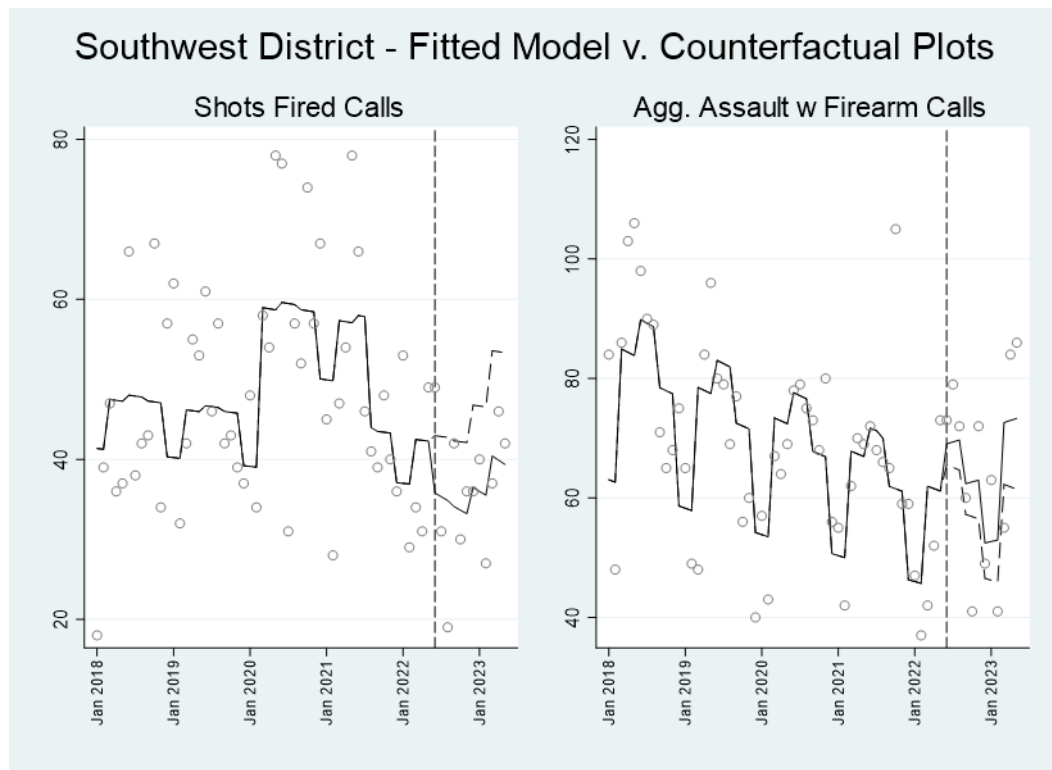


Figure 55. Fitted Model vs. Counterfactual Plots for Shots Fired and Aggravated Assault with a Firearm for the Southwest District.

Table 14 shows the results of the negative binomial Newey West models for shots fired and aggravated assault with a firearm CFS for the remaining districts. For shots fired CFS, the joint test for the Western CGIC variables is statistically significant, suggesting that shots fired calls dropped across the rest of the city at the same time as they did in the Western. The joint test for the Southwest is not significant. The model suggested that shots fired calls dropped 35.92 percent when CGIC started in the Western. Based on the local polynomial plots, it appears that January and February 2021 had an abnormally low number of shots fired CFS compared to other months. For aggravated assaults with a firearm calls, neither joint tests for the Western nor Southwest CGIC interventions are statistically significant.

Table 14. Negative Binomial Newey-West Models for Shots Fired and Aggravated Assault with a Firearm Calls for Service for the Other Districts.

Variable	b	Robust SE	Variable	b	Robust SE
Shots Fired Calls			Agg. Assault w Firearm Calls		
Time	0.015 **	(0.005)	Time	-0.004 ***	(0.001)
CGIC Western	-0.445 ***	(0.105)	CGIC Western	-0.051	(0.037)
CGIC Western x Time	-0.005	(0.013)	CGIC Western x Time	0.007	(0.005)
CGIC Southwest	-0.044	(0.089)	CGIC Southwest	-0.069	(0.054)
CGIC Southwest x Time	-0.017	(0.015)	CGIC Southwest x Time	0.007	(0.007)
Spring	0.254 ***	(0.061)	Spring	0.223 ***	(0.026)
Summer	0.255 ***	(0.069)	Summer	0.390 ***	(0.022)
Fall	0.133 *	(0.054)	Fall	0.234 ***	(0.026)
COVID-19	-0.088	(0.108)	COVID-19	-0.090 **	(0.034)
Constant	4.926 ***	(0.158)	Constant	6.134 ***	(0.038)
Model			Model		
Dispersion	0.034		Dispersion	0.007	
Log Likelihood	-340.83		Log Likelihood	-336.950	
Western Joint Test: $\chi^2(2)$	21.390 ***		Western Joint Test: $\chi^2(2)$	2.410	
SW Joint Test: $\chi^2(2)$	1.970		SW Joint Test: $\chi^2(2)$	2.870	

* $p < .05$, ** $p < .01$, *** $p < .001$

Summary

The impact evaluation shows promising results for the impact of CGIC. First, in the descriptive statistics, the counts of violent gun crime in general decreased across the city. These decreases were observed in both the Western and Southwest districts as well as with other police districts across the city. This is encouraging as it suggests that the BPD efforts to address violent gun crime appeared to be working.

