



Do real-time crime centers improve case clearance? An examination of Chicago's strategic decision support centers

Rachael Arietti*

John Jay College of Criminal Justice, City University of New York, USA

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ABSTRACT

Purpose: Real-Time Crime Centers (RTCCs) integrate a variety of technologies and information with the goal of helping police to more efficiently identify and respond to crime. A growing number of law enforcement agencies have implemented RTCCs in recent years, but few studies have evaluated their impact on crime control or investigative outcomes. This study uses a quasi-experimental design to examine whether RTCCs improve rates of case clearance for violent, property, and overall crime in Chicago, IL.

Methods: RTCCs were established in different police districts over the course of a three-year period. Difference-in-differences estimation with Poisson panel regression models are used to estimate the effect of RTCCs on case clearance, while controlling for other policing factors and neighborhood characteristics that may influence case clearance at the district level.

Results: On average, RTCCs were associated with a 5% increase in clearance rates for violent crime (IRR = 1.05, $p = .004$), a 12% increase for property crime (IRR = 1.12, $p = .003$), and an 11% increase for overall crime (IRR = 1.11, $p < .001$). These findings were robust across various model specifications.

Conclusions: RTCCs may provide investigative benefits to police through the integration of technologies and data, thus enhancing case solvability.

1. Introduction

Real-Time Crime Centers (RTCCs) represent one of the latest innovations in policing, following the growing trend of leveraging technology to support crime control and prevention efforts. A growing number of police departments have implemented RTCCs in recent years, with as many as 143 RTCCs identified across the U.S. to date, according to the Electronic Frontier Foundation's "Atlas of Surveillance" (Electronic Frontier Foundation, 2023). RTCCs integrate a variety of technologies to help law enforcement agencies more efficiently identify and respond to crime. Information from multiple data systems – often including CCTV, automated license plate readers, gunshot detection technology, and intelligence databases – is centralized in a single location to provide strategic and analytic support to police operations. The real-time integration of this information allows police to quickly respond to crime incidents in progress, conduct active surveillance, inform decision-making, and support criminal investigations (Bureau of Justice Assistance, 2019; Przeszlowski et al., 2022).

Despite the rapid diffusion of RTCCs across the U.S., few formal

evaluations have been done to assess their impact on criminal justice outcomes. This mirrors the trend in many police agencies of adopting technology in the absence of rigorous evaluation (Lum & Koper, 2017; Weisburd & Neyroud, 2011). Two studies to date have demonstrated the promise of RTCCs. One evaluation found that RTCCs were associated with reductions in crime (Hollywood, McKay, Woods, & Agniel, 2019), and a more recent study found the use of RTCCs increased the odds of violent crime clearance (Guerette & Przeszlowski, 2023). Aside from these studies, however, the evidence base is largely absent. This is surprising given the substantial costs associated with RTCCs, with initial costs ranging between several hundred thousand dollars to \$11 million (Surveillance Compounded, 2020). This does not include the costs of ongoing maintenance, technology, and personnel.

In 2017, the Chicago Police Department (CPD) began establishing RTCCs – known as Strategic Decision Support Centers (SDSCs) – in individual police districts throughout the city. The objectives of the SDSCs per CPD policy are to reduce crime, improve clearance rates, reduce police response times, and increase officer safety (Hollywood et al., 2019). Hollywood et al. (2019) assessed the impact of Chicago's SDSCs

* Corresponding author at: John Jay College of Criminal Justice, City University of New York, 524 West 59th Street, Haaren Hall, New York City, NY 10019.
E-mail address: rarietti@jjay.cuny.edu.

on crime reduction, concluding they were a promising model for improving law enforcement operations. However, the study did not examine the impact of the centers on investigative outcomes, such as case clearance. Crime clearance rates, which can be thought of as the percentage of cases solved by police,¹ are often used as a measure of police performance and investigative success (Baughman, 2020). To the extent that the SDSCs provide actionable intelligence to police, they should theoretically increase the potential to solve cases. In addition to being a stated objective of the SDSCs, improved clearance rates are arguably a better indication than crime reduction of whether the centers are generating intelligence to enhance investigations.

Using data provided by the CPD, this study explores whether SDSCs are associated with increases in case clearance for a variety of crime types in Chicago police districts. A quasi-experimental design is used to estimate the effect of SDSCs on case clearance for violent, property, and overall crime, while controlling for extraneous factors that may influence case clearance at the district level. This research contributes to the limited evidence base on RTCCs, as well as technology-driven policing strategies more generally (Lum & Koper, 2017). Given the cost and resources associated with RTCCs and their constituent technologies, this research will also be beneficial for law enforcement agencies considering implementing RTCCs in their own jurisdictions.

