Journal of Criminal Justice 94 (2024) 102233

Contents lists available at ScienceDirect

Journal of Criminal Justice

journal homepage: www.elsevier.com/locate/jcrimjus

The impact of the Detroit crime gun intelligence center on fatal and nonfatal shooting clearance rates

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ARTICLE INFO

Keywords:
NIBIN
Clearance rates
Firearm violence
Crime gun intelligence center

ABSTRACT

Purpose: Crime Gun Intelligence Centers (CGICs) are organized around the investigation of repeat shooting events that are connected through intelligence derived from the National Integrative Ballistic Information Network (NIBIN). This study investigates the potential of the Detroit CGIC to increase clearance rates for fatal and nonfatal shooting cases with NIBIN leads.

Method: The analysis consists of logistic regression models to estimate the sample average treatment effect on the treated, using weights from coarsened exact matching to reduce imbalance between treated and control cases.

Results: The study found that the benefits of the Detroit CGIC increased the odds of clearing fatal and nonfatal shooting cases with NIBIN leads. This effect is more pronounced when the Detroit CGIC optimized its capability to provide advanced intelligence.

Conclusion: Law enforcement agencies should prioritize the efficient processing of ballistic evidence and the creation of comprehensive NIBIN lead reports, particularly those containing advanced intelligence. Collaboration with the NIBIN National Correlation and Training Center is also crucial in this regard, as are the resources provided through CGICs. Grant funding is essential to support these critical initiatives in the short term, while operational funding from city and/or state budgets is crucial for their long-term sustainability.

1. Introduction

Through the application of ballistic intelligence and interagency partnerships, Crime Gun Intelligence Centers (CGICs) aim to identify and disrupt shooters and the sources of crime guns, thereby preventing future violence (National Policing Institute, 2022a). In furtherance of this mission, CGICs are organized around the investigation of repeat shooting events that are connected through intelligence derived from the National Integrative Ballistic Information Network (NIBIN) and supported by partnerships between local law enforcement agencies and the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF), among other stakeholders. Since their inception in 2016, 54 CGIC sites have been established nationwide, including one in the city of Detroit, Michigan (National Policing Institute, 2022b).

NIBIN stands as the cornerstone of the CGIC—a ballistic database and technology system designed to collect, manage, and analyze digital images of cartridge cases obtained from crime scenes or test-fires of recovered crime guns (Bureau of Alcohol, Tobacco, Firearms, and Explosives, 2023). Within CGICs, the identification of NIBIN leads informs criminal investigations of firearm-involved incidents. NIBIN leads are identified from a correlation review of the digitally captured, unique patterns left by a firearm on a cartridge case and indicate that the same firearm was discharged at two or more shooting events. These connections may not have otherwise been established through traditional means alone. By identifying NIBIN leads, NIBIN contributes to the mission of CGICs by widening the network of crime scenes from which investigators can gather critical intelligence supporting arrests and criminal convictions.

Historically, problems within two key areas have prevented NIBIN from realizing its full potential: (1) NIBIN processing time; and (2) the comprehensiveness of NIBIN lead reports. The timely processing of ballistic evidence through NIBIN affords investigators the ability to promptly act on the intelligence gathered from connected crime scenes. Unfortunately, the results of NIBIN are often not delivered quickly enough to be immediately useful (King et al., 2017). Furthermore, information related to NIBIN leads can be compiled into a report and shared with investigators to inform criminal investigations. These reports often lack actionable investigative information, such as addresses,

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https://doi.org/10.1016/j.jcrimjus.2024.102233
Received 27 February 2024; Received in revised form 16 July 2024; Accepted 17 July 2024
Available online 22 July 2024

motive, suspect or victim information, or gang affiliations, and represent a missed opportunity to maximize NIBIN's tactical potential (Braga & Pierce, 2004; King et al., 2013; King et al., 2017). The advent of the CGIC represents a concerted effort to address these problems by enhancing the efficiency of NIBIN processing and the comprehensiveness of NIBIN lead reports through federal, state, and local law enforcement partnerships. Once a NIBIN lead is identified, CGIC stakeholders investigate linked shooting events, utilizing interagency resources and intelligence to facilitate the arrest of suspects and ultimately secure their criminal conviction.

Considering the benefits afforded by CGICs, this study investigates whether enhancing the efficiency of NIBIN processing and the comprehensiveness of NIBIN lead reports within the framework of support provided by a CGIC has the potential to improve clearance rates for fatal and nonfatal shootings. Specifically, it examines the Detroit CGIC and investigates whether fatal and nonfatal shooting cases involving NIBIN leads that received CGIC benefits were more likely to be cleared compared to similar cases without them. My analysis consists of logistic regression models to estimate the sample average treatment effect on the treated, with weights produced through coarsened exact matching to reduce imbalance between treated and control cases. Overall, I find that the benefits attained through the Detroit CGIC increased the odds of clearing fatal and nonfatal shooting cases with NIBIN leads. This effect was more pronounced for NIBIN lead reports containing advanced intelligence.

In the following sections, I present research underscoring NIBIN's potential to improve clearance rates and consider the obstacles that have historically stood in its way. I then conduct a comprehensive review of the CGIC model, presenting findings from CGIC evaluations across the U. S. This review includes a discussion of the CGIC benefits that facilitate the timely delivery of NIBIN leads and advanced intelligence gathering capabilities, as well as the significance of interagency partnerships in advancing criminal investigations toward prosecution. Following this discussion, I provide a brief review of research on the factors influencing clearance rates in fatal and nonfatal shooting investigations, which further informs the study's matching approach. Finally, I present a timeline on the development of the Detroit CGIC, emphasizing critical dates as they relate to NIBN processing and intelligence-gathering capabilities.

2. Literature review

2.1. NIBIN

The development of automated ballistic imaging and analysis systems in the 1990s reduced the resources needed for law enforcement agencies to identify connections across crime scenes by virtue of ballistic evidence. The prevailing system, the Integrated Ballistic Identification System (IBIS), currently forms the backbone of NIBIN. IBIS consists of a remote data acquisition station (or NIBIN acquisition station) and a correlation review station. While the remote data acquisition station collects images of the unique markings made on a cartridge case from the discharge of a firearm, the correlation review station is where newly acquired images are compared to others previously entered into the system. Referred to as a correlation review, a firearms examiner or NIBIN technician reviews the results of these comparisons to identify NIBIN leads.