The hot spot analysis also shows some promising results. When comparing 2020 (the last full year before CGIC) to 2022 (the last full year of the data), there were clear signs that gun crime was decreasing in both the Western and Southwest. For the CFS (shots fired and aggravated



assault with a firearm calls), the hot spots from 2020 decreased considerably in intensity. The same was observed for gun homicide/aggravated assault, most of the hot spots in 2020 diminished considerably by 2022 and some of them disappeared completely. The results for gun robbery were more complex, however, as there were signs of crime displacement. Hot spots from 2020 diminished considerably (particularly in the east of the Western district), but new hot spots formed in areas where they were previously unobserved. Taken as a whole, however, these hot spot maps supported the decreasing levels of gun crime in the Western and Southwest districts.

Trajectory analysis was used to identify the particular street segments where crime was most likely to occur. The results listed in Table 9 are helpful for future planning efforts. In addition, these results also contained encouraging findings for CGIC. For most trajectory groups, particularly the chronic street segments, the identified trajectories showed either decreasing or stable shots fired and aggravated assault with a firearm CFS over time.

The time series models demonstrated that for the Western district, there was a significant reduction in violent gun crime and gun homicide corresponding to the start date of CGIC. Because GVRs and CGIC began operations around the same time, it was impossible to determine whether the reductions were due to CGIC, GVRs, or both interventions. Although gun aggravated assault and gun robbery did not achieve statistical significance, both crimes were trending downward in the Western. Intervention variables in the model for burglary were not significant, suggesting that the decline was restricted to gun-related violence and not crime in general. Shots fired and aggravated assault with a firearm CFS also showed significant interventions effects. The results showed a significant decrease in shots fired CFS. In contrast, aggravated assault with a firearm CFS increased in the Western after the intervention. Since no corresponding increase in gun aggravated assaults or robberies occurred, the results suggested that citizens are more likely to call the police about events that were occurring.

In contrast, neither the CGIC variables nor the GVRs variable achieved statistical significance in the Southwest district. This indicated that neither program resulted in significant declines in gun violence from any of the measures considered. This makes it impossible to determine whether CGIC or GVRs was responsible for the decreases observed in the Western. However, many of the crimes examined were trending in the correct direction, and it is possible that the lack of significant effects was due to the limited number of post-intervention observations.

Finally, for the remaining districts, the intervention effect for the Western was significant in the model for violent gun crime. This suggested that at least some of the decrease in the Western district was due to citywide decreases in gun violence. This effect was not observed for homicide, indicating that the reductions in gun homicide occurred in the Western district alone. Interestingly, the intervention variables for the Western and Southwest CGIC were significant in the model for gun robbery, which showed that gun robbery was declining across the city. Finally, the intervention variables for the Western district were significant in the other districts for shots fired CFS. This implies that shots fired CFS were declining across the city and some of the effect observed in the Western might be attributed to this citywide decline.



Conclusions

Summary

Similar to many urban areas, the City of Baltimore has historically struggled with elevated rates of gun crime. To address this problem, the Baltimore Police Department (BPD) implemented its Crime Gun Intelligence Center, or CGIC. The purpose of CGIC is to better leverage ballistics evidence by using it to generate investigative leads. Traditionally, ballistics evidence processing has been an arduous process and given the length of time it takes to process this evidence has been limited in use to post-arrest processing. CGIC emphasizes timely acquisition, entering, and processing of ballistics evidence, usually within 24 to 48 hours, through the National Integrated Ballistics Information Network (NIBIN) maintained by the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) to generate leads that can be used for investigative follow-up. In this way, along with information from the electronic firearm tracing system (eTrace), ballistics and recovered firearms can drive investigations and lead police to identify current active shooters and connect firearm discharge incidents to further disrupt shooting networks.

The CGIC model represents a continual partnership between the local police agency, the local ATF office, the state and federal prosecutor's offices, and additional agency and other partners to strategize enforcement and investigative efforts, share intelligence about ongoing investigations, and to provide feedback about the successes of the CGIC approach. In Baltimore, this partnership was realized by the BPD, the Baltimore field division of the ATF, the U.S. Attorney's Office for Maryland, and for a time the States Attorney's for Baltimore City Office. The BPD contributed one CGIC coordinator and one CGIC analyst at the start of this project, housed within the Data Driven Strategies Division within the BPD. Later, this unit was moved to the Anti-Crime Section and an additional sergeant and CGIC-designated detective were added to the personnel. These personnel collaborated with detectives, primarily from the homicide, Western, and Southwest units by providing intelligence packets and investigative support for gun-involved crime. Additionally, CGIC conducted community outreach using social media and the distribution of business information packets.

Implementing CGIC

CGIC was implemented first in the Western district of the BPD starting in January 2021 and then expanded into the Southwest district in June 2022. Importantly, CGIC was not the only initiative operating in these divisions at the time as the Mayor's Group Violence Reduction Strategy (GVRS) was initiated concurrently in the Western and followed CGIC into the Southwest 6 months after its implementation. These initiatives operated cooperatively and CGIC provided detectives working on GVRS cases with ballistics information when requested. As CGIC has now been located with GVRS in the Anti-Crime Section, there are signs of increased cooperation between these programs in recent months.



As the research partner for BPD, Justice & Security Strategies, Inc. (JSS) conducted a process and impact evaluation on CGIC to understand how CGIC was implemented, what were the successes and challenges of the CGIC program, and what was the impact of CGIC on gun crime in Baltimore. This process involved extensive data collection from police reports, calls for service, arrests, gun seizure, and NIBIN submission databases in addition to officer online surveys, interviews, site visits, and accompanying CGIC personnel to visits of other CGIC sites.