2. Review of relevant literature

Law enforcement agencies are increasingly adopting innovative technologies to support crime control and prevention efforts. Following the terrorist attacks of September 11, 2001, a move toward “intelligence-led policing” began to emphasize the systematic gathering of information and data-driven solutions to address crime problems (U.S. Department of Justice, 2009). The Department of Homeland Security expanded its network of fusion centers – designed to facilitate intelligence-sharing among federal, state, and local agencies in the investigation of terrorism and other criminal activities (Freilich, Chermak, Arietti, & Turner, 2024). As law enforcement agencies developed their intelligence capacities, their application expanded beyond terrorism to more routine crime problems. Today, intelligence generated from police surveillance data, information management systems, and other technology is becoming increasingly central to contemporary policing strategies (Ariel, 2019; Gaub & Koen, 2021).

2.1. Real-time crime centers

The growing demand for timely intelligence and the development of advanced technological systems paved the way for the emergence of real-time crime centers (RTCCs). RTCCs are similar to fusion centers in that they center around the integration and sharing of intelligence. But in contrast to fusion centers, which typically function at a state or regional level, RTCCs operate at a more local level within individual law enforcement agencies (Przeszlowski et al., 2022). As the name suggests, RTCCs aim to deliver information in near real-time, allowing police to respond more quickly to ongoing crime incidents, and to better identify and apprehend offenders (Guerette & Przeszlowski, 2023). In addition to real-time information sharing, RTCCs harness technology to conduct surveillance, inform decision-making, and support criminal investigations. As many as 143 RTCCs have been implemented in the United States over the past two decades, and this number has grown dramatically in recent years, from an estimated 80 RTCCs in 2020

¹ Crimes are most often cleared by arrest, meaning an offender is arrested and charged, and the case is turned over for prosecution. Less commonly, a case can be cleared by “exceptional means” in instances where there is sufficient evidence to support an arrest, but an arrest cannot be made due to factors outside of law enforcement control (e.g., the offender is dead or already in custody) (FBI, 2016).

(Electronic Frontier Foundation, 2023). Moreover, a majority of RTCCs are housed in large agencies (i.e., over 500 personnel), indicating their coverage extends to relatively large numbers of police officers (Przeszlowski et al., 2022).

The specific implementation and operating practices of RTCCs vary across agencies. Przeszlowski et al. (2022) surveyed 44 police agencies with RTCCs to better understand their characteristics, operations, and diffusion. The RTCCs employed a wide variety of information and technologies, including calls for service information, CCTV video footage, license plate readers, and intelligence databases. Primary functions of the centers included responding to crimes in progress, active surveillance, post-incident investigative support, and real-time information sharing. The authors found the proliferation of RTCCs has accelerated over the last decade, with between three to eight new centers launched each year since 2015. However, despite the diffusion of RTCCs, relatively little is known about their efficacy. Less than half of the surveyed agencies reported documenting their impact to assess outcomes such as crime reduction, officer safety, or clearance rates (Przeszlowski et al., 2022).

To date, only two studies have examined the impact of RTCCs on criminal justice outcomes. Guerette and Przeszlowski (2023) explored whether an RTCC improved case clearance for violent crimes in Miami, FL. The study compared a sample of 648 violent crime cases that received RTCC support to a sample of control cases that did not receive RTCC support. They found that RTCC-assisted cases had 66% greater odds of being cleared compared to control cases. No significant difference was observed in the number of days taken to clear a case between the RTCC-assisted cases and the control cases. Due to the incident-based application of the RTCC technologies in Miami, this study focused on a small proportion of violent crimes that received RTCC support and was unable to examine other types of crime at a jurisdiction level. However, the findings suggest that information provided by the RTCC may have helped police to generate more arrests.

Hollywood et al. (2019) conducted a mixed-methods process and outcome evaluation of Chicago’s Strategic Decision Support Centers (SDSCs). Using difference-in-differences models, they estimated the impact of the SDSCs on crime reduction at the district level. They found the SDSCs were associated with estimated crime reductions of between 3% and 17% – concluding they were effective, overall, at reducing crime. However, this study did not assess outcomes that might indicate investigative benefits of the SDSCs, such as case clearance. Case clearance reflects the ability of police to solve crime, and is thus an important measure of police effectiveness. Despite the established literature on investigative practices that improve case solvability, studies on police technology have traditionally focused on crime prevention as an outcome. A limited body of literature has examined the impact of technology on criminal investigations, and case clearance in particular (Koper & Lum, 2019).