NIBIN leads connect two or more crime scene investigations and can be confirmed by a firearms examiner at an accredited laboratory to produce NIBIN hits, with a confirmation rate of 98.9% (National Policing Institute, 2022c). While only NIBIN hits can be presented as evidence in court, the confirmation process, which is often time-consuming, labor-intensive, and expensive, is not necessary to advance investigations (Bureau of Alcohol, Tobacco, Firearms, and Explosives, 2023). For these reasons, ATF has shifted the focus of the NIBIN program to support the use of NIBIN leads as an investigative tool. This development, coupled with technological advances, has helped grow the NIBIN program and has increased the volume of ballistic evidence entered into NIBIN, leading to a rise in NIBIN leads (Braga & Pierce, 2004; Bureau of Alcohol, Tobacco, Firearms, and Explosives, 2023).

In the first comprehensive review of NIBIN, King et al. (2013) interviewed 65 investigators across nine ATF sites to assess how NIBIN hit reports affected their cases, the majority of which were homicides. As it relates to clearance rates, the results were bleak. Investigators rarely used NIBIN hit reports to make arrests or identify suspects and a little more than half of cases remained open and active. Moreover, in half of the cases, a suspect had already been identified *before* the investigator received the NIBIN hit report, and in 34% of cases, an arrest had already been made. Further investigation revealed two critical reasons for these findings. To start, NIBIN hit reports were often not delivered in a timely manner due to processing delays. In a follow-up investigation, King et al. (2017) identified a 181.4 day lag in their delivery to investigators. If NIBIN hit reports were delivered earlier in an investigation, then investigators would have had more opportunity to leverage the information contained within them (King & Maguire, 2009). With that said, increased efficiency in NIBIN processing may not be helpful to investigators unless NIBIN hit reports contain actionable information. Through interviews with investigators, King et al. (2013) found that the reports were rarely helpful and often required investigators to conduct their own research on the connected incidents.

Much of the research that followed has echoed King et al. (2013) early findings. In a case study of the factors affecting the use of ballistic imaging technology, King and Wells (2015) identified inefficiencies in the processing of ballistic evidence and time delays in the identification of NIBIN hits and delivery of NIBIN hit reports to investigators that prevented the effective use of ballistic imaging by law enforcement in Trinidad and Tobago. In a more recent evaluation of the Buffalo Police Department's Gun Violence Unit (New York), Phillips et al. (2022) found that while investigators used NIBIN in 40% of fatal and nonfatal shooting cases, it was not associated with making an arrest. They noted that the use of NIBIN leads (over NIBIN hits) by Gun Violence Unit investigators was intended to reduce issues of processing time identified in prior research. However, the study did not determine whether there were delays in NIBIN processing nor did it consider the usefulness of the information contained within NIBIN lead reports to investigators, factors that could potentially influence clearance rates.

More broadly, research on the influence of ballistic evidence on clearance rates supports its usefulness to investigators. In a comparison of fatal and nonfatal shooting cases conducted by Cook et al. (2019), investigators of the Boston Police Department (Massachusetts) identified ballistic evidence from firearms and cartridge cases and bullets to be key to making arrests in 14% of fatal shooting cases and 5% of nonfatal shooting cases. While more ballistic tests were conducted for fatal shooting cases than for nonfatal shooting cases, they were more often used in cases cleared by arrest than in those not cleared by arrest. The differential use of ballistic tests was also found by Barao et al. (2021), with more ballistic tests conducted for gang and drug-involved nonfatal shooting cases than for nonfatal shooting cases without these associations. In another study conducted in Boston, Braga et al. (2018) found that the likelihood of a homicide being solved increased with the number of forensic tests(/subsequent actions), a latent variable that included the number of ballistic tests of firearms, cartridge cases, and bullets, among other factors. Collectively, these studies highlight the value of ballistic evidence to fatal and nonfatal shooting investigations, while also revealing their differential use in criminal investigations deemed to be of a more serious nature. These examinations, however, do not explicitly consider the impact of NIBIN processing time and related intelligence-gathering efforts on clearance rates. In this regard, the establishment of the Crime Gun Intelligence Center (CGIC) is a significant milestone in the history of the NIBIN program.

2.2. Crime gun intelligence centers

The Local Law Enforcement CGIC Integration Initiative is a grant program administered by the Bureau of Justice Administration (BJA) in partnership with ATF that supports the integration of state and local government entities with CGICs. Thus far, BJA has awarded grant funding to 54 sites (Bureau of Justice Assistance, 2022c). These sites are organized around federal, state, and local law enforcement partnerships that collaborate toward the administration of the CGIC workflow, a seven-step model for identifying and disrupting shooters and the sources of crime guns (Bureau of Justice Assistance, 2022a). Currently, evaluations of nine CGIC sites highlight, to varying degrees, the seven steps of the CGIC model. These sites include Chicago, Illinois (Police Executive Research Forum, 2017), Milwaukee, Wisconsin (Police Executive Research Forum, 2017), Washington, District of Columbia (Mei et al., 2019), Los Angeles, California (Uchida et al., 2019), Denver, Colorado (Uchida et al., 2020), Kansas City, Missouri (Novak & King, 2020), Detroit, Michigan (Rojek et al., 2022), Indianapolis, Indianna (Hipple, 2022), and Tulsa, Oklahoma (Khojasteh, 2022).

The CGIC workflow begins with the comprehensive collection of ballistic evidence, including cartridge cases and crime guns. Representing the second step of the CGIC workflow, cartridge cases (including test-fires) are then entered into NIBIN, referred to as NIBIN acquisitions, and crime gun tracing is performed on recovered crime guns. Highlighting these foundational steps, an increase in NIBIN acquisitions aligning with the establishment of a CGIC is well-documented across CGIC evaluations.

Importantly, the CGIC model places a precedent on the timely submission of NIBIN evidence and firearm trace requests to ATF. A crucial method through which the CGIC model reduces the time from NIBIN acquisition to NIBIN lead identification is by collaborating with the NIBIN National Correlation and Training Center (NNCTC). Established in 2016, the NNCTC currently conducts correlation reviews for 31 NIBIN sites, with the time to lead identification typically completed within 24–48 h (Bureau of Alcohol, Tobacco, Firearms, and Explosives, 2023; National Policing Institute, 2022b). By outsourcing the correlation review process, participating law enforcement agencies not only are notified of NIBIN leads more quickly, but they are also able to re-allocate resources to other essential aspects of the NIBIN process, such as the development of comprehensive NIBIN lead reports. As of August, 2021, the NNCTC has identified 159,347 NIBIN leads from 590,449 correlation reviews (Bureau of Alcohol, Tobacco, Firearms, and Explosives, 2021).