The process evaluation revealed that there was a consistently high number of NIBIN entries, many of which resulted in NIBIN leads. Similarly, BPD recovered a consistently high number of crime guns per month, but these resulted in a small but consistent number of linked crime guns across the implementation period. Based on comparisons before and after CGIC, both the Western and Southwest districts saw slight increases in the number of guns seized. The Western and Southwest produced similar numbers of linked crime guns and ballistics evidence after implementation. In total, BPD produced 2,753 NIBIN leads across the observation period and the Western and Southwest districts comprised about 51 percent of these leads.

From the first officer survey, many of the officers were aware of CGIC in both districts early during the implementation but were generally unaware of what it was or had worked with CGIC on a limited number of cases. This is interesting as most of the officers responding to the survey from both districts were involved in activities that involved CGIC processes. At the time of the second wave of surveys, officers reported considerably more familiarity with CGIC.

CGIC conducted community engagement activities in the Western and Southwest districts. A main avenue of community engagement was conducted through social media – specifically CGIC maintained an active Facebook page that provided information to the community about gun violence incidents, guns seized, and gun violence arrests as well as providing information about contacting the police department or Metro Crime Stoppers with information. The Facebook page experienced considerable growth across the study period with over 3,300 followers by April 2022. We found a correlation between Metro Crime Stoppers tips and Facebook followers, but more research is needed to determine whether this relationship is robust.

Finally, through interviews, site visits, and other discussions, JSS found considerable support for CGIC from both command staff and detectives who work with CGIC. Many of the interviewees discussed the benefit of CGIC provided information and indicated that CGIC lead to improvements in ballistics evidence collection and processing. Respondents also emphasized that CGIC improved collaborations between departments and agencies, particularly in regards to the ATF. However, CGIC has experienced challenges as the workload outpaces the available staff, and that CGIC staff would need to increase to better utilize the information. CGIC, however, continues to evolve and improve moving forward.

The impact evaluation showed that violent gun crime has been trending downward in Baltimore over the last several years. While the trend is not constant across crime types and districts, in general, violent gun crime was lower in 2022 compared to 2017. The hot spot analysis examined



the spatial distribution of gun crime in the Western and Southwest districts. For shots fired calls for service, aggravated assault with a firearm calls for service, and gun homicide/aggravated assaults, the maps suggest that the hot spots from 2020 were considerably less intense in 2022 with little indication of crime displacement within the districts. For gun robbery, however, the intensity of the hot spots from 2020 decreased, but new hot spots emerged suggesting some displacement effects. Trajectory analysis of street segments identified the locations with chronically high levels of shots fired and aggravated assault with a firearm calls for service. These results also indicated that these calls for service have decreased over time.

To assess whether CGIC was responsible for the observed decreases in gun violence over time, we examined interrupted time series models. In the Western district, the variables for the CGIC intervention were significant in models for violent gun crime, gun homicide, and shots fired calls for service and indicated that decreases in these crimes occurred around the same time that CGIC operations began. In the Western district, GVRs and CGIC began operations at the same time, so it is not possible to determine which program was responsible for the observed crime drop. These variables were not statistically significant in the models for gun aggravated assault and gun robbery, although the effects were trending downward. Interestingly, the intervention variables were statistically significant in the model for aggravated assault with a firearm calls for service and indicated that these calls increased in response to the programs. Seeing that this was coupled with a slight decrease in the number of gun aggravated assault victims, it may be the case that citizens were more likely to call the police for shooting events after the program began. Finally, the intervention variables were not statistically significant in the model for burglary, indicating that the drop in gun crime was not simply an overall decrease in crime across the Western.

In the Southwest district, there was a six-month gap between the implementation of CGIC and the implementation of GVRs, making it possible to assess the impact of these programs separately. Unfortunately, the CGIC variables and the GVRs variable failed to reach statistical significance in any of the models in the Southwest district. As such, it appears that the successes observed in the Western district were not repeated in the Southwest. For this reason, it is still not possible to determine whether CGIC or GVRs was responsible for the decreases previously observed in the Western. It is worth noting that gun crime was decreasing and it is possible that this null finding was a result of the lack of sufficient post-intervention observations.

Finally, for the remaining districts, the intervention variables for the Western CGIC implementation were statistically significant in the models for violent gun crime, gun robbery, and burglary. This suggests that some of the reductions observed in the Western district could be attributed to citywide drops in gun violence and crime. However, these variables were not statistically significant in the model for gun homicide, indicating that citywide decreases in gun homicide would not explain the reduction in gun homicide observed in the Western district.

Taken as a whole, these results are encouraging as they suggest that there were clear reductions in gun homicide in the Western that coincided with the interventions that were implemented there. However, the failure of these results to replicate in the Southwest district would suggest



that the programs were either not as successful in this district or did not have sufficient time to manifest by the time of this report. Further, the significant reductions in violent gun crime in other districts occurring at the same time as the intervention in the Western create additional ambiguity in the interpretation of these results. In sum, CGIC/GVRS appears to have reduced gun violence in the Western, but it is not clear which program is responsible or if the decreases were due to citywide decreases in gun violence.

Limitations

While this study provides important information about CGIC, there are several limitations of this research. First, the research presented here represents one specific CGIC program implemented in one city during a particular time period. While there are standard features of CGIC programs across the country, there is also considerable variability in how these programs are implemented and operated. As such, CGIC programs may differ in their effectiveness and the experiences in other sites may differ from those observed in Baltimore. Similarly, Baltimore is an interesting site, but the city is not representative of other cities. Specifically, Baltimore is a larger, older eastern city that has been combatting its own unique problems with gun violence. Cities of different sizes with different population profiles may have their own unique issues with gun violence and may require a different strategy for combatting gun violence. Further, Baltimore's CGIC was implemented during the COVID-19 pandemic, which necessitated a unique approach.