2.2. Prior research on case clearance

Research on case clearance has considered characteristics of the incident, victim, and investigation that predict case solvability. Studies suggest it is influenced by both circumstantial factors (e.g., whether a witness was present at the crime scene) and investigative effort (e.g., faster response time and follow up by detectives) (Prince, Lum, & Koper, 2021; Wellford & Cronin, 1999). For example, the recovery of forensic evidence, recovery of weapon(s), and witness cooperation increase the likelihood of homicide clearance (McEwen & Regoeczi, 2015; Wellford, Lum, Scott, Vovak, & Scherer, 2019). Faster police response times have been associated with case clearance (Blanes i Vidal & Kirchmaier, 2018), likely because they increase the chances that responding officers will locate and arrest a suspect on scene, or obtain critical information from victims or witnesses (Greenwood & Petersilia, 1975). In addition, higher clearance rates have been associated with regular information sharing across investigative units and with patrol (Wellford et al., 2019), as well

as investigative support from intelligence and crime analysis (Carter & Carter, 2016).

Some studies have explored the impact of technology on case clearance, although as noted previously, this research is underdeveloped. For example, computer checks on suspects using Criminal Justice Information Systems have been found to improve homicide clearance (Wellford & Cronin, 2000). Research has explored whether surveillance technologies such as CCTV increase the probability of case clearance (e.g., Ashby, 2017; Piza, Caplan, & Kennedy, 2014; Robin, Peterson, & Lawrence, 2021). CCTV has been associated with modest increases in case clearance, particularly for theft (Jung & Wheeler, 2023) and other property crime (Morgan & Dowling, 2019; Sharp, 2016), although some studies have found no significant increase in case clearance (e.g., Gerell, 2021; Thomas, 2023). Koper and Lum (2019) found that license plate readers improved case clearance for auto-theft and robbery, although they note it may have to be combined with other technologies and policies in order to realize these benefits. Some studies suggest that gunshot detection technology (GDT) may improve case clearance (e.g., Vovak, Riddle, Taniguchi, Hoogesteyn, & Yang, 2021), although findings have been mixed, with other studies finding no impact (e.g., Doucette, Green, Necci Dineen, Shapiro, & Raissian, 2021; Lawrence, La Vigne, & Thompsom, 2019; Piza, Arietti, Carter, & Mohler, 2023).

Still, there is evidence to suggest the coordinated use and integration of multiple technologies enhances investigations of gun crime (Flippin, Katz, & King, 2021; Koper, Vovak, & Cowell, 2019). Crime gun intelligence centers leverage technologies including ballistic imaging software, firearms tracing, and gunshot detection systems to facilitate the analysis of ballistic evidence and firearms. Like RTCCs, crime gun intelligence centers also emphasize information sharing and intelligence gathering to enhance investigations. Koper et al. (2019) and Flippin et al. (2021) found that clearance rates increased significantly after crime gun intelligence centers were implemented in Milwaukee, WI and Phoenix, AZ, providing evidence of investigative benefits. Collectively, these findings suggest that the integration of police technologies and information sharing practices may have the potential to improve case solvability.

2.3. RTCCs in Chicago

Chicago's SDSCs are designed to support multiple aspects of district-level operations, including improving situational awareness, identifying incidents and perpetrators in real time, and providing investigative support after incidents occur. The SDSCs incorporate CCTV, gunshot detection technology, crime mapping software, and criminal history information, among other police databases. They allow district personnel to monitor display feeds and locations of interest, as well as hosting daily briefings to discuss crime patterns and hotspots (Hollywood et al., 2019). Each center is staffed by two officers, one supervisor, and a civilian crime analyst (CPD, personal communication, 2020). Importantly, the SDSCs allow for information sharing between districts, as well as with detectives, prosecutors, and partner agencies (Hollywood et al., 2019). Thus, they aim to both inform real-time decision-making as well as support active investigations.