The efficiency of NIBIN processing can be demonstrated by evaluating the time between the occurrence of a crime and NIBIN lead identification (or reporting). However, it is critical to acknowledge that a NIBIN lead may not be initially identified immediately following a correlation review. Instead, a NIBIN lead may be identified from a correlation review later in the investigative process after additional evidence is entered into NIBIN. In this scenario, the time between crime occurrence and NIBIN lead identification will be longer compared to when a NIBIN lead is identified from the outset. Keeping this in mind, the average time between crime occurrence and NIBIN lead identification in Kansas City was 90 days during the pre-CGIC period, decreasing to 32.6 days during the post-CGIC period. In comparison, the average time in Indianapolis was 88 days during the post-CGIC period, with a median of 37 days. Unlike these evaluations, the Detroit CGIC evaluation considered the time between crime occurrence and NIBIN acquisition during the post-CGIC period, which was a mean of 1.8 days and median of 1 day. With the support of the NNCTC, NIBIN correlations during the post-CGIC period could be completed within 48 h (Bureau of Alcohol, Tobacco, Firearms, and Explosives, 2023). During the pre-CGIC period, the time between crime occurrence and NIBIN acquisition ranged from 5 days to 51 days, and NIBIN correlations took anywhere from weeks to months to perform.

The ultimate purpose of comprehensive collection is to increase the likelihood of identifying NIBIN leads, thereby broadening the network of crime scenes from which investigators can collect information. Several CGIC sites have documented the significant increase in NIBIN leads following adherence to this standard. For example, the number of NIBIN leads in Kansas City averaged 128.5 per month during the post-CGIC period, which was over three times higher than that observed during the pre-CGIC period. In comparison, the median number of monthly NIBIN leads in Detroit was 221 during the post-CGIC period, which was over four times higher than that observed during the pre-CGIC period.

The third stage of the CGIC workflow involves the collection of information from NIBIN leads, firearms tracing, and investigative reports on firearm and violent gun crime events that is overseen by the primary case investigator and CGIC Investigative/Analysis Unit. The intelligence gathered from these sources can be classified into two types: fundamental intelligence and advanced intelligence. Fundamental intelligence includes information on the dates, times, locations, offenses, and involved persons of incidents connected by virtue of NIBIN leads. This information can be presented in a link chart (for an example, see Bureau of Justice Assistance, 2022b). The CGIC model supports the collection of more advanced intelligence through partnerships with federal, state, and local partners, and training of crime analysts supporting the CGIC Investigative/Analysis Unit. Examples of this type of intelligence include data obtained from cell towers, cell phone searches, license plate readers, images captured by crime cameras, alerts from gunshot detection systems, and insights derived from social media, link analysis, and spatial analysis (Bureau of Justice Assistance, 2022c). Firearms tracing investigations are also a valuable investigative tool and can provide information on the legal owner of recovered crime guns that could lead to the identification of suspects.

In the fourth and fifth stages of the CIGC workflow, key findings yielded from the third stage are compiled and consolidated into a NIBIN lead report (for an example, see Bureau of Justice Assistance, 2022d). With this information, personnel from federal, state, and local law enforcement agencies with specialized training in intelligence, firearms industry operations, and criminal investigations work together to triage NIBIN leads based on their investigative potential (Bureau of Justice Assistance, 2022e). Priority is placed on the event type, time between linked events, and geography. Events that pose a significant threat to public safety, such as fatal and nonfatal shootings, are typically scored higher, as are shooting events that occur closer in time and geographically concentrated. After meeting to review the gathered intelligence, CGIC partners organize and leverage resources to develop a strategy to investigate high-priority cases.

The usefulness of NIBIN leads to investigators has been explored in research previously presented, but not yet within the context of a CGIC. More generally, the majority of personnel from a team resulting from the integration of the CGIC with a gang task force in Denver referenced more effective and higher quality investigations. Interviews with detectives in Indianapolis and Kansas City did not provide similarly positive feedback. For both sites, the majority of detectives were ambivalent in regard to the usefulness of NIBIN leads. Critically, their usefulness did not seem to be tied to their timely delivery to detectives. In Indianapolis, further analysis of nonfatal shooting cases revealed that the usefulness of NIBIN leads was also not influenced by witness or victim cooperation (at the traditional significance level of 0.05).

While the timely delivery of NIBIN leads to detectives is a fundamental requirement for their usefulness, the Indianapolis and Kansas City CGIC evaluations indicate that there are other factors at play, acting as counteracting forces. For example, the majority of Indianapolis detectives were not offered assistance from a CGIC analyst or CGIC detective on a NIBIN lead, which may have affected their perceived usefulness. In Kansas City, NIBIN leads were least useful due to a lack of actionable information. Further interviews revealed a resource gap related to personnel allocation within investigative units responsible for investigating assaults and homicides, which may have negatively affected the comprehensiveness of NIBIN lead reports.

Following a NIBIN-related arrest, CGIC stakeholders determine how

to prosecute violent gun offenders, representing the sixth step of the CGIC workflow. Collaboration between law enforcement and prosecutors is especially vital, given the complex nature of linked shootings events. Furthermore, an offender's criminal history, current violent conduct as revealed through NIBIN and other investigative leads, and laws amendable toward prosecuting violent offenders are factors that influence whether a case is prosecuted by a state or federal prosecutor.

The CGIC workflow concludes when feedback is provided by the original case investigator and CGIC Investigative/Analysis Unit. While feedback can be given throughout the CGIC workflow, particular emphasis is placed on it after the arrest and prosecution of an offender. As part of this process, the CGIC develops and shares success stories with its partners, highlighting its achievements in NIBIN-related cases. Additionally, cases not accepted for prosecution are reviewed to identify strategies for increasing the likelihood of acceptance in the future.

Overall, the effectiveness of the CGIC model is primarily supported across evaluations through the consideration of four indicators: crime and clearance rates, prosecutorial outcomes, and success stories. Two key limitations of these evaluations are noteworthy. First, analyses of crime and clearance rates and prosecutorial outcomes are predominantly descriptive in nature. Second, many evaluations were affected by the COVID-19 pandemic, which disrupted CGIC operations and contributed to a surge in firearm-related violence (Kim & Phillips, 2021; Sun et al., 2022). With that said, notable reductions in several firearm-related violent offenses were observed in Denver and Los Angeles, as were increases in clearance rates for aggravated assaults with a firearm in Tulsa, nonfatal shootings in Milwaukee, and firearm-related violent offenses in Washington. Furthermore, prosecutorial outcomes were commonly tracked during the evaluation period. Of note, the number of weapon and aggravated assault with a firearm charges increased 150% in Tulsa during the CGIC. Success stories highlighting the usefulness of NIBIN intelligence in supporting arrest and prosecution were also emphasized across CGIC sites.