A second limitation of this research is that CGIC and GVRS were operating in the same districts during the same period. This complicates efforts to disentangle the impacts of each program. Specifically, there was only a brief window (June 2022 to December 2022 in the Southwest district) where these programs were not operating jointly. However, the lack of statistical significance for the intervention variables in the Southwest makes it impossible to clarify which program is responsible for the observed decline in gun crime. However, CGIC and GVRS were not operating independently as CGIC was providing GVRS detectives with operational intelligence on NIBIN leads that helped with the identification of group violence networks and GVRS detectives were conducting follow-ups on NIBIN leads. As such, these programs are best seen as complimentary rather than competing approaches to addressing gun crime.

A third important limitation is that we were unable to assess certain outcomes in this evaluation. During the data preparation phase, we could not match arrestees with the initial incidents that led to the arrest with sufficient precision to pass internal quality assurance checks. Therefore, it was not possible to determine if arrestees were apprehended in response to incidents involving firearms and what location the originating incident occurred. Further, this problem hampered efforts to verify case clearance dates for police incidents. This creates issues with ensuring that case clearances occurred within similar time frames (within one week, one month, within six months, within one year, etc.) across the study. Failing to adjust for this problem would bias clearance rates towards the pre-implementation period as these cases have a longer time for clearances to occur. We also were unable to obtain case outcome data from the States Attorney's Office. As such, we could not establish whether CGIC led to increased clearance rates, more gun



violence arrests, higher conviction rates, and longer times off the street for gun offenders. We recommend that these outcomes be reviewed in future research.

A fourth important limitation is that treatment diffusion from the Western and Southwest districts to the other districts of Baltimore will lead to underestimates of the true effect of CGIC. Treatment diffusion occurs when the control areas experience some or all of the treatment effects (see Clarke & Weisburd, 1994). This is problematic as the control groups may experience a treatment response, which decreases the difference between the treatment and control groups and leads to understating the impact of treatment. There are four main mechanisms that this treatment diffusion can occur with CGIC, and it is likely that all occurred within this study:

1. CGIC can provide direct assistance to other districts by providing NIBIN intelligence. Based on discussions with CGIC personnel, this was known to occur on occasion although it was less frequent due to the limited familiarity of detectives from these districts with the CGIC program. However, gun crime is a serious concern for Baltimore, and it cannot be expected that CGIC personnel would refuse assistance when requested.
2. Crime hot spots may occur on the boundaries of the treatment area and cross these boundaries into the comparison areas. Reducing the severity of crime in these hot spots would likely decrease crime in the corresponding comparison unit. In the hot spot maps in Chapter 4, there were identified hot spots on the eastern border of the Western district, on the borders between the Western and Southwest, on the eastern borders of the Southwest, and on the southern border of the Western.
3. Officers who previously worked in the treatment districts may have been transferred to the control districts and inadvertently brought standards and procedures developed for CGIC to other districts. For example, a patrol officer transferred from the CGIC district may emphasize collection of casings at crime scenes. Alternatively, a detective transferred from a CGIC district may be more likely to request and use NIBIN information. We are aware of several officers and at least one commander that were transferred out of the Western district and into other districts after CGIC began.
4. NIBIN traces often cross district lines as guns are sold, traded, or passed between individuals in a shooting network. This was often the case in Baltimore. In fact, the Southwest district was selected as the second test site for CGIC primarily because this was the most frequent second site for cross district NIBIN leads originating in the Western district. Detectives working with CGIC information were encouraged and required to collaborate with other detectives on cases that spanned multiple districts.

CGIC Mechanisms of Action

As part of the literature review, we discussed a number of possible mechanisms through which CGIC could reduce violent gun crime. Since the impact evaluation indicated that CGIC may



have had led to decreases in violent gun crime, gun homicide, and shots fired calls for service in the Western district, it is worthwhile to consider these mechanisms as this provides important guidance on future research and evaluation of CGIC. Of course, it is important to review these mechanisms with the important caveats that: 1) it is not clear whether the reductions were the result of CGIC, GVRS, or both; 2) these reductions are ambiguous as violent gun crime was declining citywide at the same time; and 3) limitations of this evaluation make it difficult to generalize the findings beyond the BPD. Nevertheless, reflecting on these mechanisms can be helpful in the design of future CGIC implementations.

Decreasing Active Shooters

Unfortunately, the data did not allow us to investigate active shooters in detail. The main measures that would be investigated to examine this mechanism includes an increase in the clearance rates for violent gun crime, an increase in violent gun crime arrests, and a longer time off the streets for gun offenders. However, fully exploring this mechanism of action in detail would actually require considerably more information. It is possible that clearance rates, arrests, and time off the streets all decrease in aggregate, but still yield successful reductions provided that CGIC efforts target the correct individuals. This intervention is predicated on the notion that a small proportion of active shooters are responsible for the majority of shooting incidents. As such, if CGIC resulted in the apprehension of individuals who either have a history of prior shooting offenses or have a higher propensity for engaging in these offenses considerable reductions in gun crime could still occur. In order to assess this, more detailed information about arrestees including criminal histories, gang associations, and association with other known shooters would be necessary. Future studies of CGIC should consider obtaining this information.