Prior research suggests there are a number of causal mechanisms through which SDSC technologies and practices might increase the likelihood that cases are solved. For example, SDSCs may allow officers to respond to crime scenes more quickly, potentially allowing them to identify more investigative leads. Gunshot detection technology (GDT) allows police to be immediately notified of gunfire, as opposed to waiting for members of the public to report a shooting. Research has shown that GDT leads to detection of gunfire events that were not reported by citizens, as well as faster police response times (e.g., Choi, Librett, & Collins, 2014; Mares & Blackburn, 2012; Piza, Hatten, Carter, Baughman, & Mohler, 2023). Improved response to shooting incidents may increase the chances that police identify evidence on-scene, thus enhancing case solvability (La Vigne, Thompson, Lawrence, & Goff,

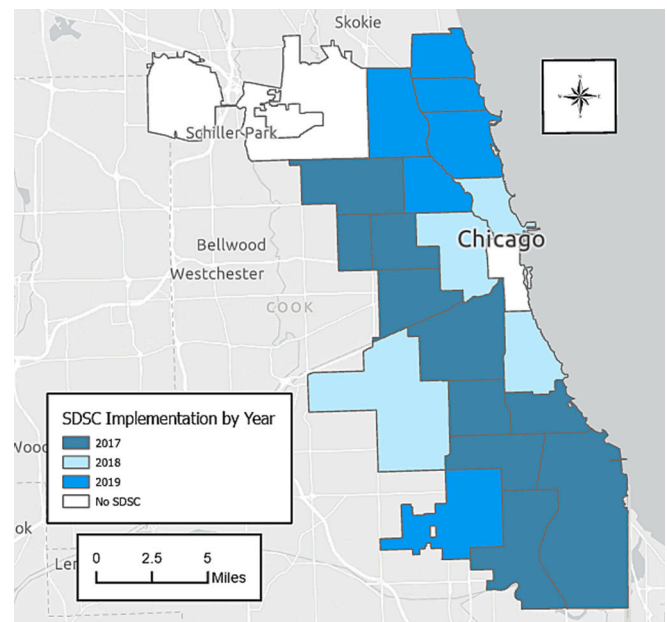


Fig. 1. SDSC implementation by year (2017–2019).

2019). In addition, monitoring CCTV footage may allow police to identify crime incidents in progress, and to dispatch nearby units to apprehend offenders on-scene (Piza et al., 2014). Camera footage may also be used retroactively in investigations (e.g., Robin et al., 2021), potentially allowing for further identification of suspects and evidence. Finally, support from crime analysis, as well as information sharing between officers and detectives, is likely to enhance ongoing investigations. For these reasons, it is hypothesized that Chicago's SDSCs will improve case solvability, thus resulting in increased rates of case clearance.

2.4. Literature review summary and scope of the current study

Relatively few studies have examined the impact of police technologies on investigative outcomes such as case clearance, and existing findings have been mixed. However, there is evidence to suggest the integration of technology coupled with timely information and analysis may enhance investigations. RTCCs have been adopted at a rapid rate over the last two decades, and a majority of agencies report using their RTCCs for post-incident investigative purposes (Przeszlowski et al., 2022). Yet only a single study has explored the potential investigative benefits of RTCCs. This study found that RTCC-assisted violent crime cases had increased odds of case clearance in Miami. However, the application of RTCC resources to only a small subset of incidents prevented a more comprehensive analysis of case clearance at the jurisdiction level (Guertette & Przeszlowski, 2023). The present study seeks to further contribute to our understanding of the investigative potential of RTCCs, while building on prior research on RTCCs in Chicago. Specifically, the study extends the methodology employed by Hollywood et al. (2019) to examine whether Chicago's Strategic Decision Support Centers (SDSCs) improve case clearance for violent, property, and overall crime.

3. Study setting

The City of Chicago has a total population of nearly 2.7 million, and has struggled with high levels of violence for decades. In 2016, the city witnessed a spike in violence amidst controversial police-citizen encounters across the country, including the release of the Laquan

McDonald shooting video.² The CPD sought to implement a crime reduction strategy to address this increase in violence, and this was the context for the development of the SDSCs. The SDSCs leveraged existing technology in Chicago and were established in individual police districts over the course of a three-year period. The cost of the SDSC rooms and associated technology is about \$10.6 million, plus an additional \$600,000 annually (Hollywood et al., 2019). As of the time of this study, which includes data from 2013 to 2019, SDSCs were operational in 20 out of 23 police districts. Fig. 1 shows a map of the years in which SDSCs were implemented in each district.

Implementing RTCCs at the district level is somewhat innovative, as most agencies have one centralized RTCC for the jurisdiction. However, given the size of Chicago's police districts, which serve more residents than the majority of police departments nationwide, the SDSCs may be comparable to jurisdiction-level RTCCs in other agencies. Chicago has a land area of 234 mile², and district size and population vary across the city. On average, each CPD district provides service for about 125,000 people over 11 mile² (Hollywood et al., 2019). Because the SDSCs were implemented in different districts at different points in time, it provides an ideal setting to measure the effect of the intervention on case clearance. Analysis of district-level changes additionally allows for greater statistical power than would be possible with an analysis of citywide effects.