2.3. Clearance rates

Thus far, a review of relevant literature has uncovered the challenges in leveraging NIBIN leads to enhance clearance rates and the potential of CGICs to improve them. What remains is a broader discussion of the factors that influence fatal and nonfatal shooting clearance rates. Research on homicide clearance rates highlights the influential role of several individual, incident, and investigative factors. This body of research, which primarily considers firearm-related homicides, can be used to identify the factors affecting fatal and nonfatal shooting clearance rates given the substantial overlap in their circumstances and characteristics (Braga & Cook, 2018; Cook et al., 2019).

While research conducted on the individual-level factors affecting homicide clearance rates is not conclusive, it is inclined toward supporting a decreased likelihood of solving homicide cases that involve victims that are male (e.g., Alderden & Lavery, 2007; Avdija et al., 2022; Lee, 2005; Litwin & Xu, 2007; Magee et al., 2020; Regoeczi et al., 2008), have a prior criminal history or criminal lifestyle (e.g., Alderden & Lavery, 2007; Pizarro et al., 2018; Rydberg & Pizarro, 2014) and belong to a minority group (e.g., Alderden & Lavery, 2007; Avdija et al., 2022; Lee, 2005; Regoeczi et al., 2008). Furthermore, a growing body of evidence supports a non-linear relationship between victim age and homicide clearance rates. Homicide clearance rates tend to be higher for cases that involve young children (e.g., Puckett & Lundman, 2003; Lee, 2005; Roberts, 2007), and tend to decline for young adults and improve for elderly victims (e.g., Magee et al., 2020; Regoeczi et al., 2008). Notwithstanding these findings, the intersectionality of victim characteristics stands to affect the solvability of homicide cases, the importance of which was underscored by an analysis of the contextual influences of victim, race, sex, and age conducted by Regoeczi et al. (2020).

At the incident-level, criminal investigations involving gang and/or drug-related crimes are more difficult to solve (Barao et al., 2021; Wellford & Cronin, 1999), as are homicides that occur outdoors (Regoeczi et al., 2008; Wellford & Cronin, 1999). The relationship between the offender and victim is another important factor affecting clearance rates. Homicide studies have found that clearance rates are enhanced when there is a known relationship between the victim and the offender, such as in domestic and family-related disputes (Lattimore et al., 1997; Lee, 2005; Litwin & Xu, 2007; Riedel, 1999). Furthermore, incidents that involve more than one victim are more likely to receive additional police resources, thereby increasing their likelihood of being cleared (Lee, 2005). As it relates to nonfatal shootings, the surviving victims of firearm violence may provide compelling testimony that leads to an arrest. Their willingness to collaborate in criminal investigations, however, is moderated by their trust in the police and their involvement in a deviant lifestyle (Brunson & Wade, 2019; Cook et al., 2017; Keel et al., 2009). Along a similar vein, a large body of evidence suggests that the presence and/or cooperation of witnesses increases the likelihood of case clearance (Peterson et al., 2010; Pizarro et al., 2018; Wellford & Cronin, 1999). More broadly, homicides are less likely to be solved in poor and socially disorganized neighborhoods, which may in part be due to the prevalence of legal cynicism that discourages citizen cooperation with the police (Brunson & Wade, 2019; Cook et al., 2017; Litwin & Xu, 2007; Regoeczi & Jarvis, 2013).

Research has highlighted various investigative strategies and tactics that impact clearance rates. Braga and Dusseault (2018) observed a significant improvement in homicide clearance rates following the implementation of a problem-oriented strategy by the Baltimore Police Department to identify and address challenges associated with clearing homicide cases. The deployed intervention included intensified training for homicide investigators, an expansion of the homicide unit and deployed squads, and the development and implementation of standardized protocols to guide homicide investigations. Likewise, Pizarro et al. (2018) attributed similar changes by the Rochester Police Department (New York) to improvements in homicide clearance rates. These studies align with a prior evaluation conducted by Keel et al. (2009), which concluded that initiatives to ensure sufficient staffing, autonomy for investigators, and continuous and rigorous training are likely to improve homicide clearance rates. Other studies have supported the correlation between staffing and homicide clearance rates (Horvath et al., 2001; Wellford & Cronin, 1999), as well as the value of developing collaborative partnerships with external agencies (Carter & Carter, 2016; Richardson & Kosa, 2001). Furthermore, research on homicides has indicated that prompt response times to the crime scene, the presence of support staff to canvass the area for witnesses and physical evidence, and conducting computer checks on individuals and items linked to the crime scene improve clearance rates (Carter & Carter, 2016; Schroeder & White, 2009; Wellford & Cronin, 1999). Collectively, these studies suggest that the investigative strategies and tactics used by law enforcement agencies matter, a finding that has historically not garnered strong support (Borg & Parker, 2001; Eck, 1992; Greenwood et al., 1977; Greenwood & Petersilia, 1975; Puckett & Lundman, 2003). In the pursuit of enhancing homicide clearance rates, these findings contribute to an understanding of the disparities between clearance rates for fatal and nonfatal shooting cases, with the former exceeding the latter (Cook et al., 2019).

Beyond the impact of ballistic evidence on clearance rates, the role of physical evidence is mixed and less developed. Although research generally supports the value of DNA evidence to criminal investigations (Wilson et al., 2011), its impact on clearance rates is mitigated by the availability of resources allocated to its collection and analysis (McEwen & Regoeczi, 2015; Schroeder & White, 2009). The application of this tool can vary, and limited resources may lead to its use primarily in the most challenging cases. Conversely, with fewer constraints on resources, DNA evidence may be discovered to play a more influential role in case closure. Relatedly, the presence of identifiable documents may wield significant influence in solving cases by generating investigative leads that may result in the identification of witnesses, victims, or suspects.

Research has also emphasized the value and growing use of digital evidence, such as electronic devices, software, and video/audio recordings, in criminal investigations (Horsman, 2021; Wellford & Cronin, 1999).