Another aspect of decreasing active shooters is disrupting social networks of shooters. This strategy was evident in early GVRS/CGIC meetings as a considerable amount of investigative discussion considered the known criminal networks (gangs, crews, etc.) that were operating in the Western district at the time. To assess whether these networks were successfully disrupted, researchers need to consider network analyses of police intelligence data to determine whether highly connected individuals were apprehended. Future research on CGIC should consider how a social network analysis of shooters could be created and how to measure whether arresting key individuals have disrupted this network.

Decreasing Firearm Availability

The main concern regarding this mechanism of action is the marginal increase in the number of guns seized by the BPD. While there appears to be an increase in the volume of firearms recovered after CGIC, this increase in volume is likely not substantial enough to result in the observed decrease in gun violence. Again, however, the issue is not necessarily the volume of firearms, but rather whether the correct firearms are being recovered. Studies on CGIC should assess whether there is an increase in firearms recovered that have prior NIBIN linkages as this suggests that the firearms in question are getting used in multiple incidents. Figures 9 and 10 in

Chapter 3 suggests that these linked firearms are being recovered in the Western and Southwest districts, but we cannot determine whether this represents an increase in linked firearms seized or that prior firearms were not tested.

A second important component in decreasing firearm availability is the disruption of firearms trafficking networks. Much of this effort is accomplished by the ATF in identifying straw purchasers or dealers that allow diversion of firearms into the black market. Unfortunately, we did not have access to these data and the data itself is difficult to use. Further complicating this issue is that in the city of Baltimore, many firearms are manufactured and sold in other states and require cross-jurisdictional data. While some metrics such as the number of straw purchasers identified and charged or the total number of trafficked firearms seized may provide information on how CGIC can lead to disruptions of gun trafficking networks, the ideal measure would be an estimate of the average firearm black market street value. Obviously, this information would be difficult to obtain, but further research might help identify useful proxy measures.

Increasing Resources Devoted to Firearm Violence

Perhaps the most unambiguous mechanism of action for CGIC is that it resulted in more BPD resources spent addressing gun crime. However, at least in part, the implementation of CGIC may be a response to the concern over gun crime, rather than directing additional effort towards addressing these crimes. Elevated levels of gun crime motivated the creation of the Mayor's GVRs, which directed a considerable amount of resources to addressing gun crime in Baltimore and their initial efforts focused on the Western district. This occurred contemporaneously with the development and implementation of CGIC. As such, police resources were already being directed towards gun violence while CGIC was being implemented.¹⁸

This is not to suggest that CGIC did not direct resources towards the Western. In fact, CGIC contributed at least one analyst, one coordinator, one detective, and one sergeant dedicated to addressing gun crime. What is more difficult to assess, however, is whether CGIC led to increased manpower through detective hours spent on solving gun crimes and arresting gun crime suspects. If one of the main benefits of CGIC is that it increases the number of resources devoted to addressing gun crime, this should be reflected in the proportion of time that detectives specifically spend on these activities. The measurement of this time would be tricky given the variety of activities of detectives and the number of simultaneous cases they work. Better measurement likely requires researchers to obtain access to detectives' logs to determine the time spent on each investigation. This has been done in previous studies on homicide either using coding sheets (see Wellford, Lum, Scott, Vovak, & Scherer, 2019) or AI textual analyses (see Pandey, Brantingham, Uchida, & Mohler, 2020; Uchida, Swatt, Kato, Blanco, & Brantingham, 2022), but these efforts depend on detectives keeping accurate, detailed logs during investigations.

¹⁸ It is noteworthy that the CGIC grant application was submitted before the announcement of the Mayor's GVRs strategy.



Increasing Community Trust and Cooperation

There are indications in this report that CGIC contributed to increased trust and cooperation among community members. The CGIC Facebook page has continued to gain followers and visibility. There are indications that an increased social media presence is correlated with an increased number of tips through Metro Crime Stoppers. Further, the number of aggravated assault calls for service has increased in the Western after CGIC implementation without an apparent increase in the number of gun aggravated assault victims, suggesting that residents of the Western may be more likely to call the police in the event of a shooting incident. CGIC has also increased the visibility of anti-gun efforts using canine canvassing and the distribution of crime information pamphlets to businesses in the Western and Southwest districts. While none of these indicators is conclusive, they do suggest that community members may be more aware of and receptive to BPD's efforts to address gun crime.

Unfortunately, measuring changes in community awareness and support of BPD's efforts requires considerably more complex data collection strategies. Specifically, to measure this type of change, it is necessary to conduct community surveys of neighborhood residents before and after CGIC is implemented. In our experience, the best results from community surveys come from brief face-to-face interviews selected using a geographically stratified sampling strategy (see Solomon, Swatt, Uchida, & Schmitz, 2022; Uchida, Swatt, Solomon, & Varano, 2015). Further, we recommend that these surveys should be conducted using neighborhood residents as the interviewers to avoid selection biases associated with using police officers or non-residents for data collection. In this way, it would be possible to determine whether citizens are aware of the intervention and whether they are supportive of CGIC efforts.

Recommendations

Based on the current research, we have developed a set of recommendations for BPD for future improvements to the current CGIC.

Recommendation 1 – Continue CGIC and gradually expand it to the remaining districts using a phased approach.