4. Methods

4.1. Data

The data for this study was compiled from several sources. CPD provided geographic data on crime incidents and case clearance dispositions, GDT coverage, CCTV camera locations, and calls for service for "shots fired" between 2013 and 2019.³ Data were provided at the address level with XY coordinates identifying the locations of the data points, allowing each data point to be assigned to a particular district. The crime and calls for service data were geocoded using a custom-built address locator in ArcGIS Pro.⁴ The GDT and CCTV data included pre-geocoded XY coordinates. The *tidycensus* R package was used to collect American Community Survey (ACS) (2013–2019) five-year estimates at the census block group level.⁵ Ambient population data was derived from the Land Data Scan generated by the Oak Ridge Laboratory.

4.2. Unit of analysis and sample

The present study period is from 2013 to 2019, and SDSCs were established in Chicago between 2017 and 2019. The SDSCs were installed in different districts at different points in time, and the staggered implementation was used to estimate the effect of the introduction of the SDSCs on case clearance. Because the SDSCs were installed at the district level in Chicago, the final dataset was aggregated to the district level for analysis.⁶

² <https://www.chicagotribune.com/news/laquan-mcdonald/ct-graphics-laquan-mcdonald-officers-fired-timeline-htmlstory.html>.

³ As criminal investigations can take varying amounts of time to solve, crimes are sometimes cleared months or years after they are reported. Although data for this study included crime measures through 2019, the data was obtained in 2021, meaning clearance information was current as of that year.

⁴ Geocoding match rates were at least 95%.

⁵ <https://walker-data.com/tidycensus/>.

⁶ The research team spatially joined the point-level data to individual street segments (data were geocoded with an offset distance, allowing data points to be aggregated to the closest street segment), and the street segments were assigned to corresponding police districts in ArcGIS Pro. Census measures for block groups contained within each district (i.e. their centroid fell within the district) were averaged to generate district-level values. Ambient population data for 1.5 km² grids contained within each district were also averaged to the district level.

Table 1
SDSC operational dates in CPD districts.

District	Operational date
7	January 7, 2017
11	February 7, 2017
6	March 15, 2017
9	March 15, 2017
10	March 15, 2017
15	March 15, 2017
3	December 29, 2017
4	December 29, 2017
5	December 29, 2017
25	December 29, 2017
2	March 1, 2018
8	March 1, 2018
12	March 1, 2018
18	July 2, 2018
19	February 5, 2019
24	February 5, 2019
14	February 8, 2019
17	February 9, 2019
20	February 22, 2019
22	February 22, 2019

The panel dataset is comprised of the 23 districts observed over the seven-year (84 month) study period, for a total of 1932 observations. Thus, the unit of analysis is the district-month. District-months in which an SDSC was operational are considered "treated" units, and district months in which there was no SDSC are considered control units. A total of 443 units were considered treated in the sample.

4.3. Variables

4.3.1. Independent variable

The independent variable is a dummy variable for SDSC presence (1/0) indicating whether an SDSC was operational in a given district-month. If a center became operational a week or more into the month, the following month was considered as the post-intervention period. Table 1 displays the dates at which SDSCs became operational in each police district.

4.3.2. Outcome variables

The outcome variables are the number of crime incidents cleared per district, per month. Because the investigative benefits of the SDSCs – as well as rates of case clearance – may differ across crime types (Gottfredson & Hindelang, 1979), separate measures were created for violent crime (assault, battery, sexual assault, homicide, robbery) and property crime (arson, burglary, criminal damage, criminal trespass, theft, and motor vehicle theft). An overall crime category comprised of both the violent and property crime offenses, as well as some additional offense types that may be impacted by the SDSCs (e.g., drug offenses and weapons violations), was created to test the aggregate effect of the SDSCs on case clearance. Crimes designated as "cleared" within CPD's crime data were used to create the outcome measures for each category.⁷

4.3.3. Control variables

The existence of other police efforts and technologies that vary across districts may also influence case clearance at the district level. For example, prior literature suggests that the use of CCTV and gunshot

⁷ The case clearance measures include cases that were cleared both by arrest and by exception. Exceptionally cleared cases represent cases in which there is sufficient evidence to support an arrest, but an arrest cannot be made due to factors outside of law enforcement control (FBI, 2016). Because both clearance dispositions require the identification of the offender and must meet the same evidentiary standard, theoretically, they may both be considered "solved" for investigative purposes.

detection technology may impact case clearance. During the study period, CPD increased the number of CCTV camera installations and expanded the deployment area for GDT across the city, which may have impacted investigations in different areas.