3. Current study

Foundational evaluations have shown that the CGIC model is an innovative and promising strategy for addressing firearm-related violent crime by investigating NIBIN-related cases. These evaluations have laid the groundwork for a more thorough investigation into its impact on clearance rates. To this end, the current study examines whether the benefits afforded by CGICs pay dividends in terms of improving the clearance rates for fatal and nonfatal shootings. To do so, it uses coarsened exact matching to compare fatal and nonfatal shooting cases with NIBIN leads that benefited from efficient NIBIN processing, comprehensive NIBIN lead reports, and, more generally, the resources leveraged by CGIC interagency partnerships to similar cases without these benefits. The Detroit CGIC is an ideal site for this study for two critical reasons. First, the volume of firearm violence within the city is significant as compared to similar Midwest cities (Rojek, De Biasi and McGarrell, 2022). Second, the high level of firearm violence observed in Detroit increases the likelihood of producing NIBIN leads.

3.1. Detroit CGIC: a focus on NIBIN

Table 1 delineates critical events in NIBIN processing and the formulation of comprehensive NIBIN lead reports, drawing from the Detroit CGIC evaluation (Rojek et al., 2022). Later discussed, these events help differentiate the treatment and control periods, which underpin the study's analysis. The establishment of the Detroit CGIC represents the city's first comprehensive and systematic effort to investigate NIBIN-related cases that leverages the joint resources of federal, state, and local partners.

Detroit was awarded funding to establish a CGIC in September 2018. Prior to this date, the Detroit Police Department (DPD) outsourced NIBIN to the Michigan State Police. NIBIN processing commonly took months to perform, and the information provided in the summary report of connected incidents was underdeveloped. With the establishment of the Detroit CGIC, DPD began performing its own correlation reviews, which could be performed within a matter of 1 to 2 weeks. This changed when DPD began working with the NNCTC in February 2019. This partnership shortened the time needed to conduct NIBIN correlation reviews to 24–48 h, a standard reported by the NNCTC (Bureau of Alcohol, Tobacco, Firearms, and Explosives, 2023).

Through the support of the Detroit CGIC, DPD also developed the capacity to compile actionable investigative intelligence from NIBIN leads in the form of NIBIN lead reports. The assignment of a crime analyst in September 2019 was the first significant effort to develop NIBIN lead reports with fundamental intelligence, with the capacity to collect more advanced intelligence in February 2020 with the hiring and training of additional crime analysts, and DPD and ATF streamlining their data output processes. Examples of the advanced intelligence featured in NIBIN lead reports include the incorporation of insights from social media and link analyses, firearm trace records, as well as temporal and geographic assessments of connected incidents. Importantly, the ability of the Detroit CGIC to rely on partnering agencies to assist in NIBIN processing and intelligence-gathering efforts helped lessen the disruption to standard operation practices and procedures experienced due to the COVID-19 pandemic.

4. Data and methods

The current study uses data provided by DPD on fatal and nonfatal shooting cases that occurred from January 2017 through August 2021. The data originated from three DPD sources: (1) fatal and nonfatal shooting incident records; (2) NIBIN records; and (3) the records management system (RMS). For internal record-tracking purposes, DPD began recording information on fatal and nonfatal shooting incidents in 2017. A fatal shooting involves the lethal injury of an individual from the projectile of a firearm, while a nonfatal shooting involves the nonlethal injury of an individual from the projectile of a firearm. In combination, records of fatal and nonfatal shooting incidents better capture the breadth of firearm violence.

Fatal and nonfatal shooting cases were excluded from examination based on two criteria. Given the focus of CGICs on violent offenders, all accidental or self-inflicted shootings were removed from the study. Furthermore, I identified the corresponding NIBIN record for each fatal and nonfatal shooting. These records include the correlation review findings of ballistic evidence submitted into NIBIN that were either collected from shooting events (i.e., cartridge case evidence) or those produced from the test-fire of recovered crime guns (i.e., test-fire evidence). DPD recorded this information to support the activities of the Detroit CGIC. Only those fatal and nonfatal shooting cases that were connected to one or more crime scenes by virtue of a NIBIN lead were retained for further analysis. The final sample for this study includes a total of 951 fatal (235) and nonfatal (717) cases with NIBIN leads that occurred during the treatment and control periods.

I used a matching approach to more precisely identify the impact of the Detroit CGIC benefits on the likelihood of clearing fatal and nonfatal shooting cases with NIBIN leads. This was achieved by exclusively examining such cases for which there was common support (or overlap in pre-treatment covariates). While exact matching excludes cases that do not perfectly align on a set of covariates, coarsened exact matching (CEM) relaxes this criterion by binning (or grouping) continuous or high-dimensional covariates (Iacus et al., 2011; Rosenbaum & Rubin, 1985). This adjustment prevents excessively restrictive matching conditions that, among other consequences, can result in a loss of statistical power and precision, difficulties achieving balance, and biased estimates.[1] Developed by Iacus et al. (2011), the $\mathscr{L}_1$ statistic is a measure of overall imbalance, which ranges from 0 (perfect global balance) to 1 (perfect global imbalance). A good matching solution is one that reduces the $\mathscr{L}_1$ statistic from pre- to post-matching. In addition, CEM calculates weights to compensate for differential bin sizes (Blackwell et al., 2009). These weights can then be used in subsequent analyses to estimate the sample average treatment effect on the treated (SATT).

Analysis for this study involved two steps. Drawing from case and investigative characteristics, I performed CEM for cases that occurred during the treatment period (i.e., treatment cases) and two treatment sub-periods relative to those that occurred during the control period (i.e., control cases). The treatment group consists of fatal and nonfatal shooting cases that occurred when the Detroit CGIC was operational and captures the period following the Detroit CGIC's partnership with the NNCTC and the development of fundamental and advanced intelligence capabilities. The treatment period is also distinguished by the type of available intelligence (fundamental vs. advanced) provided through the CGIC. The control group consists of fatal and nonfatal shooting cases that occurred prior to the Detroit CGIC. The differentiation of the treatment and control periods is further supported by an assessment of NIBIN processing time which considers the time between crime occurrence and NIBIN lead identification, as well as the time between crime occurrence and NIBIN acquisition, and NIBIN acquisition and NIBIN lead identification.

To assess the performance of CEM, I report the reduction in the $\mathscr{L}_1$

[1] As compared to propensity score matching (PSM), CEM achieves balance on covariates that are coarsened, which ensures that the distribution is comparable between the treatment and control groups. PSM achieves balance in the distribution of the estimated propensity scores. Furthermore, CEM is less sensitive to model specifications than PSM and is better-suited for dealing with continuous or high-dimensional covariates.

Table 1
Detroit CGIC timeline.