While it is not clear whether CGIC, GVRs, or both programs are responsible for the improvements observed in the Western district, it is clear that there are important benefits from the CGIC program regardless of its impact on gun crime. In our discussions with a number of BPD employees, there was considerable praise for how CGIC resulted in improvements in the process of handling ballistics evidence and the intelligence information that derived from NIBIN results. Detectives suggested that the timeliness of evidence processing led to new case leads that would have been missed had NIBIN results been unavailable. CGIC has forced BPD to re-examine ballistics evidence processing to streamline processes and reconsider practices that interfere with the distribution of timely results. Further, there is considerable evidence to suggest



that CGIC has improved both formal and informal communication between BPD and the ATF. These reasons alone would be sufficient to recommend the continuation and expansion of CGIC. When adding a possible decrease in gun violence accompanying the implementation of CGIC, the calculus of continuing and expanding CGIC falls clearly on the side of continuation.

We encourage BPD to expand CGIC by gradually incorporating additional districts into the program. One of the key issues that CGIC must address going forward is capacity. As more districts are incorporated into CGIC, the workload of CGIC analysts and detectives will increase substantially. Phased expansion provides a strategy for mitigating the increased workload and given the difficulties faced by BPD with hiring, it is sensible to expand the capacity of CGIC slowly rather than to try to hire for several open positions simultaneously. A further issue is that expanding into other districts requires additional training of officers and detectives and achieving buy-in for the operational changes that are required for a successful CGIC. Phased implementation provides time and allows for monitoring and course corrections if needed.

Recommendation 2 – Increase staffing and support for CGIC by hiring additional CGIC detectives and CGIC analysts.

Due to the difficulties faced by BPD with officer turnover and recruitment, CGIC has been understaffed for most of its existence at BPD. This has significantly impacted the workload of CGIC analysts and it is very difficult for them to accomplish all the necessary tasks needed for CGIC. As a result, CGIC staff have needed to triage workload tasks, which impedes the effectiveness of CGIC as a whole. Further, CGIC did not have an assigned detective until recently and follow-ups were conducted primarily by the analyst. Based on our observation of the current workload of CGIC, we recommend hiring at least one additional analyst and one additional detective dedicated to CGIC to help accommodate the currently existing workload.

Recommendation 3 – Continue the use of social media by CGIC and expand social media presence by partnering with anti-violence community organizations.

In addition to providing a vehicle for improving community relations, social media can serve to inform the community about CGIC and how it improves public safety by removing crime guns from the streets. Our analyses reveal that social media may also yield tangible intelligence for investigations, as higher numbers of social media followers appears related to higher numbers of tips through Metro Crime Stoppers. We believe that additional engagement through social media for CGIC will continue to yield benefits. Besides the Facebook page, CGIC has also created an Instagram page, and we would encourage CGIC to consider expanding to other social media sites to reach additional community members. There are many opportunities for CGIC to engage with outside anti-gun violence community groups across Baltimore and to promote community-based anti-violence strategies as well. Assisting these groups with the promotion of their events on the CGIC page would provide additional opportunities to reach community members and gain additional followers. In turn, these groups offer opportunities to spread information about CGIC



successes leading to removing crime guns from the streets, solving shooting incidents, and arresting violent offenders.

Recommendation 4 – Require the Firearms Analysis Unit to participate in the NNCTC to assist with processing of NIBIN evidence.

Noting that the Firearms Analysis Unit is a high-performing organization, we still see no potential downside with them participating with the National NIBIN Correlation and Training Center for processing firearms evidence. While the Firearms Analysis Unit would prefer to conduct most correlation testing in-house, participation in NNCTC can be used to ensure that a buffer exists when the Firearms Analysis Unit is operating at capacity or when circumstances cause the unit to be non-functional for a period of time. As a matter of practice, the Firearms Analysis Unit can triage cases and keep high priority cases, such as homicides, in-house while sending lower priority cases to NNCTC for analysis. This strategy, or a similar one, would enable the unit to develop protocols and procedures for sending cases to NNCTC when additional assistance is needed in the future.

An excellent example of why participation would be beneficial occurred near the end of the grant period. The testing range at the Firearm Analysis Unit closed for upgrades in 2023. This closure resulted in the unit delaying firearm processing by a month, and it appears that by June 2023, the unit remains at least one month behind in the processing of firearms. Obviously, this creates problems for CGIC as it undermines the strategy of rapid processing of evidence to generate actionable investigative intelligence. While the delay due to the lab refurbishment was unavoidable, the continued backlog resulting from this closure could be mitigated through participation in NNCTC. Specifically, members of the FAU could focus on working through the backlog of test fires and NIBIN entries, while the NNCTC could evaluate correlations.

It seems logical that similar situations such as equipment upgrades, equipment failures, high demand for evidence processing, employee turnover or unavailability, or similar situations will occur in the future, which will also lead to delays in evidence processing. Participation in the NNCTC should blunt the impact of such delays in the future. In our experiences with other CGIC sites (Denver and Los Angeles), there was initial resistance to participating in NNCTC by the crime labs. However, following the initial adjustment period, both agencies have experienced successes through this partnership.

Recommendation 5 – Re-engage with the SAO and find ways to strengthen the SAO's participation in CGIC.

One of the persistent difficulties faced by BPD's CGIC is that the SAO became a silent partner in CGIC and has not participated in CGIC activities. Under the previous SAO, reorganizations, turnover, and priority changes limited the participation of the SAO in setting CGIC priorities for prosecution, communicating with CGIC personnel about persistent gun crime problems, ensuring that "active shooters" were consistently charged and convicted to incapacitate them, and



providing feedback to CGIC about convictions and success stories. With the new State's Attorney, efforts are underway to reorganize the office and prioritize the prosecution of gun crime. The new State's Attorney has shown interest in CGIC and has requested NIBIN training. This offers considerable opportunity to re-engage the SAO in the CGIC process and re-start some of the initiatives where the SAO was involved.