In addition, factors outside of police control including investigative workload and neighborhood characteristics may impact case clearance at the district level. Drawing on prior literature on technology and criminal investigations (e.g., Piza et al., 2014; Robin et al., 2021), the following measures were included as controls in the statistical models. The controls measure potential confounding factors related to police response, workload, seasonality, on-scene visibility, and socio-demographic neighborhood factors.

1. Lagged outcome measure: count of the outcome measure in a given district during the previous month, to account for within-district correlations in case clearance over time.
2. GDT presence: whether gunshot detection technology was present in a given district and month (coded as "1") or not (coded as "0").
3. CCTV surveillance: the number of CCTV cameras in each district and month
4. Shots fired calls for service (CFS), to account for call volume in each district. Call volume can impact police workload and therefore the ability to clear cases (Logan, 1975).
5. Disadvantage index (time-invariant): summed standardized percentages of households receiving public assistance, households below the poverty line, persons unemployed, single female-headed households with children under the age of 18, and persons without a high-school diploma or equivalent, as measured in the annual American Community Survey 5-year estimates.⁸
6. Demographic index (time-invariant): summed standardized percentages of non-White residents, residents aged 15–29, vacant properties, and renter-occupied properties, as measured in the annual American Community Survey 5-year estimates.^{9,10}
7. Ambient population index (time-invariant): standardized annual ambient population, as measured in the annual Oak Ridge Laboratory Land Scan data (1.5 km² grid).¹¹
8. Dummy variables for each month and year, to account for potential seasonal and yearly variations in case clearance. Monthly and yearly dummy variables control for variations in case clearance over time, accounting for any unobserved yearly or seasonal trends (Wooldridge, 2002) that may influence case clearance.

Descriptive statistics for select variables included in the statistical models are presented in Table 2. Across the full seven-year study period, an average of 117 violent crimes were cleared per district per month, with an average of 295 total violent crimes reported (approximately 40% cleared on average). Relatively fewer property crimes were cleared,

⁸ American Community Survey 5-year estimates were collected through the *tidycensus* R package at the census block group level. District-level values represent the mean of the values for the corresponding census block groups.

⁹ District level values represent the mean of the values for the corresponding census block groups.

¹⁰ Control variables were selected based on prior literature on technology and criminal investigations (e.g., Piza et al., 2014; Robin et al., 2021), and measure potential confounding factors related to police response, workload, and socio-demographic neighborhood factors. Ancillary analysis revealed a high degree of correlation between the disadvantage index and the demographic index, suggesting they capture similar neighborhood conditions. Additional models were run combining the two indices, and subsequently retaining the disadvantage index (due to its established connection to crime) and dropping the demographic index. The results were substantively similar, except for the violent crime model, in which the SDSC variable dropped below the traditional threshold for statistical significance.

¹¹ District level values represent an average of the 1.5km² grids that fall within each district.

Table 2
Descriptive statistics (monthly averages per district).

	Mean	SD	Min	Max
Violent crimes cleared	117.13	58.39	0.00	314.00
Total Violent crimes	294.53	136.18	1.00	700.00
Property crimes cleared	74.04	37.34	0.00	211.00
Total Property crimes	447.89	181.06	3.00	1149.00
Overall crimes cleared	287.04	167.81	0.00	1108.00
Total Overall crimes	847.83	336.58	5.00	1981.00
SDSC	0.23	0.42	0.00	1.00
GDT	0.15	0.36	0.00	1.00
CCTV	85.28	58.95	0.00	269.00
CFS	155.35	142.51	0.00	819.00
<i>N</i> (district-months)	1932			

with 74 crimes cleared and 448 total property crimes on average per month (average of approximately 16.5% cleared). Overall, an average of 287 total crimes were cleared, with 848 total crimes reported (average of approximately 34% cleared per month) over the study period. It is important to note that these are overall descriptives and do not reflect variation across districts or individual points in time. Table 2 also shows that about a quarter of the observations in the sample (23%) are considered "treated" during the study period. The number of months an SDSC was present varies across districts, from between 0 and 35 months.

4.4. Analytic approach

Because this study considers changes in case clearance over a seven-year period, panel regression analyses were employed. Panel models are more appropriate than cross-sectional or single time series models for estimating causality (Finkel, 1995). Difference-in-differences models are used to estimate the changes in case clearance associated with the introduction of an SDSC, calculated as changes in the rate of case clearance per month, per district. This follows the approach used by Hollywood et al. (2019) in their analysis of crime reduction effects. Because the outcomes are counts of cases cleared for each crime category, the study uses Poisson panel regression with the corresponding crime count as an exposure variable.