Timeline	Description of Activities	NIBIN Correlation Review	Comprehensive NIBIN Lead Reports	Type of Intelligence, Comprehensive NIBIN Lead Reports	Control/ Treatment Group
Before September 2018	▪ NIBIN externally sourced ▪ Correlation reviews performed by Michigan State Police	Months	No	–	Control
September 2018	▪ Received BJA funding to establish a CGIC ▪ Correlation reviews are performed in-house	1–2 Weeks	No	–	–
February 2019	▪ Joined the National NIBIN Correlation and Training Center	24–48 Hours	No	–	–
September 2019	▪ Assigned a crime analyst to create NIBIN lead reports	24–48 Hours	Yes	Fundamental Intelligence	Treatment
February 2020	▪ DPD and ATF streamlined data output process ▪ Additional crime analysts are assigned to create NIBIN lead reports	24–48 Hours	Yes	Advanced Intelligence	Treatment

statistic for each CEM result. Following CEM, I separately estimate the odds of clearing fatal and nonfatal shooting cases with NIBIN leads for the treatment period and two treatment sub-periods relative to the control period. This was achieved through logistic regression, incorporating robust standard errors and the weights returned from CEM. I refer to these models as the full, fundamental, and advanced treatment models. In addition, I report the results of power-analyses, which were performed for each model after CEM using a two-sample proportion tests for unequal sample sizes at a significance level of 0.05 for small (0.20), medium (0.50), and large (0.80) effect sizes (Cohen, 1988).

4.1. Dependent variable

My dependent variable was created in the summer of 2023, allowing sufficient time for the investigation of cases that occurred during the study period (January 2017–August, 2021) to develop. In accordance with the prevailing conceptualization used by law enforcement (Jarvis & Regoeczi, 2009; Phillips et al., 2022), a case was considered cleared upon the arrest or death of an offender, as well as the denial of prosecution. Cases cleared after the identification of a NIBIN lead can be more conclusively attributed to the impact of its delivery to investigators and its unfolding investigation by CGIC partners. For this reason, my dependent variable considers the temporal ordering of each case's status relative to the delivery of a NIBIN lead (Case Cleared After NIBIN Lead = 1; Case Not Cleared After NIBIN Lead = 0). A case must be cleared following the delivery of a NIBIN lead for its status to be related to the influence of CGIC benefits.

4.2. Independent variable

I consider three intervention variables that distinguish those fatal and nonfatal shooting cases that received CGIC benefits from those that did not. The control group remained consistent across all three intervention variables and consists of those fatal and nonfatal shooting cases that occurred before the Detroit CGIC (January 2017–August 2018). During this period, the Detroit CGIC was not operational, and there were substantial delays in NIBIN processing and no comprehensive NIBIN lead reports. Furthermore, the first intervention variable identifies those fatal and nonfatal shooting cases that occurred during the Detroit CGIC following its partnership with the NNCTC and development of fundamental and advanced intelligence capabilities (September 2019–August, 2021). The second intervention variable identifies those fatal and nonfatal shooting cases that occurred when the Detroit CGIC was operational and NIBIN lead reports contained fundamental intelligence (September 2019–January 2020). The third intervention variable identifies those fatal and nonfatal shooting cases that occurred when the Detroit CGIC was operational and NIBIN lead reports contained advanced intelligence (February 2020–August 2021).

4.3. Pre-treatment covariates

Informed by prior research, I created pre-treatment covariates that captured characteristics of fatal and nonfatal shooting cases to support CEM.

4.3.1. Case characteristics

I created binary indicators (Yes = 1; No = 0) that captured whether there were multiple victims, whether there were any survivors, whether any of the victims knew one or more of the offenders, and the presence of eyewitnesses. Furthermore, I included binary indicators that captured whether a shooting event occurred outside or inside (1 = Outside; 0 = Inside) and whether it involved gang- (Yes = 1; No = 0) or narcotic-related (Yes = 1; No = 0) activities. Lastly, I created an ordinal measure to capture the time between crime occurrence and a case's latest status update in the RMS, with each level capturing the number of cases that fell into one of seven quantiles. This measure takes into consideration the likelihood that cases occurring earlier provide investigators with more time to gather intelligence, potentially leading to case clearance.[2]

4.3.2. Investigative characteristics

I created binary indicators (Yes = 1; No = 0) that captured the collection of DNA evidence, the recovery of electronic devices and software, (computers, phones, software programs, etc.), the recovery of identifiable documents (photo identifications, mail, etc.), and the recovery of video/audio recordings. As it relates to NIBIN, I created a binary indicator that captured the type of ballistic evidence submitted into NIBIN (Test-fire evidence = 1; Cartridge case evidence = 0). As compared to the recovery of a cartridge case from a crime scene, the recovery of a crime gun can provide additional information through a firearms tracing investigation conducted by ATF that may enhance clearance rates. From the correlation review findings, I created a binary indicator that identifies whether two or more crime scenes were connected by virtue of a NIBIN lead (Two Crime Scenes = 1; More than Two Crime Scenes = 0). NIBIN leads that connect more than two crime scenes are more likely to generate actionable information to help clear fatal and nonfatal shootings. This is in contrast to the connection of only two crime scenes, which represents the minimum requirement for identifying a NIBIN lead. Relatedly, I created a binary indicator that identifies

[2] This measure was created at the same time as the dependent variable.

those fatal or nonfatal shooting cases for which a NIBIN lead was identified within two weeks of its most recent NIBIN acquisition (Within Two Weeks = 1; Over Two Weeks = 0). Given the recency of the connected shooting events, these cases are more likely to be seen as high-priority.

5. Results

Table 2 presents descriptive statistics prior to matching for the full sample, and treatment and control periods. None of the variables have unknown or missing values. Overall, 65% of fatal and nonfatal shooting cases occurred when the Detroit CGIC was operational. Accounting for temporal ordering, 21% of cases that occurred during the full treatment period were cleared following the delivery of a NIBIN lead, compared to 14% for the fundamental treatment period, 22% for the advanced treatment period, and 8% for the control period.

Across all treatment periods and the control period, fatal and nonfatal shooting cases were most likely to involve one surviving victim who had no known relation to the offender. Apart from the fundamental treatment period, more than half of cases had one or more eyewitness. Furthermore, video/audio recordings of shooting events were commonly available, which represented more than half of cases for all but the control period. In addition, the vast majority of cases involved shooting events that occurred outside, were connected to one additional crime scene (i.e., two connected crime scenes in total), and had a NIBIN lead that was identified more than two weeks from its most recent NIBIN acquisition. Cases rarely involved gangs or narcotics, test-fires, or the collection of DNA evidence and identifiable documents. Lastly, the time between crime occurrence and a case's most recent status update in the RMS was longer for treatment cases than for control cases.