Future Directions of BPD's CGIC

During the preparation of this report, we had a number of discussions with BPD in terms of what the future holds for CGIC. One of the critical items discussed was whether and how CGIC would continue after the end of the grant period. To this end, there have been some important developments that suggest to us that CGIC will continue to play an important role in the gun crime reduction strategy of the BPD in the future.

One important development is that CGIC was moved from the Data Driven Strategies Division to the Anti-Crime Section. This section is under the Detective Bureau and specifically focuses on investigation. Arguably, this better aligns CGIC with the mission of providing investigative resources for cases. Further, this reorganization of CGIC was part of the effort to secure long term funding for the CGIC program within the BPD. The Department has invested into CGIC by adding personnel, including hiring a CGIC coordinator, hiring a CGIC detective, assigning a sergeant/supervisor to CGIC, and retaining a CGIC analyst. These steps suggest that BPD is planning to support CGIC through departmental funds at least in the foreseeable future.

Efforts are also underway to expand CGIC beyond the Western and Southwest districts. Detectives from the Northeastern division intelligence unit have been attending CGIC meetings and there appears to be efforts to train these detectives about NIBIN evidence and its usefulness for investigations. Further, BPD's CGIC along with the ATF have conducted a series of NIBIN and CGIC related trainings to officers across the department.

While the future direction of CGIC is currently being discussed, current indications are that CGIC will continue at BPD after the grant period is concluded and may be further expanded to other districts across the department. While there will be new challenges faced by CGIC moving forward, it is apparent that this program has a path towards sustainability within the BPD.



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Appendix A – Technical Details on Analyses

Trajectory Modeling

We use group-based trajectory analysis (GBTA) to explore the underlying heterogeneity in the population of street segments in Baltimore to assess stability and variability of gun violence from 2017 to 2023. This analysis identifies the evolution of unique groups in a given outcome over time (Nagin & Land, 1993). It has been widely used in social sciences, and it is increasingly applied to examine crime at the street segment level (e.g., Gill et al., 2017; Groff et al., 2010; Weisburd et al., 2004). This analysis is based on a finite mixture model that has been adapted for a Poisson distribution.

GBTA requires that the user select the number and polynomial order (linear, quadratic, and cubic) of the trajectory groups, with the goal of the analysis being to minimize within-group differences and maximize variability between trajectory groups. GBTA was conducted in Stata 18 using the *traj* plug-in and *zip* command to specify a zero-inflated Poisson model (Jones & Nagin, 2013). Several tools were used to identify the best model (e.g., the Bayesian Information Criterion, posterior probabilities). The final solution for all outcomes was a 6-group quadratic model for shots fired and aggravated assault, and the 9-group cubic model for the combined analysis.

Nagin (2005) recommends a minimum average posterior probability of group membership of 0.7, which is the likelihood of a given street segment belonging to each trajectory group. The posterior probabilities of average group membership appear in Table 15 below. All were within acceptable ranges.

Table 15: Average Posterior Probabilities by Analysis and Group

	Shots Fired	Agg. Assault	Combined
Group 1	0.785	0.722	0.764
Group 2	0.775	0.840	0.724
Group 3	0.908	0.898	0.940
Group 4	0.855	0.741	0.765
Group 5	0.947	0.880	0.785
Group 6	0.999	0.912	0.776
Group 7	-	-	0.914
Group 8	-	-	0.988
Group 9	-	-	0.999

Police calls-for-service (CFS) data were used for the analysis. Only those CFS where CALL_TYPE_FINAL_D is equal to DISCHRG FIREARM and CALL_TYPE_FINAL is equal to 4D were included. The calls were divided into 6-month intervals using CALL_CREATED_DATE, with January-June 2017 being the first time period. To reduce error



in assigning CFS to street segments, CFS were re-geocoded since the XYY coordinates in the file had an offset from the street centerline. The centerline file used in the address locator was obtained from the U.S. Census Bureau.

Street segments are defined as portion of a street between two intersections. Prior to joining the CFS to the segments, streets were retained in the centerline file where the ROADFLG was equal to Y. The random breaks in the centerline file were mended using the dissolve tool and the streets were separated at each intersection. Geocoding hit rates were >89% for the 2,136,632 calls. This is considered an acceptable hit rate (Ratcliffe, 2004). CFS at intersections were tied to the street segment, which slightly inflates the total number of CFS (e.g., one crime at an intersection is associated with each 4 street segments it touches so each segment would have 1 crime). Those counts then associated with the street that the CFS was geocoded to (twelve 6-month time intervals in total).

Only those street segments in the Southwestern and Western divisions were included in the analysis (n=5,387), and these were selected by specifying lines whose centroid fall within the two police division polygons.

Local Polynomial Graphs

Local polynomial regression models are non-parametric regression models and require few distributional assumptions. These models combine features of other non-parametric models, such as lowess regression models and kernel regression models.

In this model, for each observation point a local neighborhood of nearby observations are selected according to the size of the bandwidth of the local polynomial model. Stata 15.0 incorporates a “rule of thumb” bandwidth selection strategy to simplify this parameter. Points within the bandwidth are assigned weights according to the distance from the focal points using the Epanechnikov kernel function. A cubic regression model is then estimated using these weighted points. These local regressions are then averaged across all focal points to produce a smooth response surface between the two variables (see Fan & Gijbels, 1996; Fox, 2008; and StataCorp, 2013 for further discussion of this model).