Panel models were estimated using the XTPOISSON command in Stata 17. Models for each of the outcome measures were specified with random effects. The incident rate ratios (IRRs) and standard errors are reported for each covariate. Standard errors are clustered at the district level to account for clustering of monthly observations within districts, as well as unobservable district-level factors that may impact case clearance.

5. Results

Table 3 presents the results of the Poisson regression models on case clearance for violent, property, and overall crime. Results are reported as incident rate ratios (IRRs), which indicate the rate of change in case clearance associated with the addition of an SDSC. An IRR of greater than 1 indicates an expected increase in case clearance, and an IRR of below 1 indicates an expected decrease in case clearance.

Results indicate an overall positive impact of SDSCs for each of the outcomes. Findings are significant after controlling for yearly and seasonal effects, as well as additional policing factors (GDT, CCTV, and shots fired calls for service) that may impact case clearance at the district level. On average, SDSCs were associated with a 5% increase in clearance rates for violent crime (IRR = 1.05, $p = .004$), a 12% increase for property crime (IRR = 1.12, $p = .003$), and an 11% increase for overall crime (IRR = 1.11, $p < .001$). Results suggest modest support for the hypothesis that the introduction of SDSCs is associated with increases in

case clearance.¹²

5.1. Sensitivity analyses

Additional sensitivity checks were conducted to test the robustness of the results across alternative model specifications. Although there was no evidence of overdispersion among the outcome variables, negative binomial models were also estimated and produced similar results. Additionally, some prior studies have recommended mixed effects models with random effects for the spatial unit and fixed effects for the independent and control variables (Mares, 2023). Mixed effects Poisson models in which the district was assigned as a random effect with all other variables as fixed effects also produced substantively similar results.¹³

Finally, models were estimated excluding the first year of the study period (2013), restricting the study period to three years before and after the start of the implementation. These models also produced substantively similar results, indicating the findings were not sensitive to the length of the pre-intervention period.¹⁴

6. Discussion

This study finds that SDSCs in Chicago were associated with modest increases in case clearance, on average, for violent, property, and overall crime. The results were robust across various model specifications, providing a greater level of confidence in the findings. Further, this positive effect was observed during a time when clearance rates were generally declining in Chicago. This study builds upon prior research indicating the SDSCs were associated with crime reductions (Hollywood et al., 2019), and suggests they may provide further investigative benefits by helping police to solve crime.

The largest effect was observed for property crime clearance (12% increase), while the SDSCs appeared to have a relatively smaller impact on violent crime clearance (5% increase). A prior study found that RTCC-assisted violent crime cases in Miami had 66% higher odds of being cleared compared to control cases (Guerette & Przeszlowski, 2023). This may be due to differences in how the RTCCs were implemented in the two jurisdictions. RTCCs vary in their deployment across sites (Przeszlowski et al., 2022), which likely impacts the extent to which they will generate investigative benefits. In Miami, only a small proportion of violent crime cases received RTCC support, and the study compared these cases to a control sample of cases that did not receive RTCC support. The focus in the present study on aggregate crime clearance likely contributes to the smaller effect observed for violent crime.

Although the specific mechanisms through which the SDSCs improve case clearance was beyond the scope of this study, Hollywood et al.

¹² Some research on homicide clearance suggests there may be differences in case characteristics for homicides that are cleared by arrest versus those that are cleared by exception (e.g., Jarvis & Regoezci, 2009). The homicide data provided in the present study did not distinguish between cases that were cleared by arrest versus by exception. However, to assess whether this distinction impacted the findings for other crime categories, additional models were run excluding the cases that were exceptionally cleared. Interestingly, more than a third of crimes cleared within the overall crime category were cleared by exception (on average per district, per month) over the study period. Within the violent crime category (not including homicide), almost half of cleared cases were cleared by exception, and within the property crime category, about a quarter of cleared cases were cleared by exception. Results of the regression models excluding exceptionally cleared cases were similar for the model examining the effect of SDSCs on overall crime clearance. In the violent crime and property crime models, however, the effect dropped to below statistical significance.

¹³ Regression tables may be viewed in the online supplementary material.

¹⁴ Regression tables may be viewed in the online supplementary material.

Table 3

Poisson panel regression models, case clearance predicted by SDSCs.