A more in-depth examination is dedicated to the NIBIN process, with key findings presented in Table 3. The NIBIN process encompasses the time between crime occurrence and NIBIN lead identification, which is further subdivided into two timeframes: the time between crime occurrence and NIBIN acquisition, and the time between NIBIN acquisition and NIBIN lead identification. On average, the NIBIN process was over 5 times longer for control cases than treatment cases, with a median of 130 days for control cases and 8 days for treatment cases. This finding is driven by the time between NIBIN acquisition and NIBIN lead identification. A cumulative analysis revealed that NIBIN processing occurred within 8 days for about half of the treatment cases compared to 130 days for control cases. As it relates to the sub-treatment periods, the NIBIN process tended to be longer for cases that occurred during the fundamental intelligence period, which captures the initial implementation phase of the Detroit CGIC.

Moving forward, the average time between crime occurrence and NIBIN acquisition was nearly nine times longer for control cases than treatment cases, with a median of 43 days for control cases and 2 days for treatment cases. Furthermore, the average time between NIBIN acquisition and NIBIN lead identification was nearly five times longer for control cases than treatment cases, with a median of 67 days for control cases and 3 days for treatment cases. A cumulative analysis revealed that a NIBIN lead was identified for about half of the treatment cases within 3 days of a NIBIN acquisition, and by one week, a NIBIN

Table 2
Descriptive statistics.

Variables	All (N = 952)	Full Treatment Period (n = 617)	Basic Treatment Period (n = 112)	Advanced Treatment Period (n = 505)	Control Period (n = 335)
Dependent					
Cleared After NIBIN Lead	0.16	0.21	0.14	0.22	0.08
	(0.37)	(0.41)	(0.35)	(0.42)	(0.27)
Independent					
DCGIC	0.65	–	–	–	–
	(0.48)				
Case Characteristics					
Multiple Victims	0.23	0.22	0.24	0.22	0.26
	(0.42)	(0.42)	(0.43)	(0.41)	(0.44)
Survivors	0.77	0.79	0.77	0.80	0.76
	(0.41)	(0.40)	(0.42)	(0.40)	(0.43)
Acquainted	0.23	0.24	0.20	0.26	0.21
	(0.42)	(0.43)	(0.40)	(0.44)	(0.41)
Eyewitness	0.51	0.51	0.46	0.52	0.53
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)
Outside	0.87	0.85	0.79	0.87	0.89
	(0.34)	(0.35)	(0.41)	(0.34)	(0.31)
Gang	0.03	0.04	0.05	0.03	0.03
	(0.18)	(0.19)	(0.23)	(0.18)	(0.16)
Narcotics	0.07	0.09	0.10	0.08	0.04
	(0.26)	(0.28)	(0.30)	(0.28)	(0.20)
Time to Status Update*	4	4	4	4	3
Investigative Characteristics					
DNA	0.06	0.06	0.05	0.06	0.06
	(0.23)	(0.23)	(0.23)	(0.23)	(0.24)
Electronic Devices/Software	0.23	0.26	0.25	0.26	0.18
	(0.42)	(0.44)	(0.43)	(0.44)	(0.39)
Identifiable Documents	0.06	0.06	0.04	0.06	0.07
	(0.24)	(0.23)	(0.21)	(0.24)	(0.25)
Video/Audio Recordings	0.54	0.58	0.54	0.59	0.47
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)
Test-fire	0.07	0.08	0.07	0.08	0.06
	(0.25)	(0.27)	(0.26)	(0.27)	(0.23)
Connected Shooting Events	0.75	0.72	0.71	0.72	0.82
	(0.43)	(0.45)	(0.45)	(0.45)	(0.39)
Connected Shooting Event within	0.20	0.21	0.21	0.21	0.18
Two weeks	(0.40)	(0.41)	(0.41)	(0.41)	(0.39)

Notes. *Median values are reported. Means are displayed with standard deviations in parentheses.

Table 3
NIBIN process: duration in days.

	Event to NIBIN Acquisition		NIBIN Acquisition to NIBIN Lead Identification		Event to NIBIN Lead Identification	
	Average	Median	Average	Median	Average	Median
Treatment Group	5.7	2	48.0	3	53.6	8
Fundamental Intelligence	7.4	2	82	1.5	89.4	5.5
Advanced Intelligence	3.6	2	40.4	3	45.7	8
Control Group	50.8	43	224	67	274.7	130

lead was identified for 62.1% of treatment cases. In comparison, a NIBIN lead was identified for 30% of control cases within 3 days of a NIBIN acquisition, and by one week, a NIBIN lead was identified for only 34% of control cases. For nearly half of control cases, it took 67 days for a NIBIN lead to be identified following a NIBIN acquisition.

Table 4 presents the results of power-analyses performed for the full, fundamental, and advanced treatment models after CEM. Specifics regarding the number of fatal and nonfatal shooting cases considered by these models are provided in the following sections. The full and advanced treatment models are adequately powered to identify medium and large effects but are under-powered to identify small effects. The fundamental treatment model is only adequately powered to identify large effects.

Table 5 presents the results of the logistic regression analyses as odds ratios for the full, fundamental, and advanced treatment models.

5.1. Full treatment model

The $\mathscr{L}_1$ statistic was 0.70 for the full treatment model. This value serves as a baseline reference for the unmatched data. After performing CEM, the $\mathscr{L}_1$ statistic dropped to nearly zero, indicating almost perfect global balance. The final sample size includes 381 matched, fatal and nonfatal cases, with 211 occurring during the treatment period and 170 during the control period.

The likelihood of case clearance was 4.84 times higher (p-value $\leq$0.001) after the delivery of a NIBIN lead as opposed to before it or not at all for cases that occurred during the Detroit CGIC compared to cases that occurred prior to the Detroit CGIC.

5.2. Fundamental treatment model

After performing CEM, the $\mathscr{L}_1$ statistic for the fundamental treatment model dropped from 0.85 to nearly zero. The final sample size includes 87 matched fatal and nonfatal cases, with 28 occurring during the treatment period and 59 during the control period. The likelihood of case clearance was 3.25 times higher (p-value = 0.13) after the delivery of a NIBIN lead as opposed to before it or not at all for cases that occurred during the fundamental intelligence period of the Detroit CGIC compared to cases that occurred prior to the Detroit CGIC.