In this analysis, the linear time variable that represents the number of months since the start of the data series. The benefit of this approach is that the local polynomial model yields a smoothed estimate of the time trend for each outcome variable. Prior experience with these models shows that the estimated time trends are responsive to local non-linearities in the data while still providing a sufficiently smoothed trend line that allows for sensible interpretation.

Time Series Analysis

The main strategy for analyzing the time series models uses segmented regression. The specification of this model includes an intercept, a variable for time, a variable for the

intervention, and a variable representing the interaction between time and the intervention (see Linden, 2015; Ramsay, Brown, Hartman, & Davey, 2003; Shardell, Harris, El-Kamary, Furuno, Miller, & Perencevich, 2007; Wagner, Soumerai, Zhang, & Ross-Degnan, 2002). Figure 56 provides a visualization for the parameters in this model.

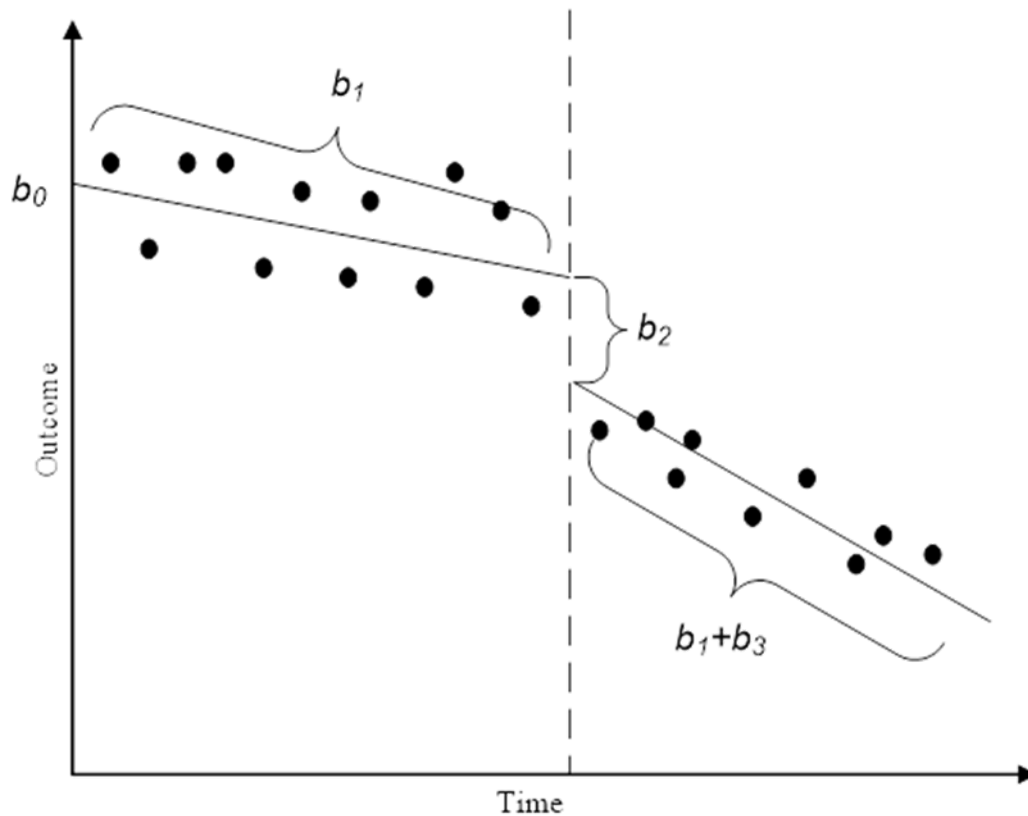


Figure 56. Representation of Segmented Regression Parameters for Interrupted Time Series Analyses.

The intercept (b_0) captures the value of the outcome variable at the start of the intervention and in the absence of a trend is interpreted as the mean of the outcome variable prior to the intervention. The time variable takes a value of one at the start of the observational period and then increments by one each period thereafter. The coefficient of this variable (b_1) captures the linear trend prior to the intervention. The intervention variable takes a value of zero before the intervention and a value of one after the intervention occurs. The coefficient of this variable (b_2) captures the immediate increase or decrease associated with the intervention. If there is no change in trend after the intervention, this variable captures the average treatment effect associated with the intervention. The intervention \times time interaction variable takes a value of zero before the intervention and during the initial month of implementation and then increments by one each month thereafter. The coefficient for this variable (b_3) captures the change in the trend after the intervention occurs.

One of the main concerns in time series models is temporal autocorrelation. In this application, temporal dependence is a nuisance and the focus of correcting for temporal dependence is on correcting standard errors rather than formally modeling temporal dependence with ARIMA and related models. For this reason, Newey-West adjusted robust standard errors are used to remove the impact of temporal dependence (see Linden, 2015). Following the recommendation by Greene (2008: 463), we set the lag equal to $n^{.25}$, or 3, in all models.

Since the dependent variables in all of these models are counts of events, we used the negative binomial specification of the Newey-West model. The negative binomial model is one of a number of distributions related to the Poisson distribution that is specifically designed for counts of events. The main difference is that the negative binomial distribution introduces an additional term to control for overdispersion – when the mean of the Poisson distribution is not equal to its variance (see Cameron & Trivedi, 1998). In these models, the dispersion parameter was estimated separately using maximum likelihood (ML) and incorporated into the model. Following the recommendation of Long & Freese (2014), $(\exp(b) - 1)$ can be interpreted as the percentage change in the count of events for a one unit increment in the independent variable. Plots of fitted values vs. the counterfactual (i.e., the fitted model excluding the intervention variables) are also used to interpret the results of these models.