5.3. Advanced treatment model

After performing CEM, the $\mathscr{L}_1$ statistic dropped from 0.66 to nearly zero. The final sample size includes 338 matched fatal and nonfatal cases, with 180 occurring during the treatment period and 158 during the control period. The likelihood of case clearance was 3.66 times higher (p-value = 0.02) after the delivery of a NIBIN lead as opposed to before it or not at all for cases that occurred during the advanced intelligence period of the Detroit CGIC compared to cases that occurred prior to the Detroit CGIC.

Table 4
Power analyses.

Models	Small Effect Size	Medium Effect Size	Large Effect Size
Full Treatment Model	0.49	1	1
Basic Treatment Model	0.14	0.59	0.94
Advanced Treatment Model	0.45	1	1

Table 5
Logistic regression results: treatment models.

Treatment Model	Treatment	Baseline (Constant)
Full	4.84***	0.03***
(N = 381)	(2.19)	(0.01)
Fundamental	3.25	0.05***
(N = 87)	(2.52)	(0.03)
Advanced	3.66*	0.03***
(N = 338)	(1.96)	(0.01)

Note. Coefficients are displayed as odds ratios with robust standard errors. *P-value ≤0.05; **P-value ≤0.01;***P-value ≤0.001***.

6. Discussion and conclusion

The purpose of this study was to determine whether the CGIC's focus on NIBIN-related cases supported by the timely delivery of NIBIN leads, comprehensive NIBIN lead reports, and resources leveraged through interagency partnerships adds value in terms of improving clearance rates for fatal and nonfatal shootings. While the specifics of my research are restricted to the Detroit CGIC, larger conclusions can inform policing policy and practice as it relates to the operation of CGICs.

The establishment of the Detroit CGIC drastically reduced NIBIN processing time, which took over five times longer for cases that occurred during the control period than those that occurred during the treatment period. Not only were cartridge cases entered into NIBIN more quickly during the treatment period, but the time to NIBIN lead identification was also significantly reduced. The shorter time from NIBIN acquisition to NIBIN lead identification could, in part, be attributed to the increase in ballistic evidence entered into NIBIN through comprehensive collection, which heightens the likelihood of identifying NIBIN leads. However, the Detroit CGIC's collaboration with the NNCTC cannot be ignored, allowing correlation reviews to be conducted within 24–48 h of a NIBIN acquisition. While the advanced treatment period coincided with the onset of the COVID-19 pandemic, the average NIBIN processing time was shorter than that observed during the fundamental treatment period. The collaborative partnerships afforded by the Detroit CGIC most likely helped mitigate the impact of the COVID-pandemic on NIBIN processing.

Together, these findings help substantiate the distinction between the treatment and control periods, while also endorsing the collaboration between CGICs and the NNCTC. Another advantage of reducing NIBIN processing time is that the NNCTC allows law enforcement agencies the ability to allocate saved resources to other crucial activities, such as the development of comprehensive NIBIN lead reports. Resources directed toward the development of advanced intelligence, such as the hiring and training of additional crime analysts, have the potential to impact clearance rates by enhancing the usefulness of NIBIN lead reports to detectives.

To this point, fatal and nonfatal shooting cases with NIBIN leads that

occurred during the Detroit CGIC were more likely to be cleared compared to similar cases that occurred prior to its establishment. This finding was driven by the advanced treatment model, which captures the period when advanced crime intelligence was available in NIBIN lead reports. While the timely delivery of NIBIN lead reports is a base requirement for their usefulness to detectives, the Kansas City and Indianapolis CGIC evaluations drew attention to other critical, mitigating factors, one of which being the quality of the intelligence contained within them. A comparison of the effects of the fundamental and advanced treatment models appears to support the notion that the depth and quality of information available in NIBIN lead reports matters. In Detroit, crime analysts utilized multiple advanced analysis techniques in combination to develop NIBIN lead reports. Collaborating with ATF and other CGIC partners on intelligence gathering efforts expands the pool of available resources, thereby enhancing the usefulness of NIBIN lead reports for criminal investigations.

This study's findings should be considered in light of four limitations that can guide future research. First, the distinction between the treatment and control periods, while supported by an assessment of NIBIN processing time, does not consider the possibility that fatal and nonfatal shooting cases that occurred during the pre-CGIC period received the benefits of advanced intelligence and collaborative, interagency partnerships. With that said, this scenario is unlikely; the scope and level of attention afforded by the Detroit CGIC to the investigation of NIBIN-related cases is unprecedented. However, future research would benefit from a deeper assessment of the types of intelligence used in the investigation of NIBIN-related cases and their usefulness. Second, the study's matching approach could be expanded to consider additional controls and levels of analysis. For example, my case-level analysis excludes from consideration individual-level characteristics of victims. Given data restrictions, I was also unable to account for the experience of investigators, the number of officers and support staff assigned to crime scenes, as well as finer nuances of investigative efforts, such as whether witnesses or victims were interviewed. The evaluation of the Indianapolis CGIC discovered that the usefulness of NIBIN leads to detectives remained unaffected by witness and victim cooperation, with statistical significance determined at the traditional 0.05 level (Hipple, 2022). Further research is ultimately required to determine whether these findings can be replicated in other contexts. Third, my study is sufficiently powered to identify medium and large effects for the full and advanced treatment models, and only large effects for the fundamental treatment model. Given its low sample size, the fundamental treatment model may be particularly vulnerable to Type II error. My study's focus on fatal and nonfatal shooting cases prevented me from expanding the study period to include additional cases, as DPD only began identifying nonfatal shootings for record-tracking purposes in 2017. Fourth, I do not compare fatal and nonfatal shooting cases with NIBIN leads to similar cases without NIBIN leads. Such a comparison would broaden understanding of the impact of NIBIN more generally on clearance rates. Considering the CGICs' emphasis on NIBIN-related cases, the choice of control cases for this study is appropriate and contributes to establishing foundational knowledge regarding the impact of CGICs on clearance rates.

Ultimately, the continuation of funding to support CGICs and their collaboration with the NNCTC are important factors toward improving clearance rates of fatal and nonfatal shootings. Efficient NIBIN processing and comprehensive NIBIN lead reports, especially those that include advanced intelligence, should be prioritized by law enforcement agencies. Prior research that failed to show the benefit of NIBIN leads to criminal investigations should be reconsidered in light of this study's findings.

Funding source

National Collaborative on Gun Violence Research.

CRediT authorship contribution statement

Alaina De Biasi: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

None.

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