	Overall crimes cleared	Violent crimes cleared	Property crimes cleared
SDSC	1.11*** (0.03)	1.05** (0.02)	1.12** (0.04)
Cleared overall (lag)	1.01* (0.00)		
Cleared violent (lag)		1.01** (0.00)	
Cleared property (lag)			1.01* (0.00)
GDT	0.96 (0.03)	0.93** (0.02)	0.98 (0.05)
CCTV	0.99 (0.00)	0.99 (0.00)	0.99 (0.00)
CFS	0.99*** (0.00)	0.99*** (0.00)	0.99*** (0.00)
Disadvantage index	1.03*** (0.01)	0.99 (0.00)	1.02* (0.01)
Demographic Index	0.97 (0.03)	0.98 (0.04)	0.98 (0.07)
Ambient Population	1.01 (0.01)	0.99 (0.02)	1.02* (0.01)
January	1.13*** (0.01)	1.06*** (0.01)	1.12*** (0.02)
February	1.18*** (0.01)	1.11*** (0.02)	1.16*** (0.02)
March	1.18*** (0.01)	1.10*** (0.02)	1.18*** (0.03)
April	1.09*** (0.01)	1.01 (0.01)	1.09*** (0.02)
May	1.09*** (0.02)	1.03*** (0.01)	1.11*** (0.02)
June	1.02 (0.02)	0.96** (0.01)	1.01 (0.03)
July	1.00 (0.01)	0.93*** (0.01)	0.96** (0.01)
August	0.99 (0.01)	0.94*** (0.01)	0.96 (0.02)
September	1.00 (0.01)	0.96*** (0.01)	0.97 (0.02)
October	1.00 (0.01)	0.97*** (0.01)	0.98 (0.02)
November	1.02** (0.01)	0.98 (0.01)	0.00 (0.02)
December (ref)			
2013	1.21*** (0.05)	1.14** (0.05)	1.12 (0.08)
2014	1.26*** (0.05)	1.18*** (0.04)	1.25*** (0.08)
2015	1.20*** (0.04)	1.12*** (0.03)	1.19** (0.07)
2016	1.04 (0.03)	1.01 (0.03)	1.11* (0.05)
2017	0.98 (0.03)	0.96 (0.02)	1.04 (0.04)
2018	0.96** (0.01)	0.98 (0.02)	0.97 (0.02)
2019 (ref)			
lnalpha	0.01 (0.17)	0.01 (0.14)	0.02 (0.32)
N ^a	1909	1909	1909

Incident rate ratios; Robust standard errors in parentheses.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

^a Note that the total N of 1909 reflects inclusion of the lagged outcome variables in the models, resulting in the exclusion of the first monthly time period for each district.

(2019) provide anecdotal information about how the SDSCs support investigations. For example, CPD described reviewing camera footage to identify crimes in progress, offenders, and evidence such as discarded firearms. Prior research has found that CCTV is associated with increased clearance rates for theft (Ashby, 2017; Jung & Wheeler, 2023) and other property crime (Morgan & Dowling, 2019; Sharp, 2016), which may play a role in the larger effect observed for property crime clearance.¹⁵ Further, interviews with CPD indicated that meetings between SDSC staff, detectives, and prosecutors contributed to building the evidence needed to charge offenders (Hollywood et al., 2019). This appears to further support the hypothesis that SDSCs improve case clearance through enhancing case solvability.

This study has a number of limitations. Firstly, results suggest a positive effect of the SDSCs on average across police districts, but the study does not consider the impact of the SDSCs in individual districts. Future research should examine whether the impact of the SDSCs varies

¹⁵ Although CCTV was not significant in the property crime model, it is important to acknowledge this analysis took place during a time period for which the number of CCTV cameras was relatively stable within districts. Lower variation within districts as compared to between districts may explain why CCTV was not a significant predictor in the models presented.

across districts, as individual districts may have different staffing levels, workloads, and investigative practices that could impact case clearance. This study attempted to account for unobserved heterogeneity across districts by controlling for potential confounding factors including additional police strategies, workload, and neighborhood characteristics that may influence case clearance at the district level. However, it is unknown whether this effect varies by district or what characteristics may be associated with any variation observed.

Because investigations do not always fit cleanly within district boundaries, the SDSCs may contribute to investigations outside their respective districts, resulting in potential spillover effects. For example, if a crime is committed in one district and the perpetrator is captured on CCTV in another district, this may generate investigative leads or improve case clearance even in districts that do not have SDSCs. For this reason, the study design may actually underestimate the effect of the SDSCs on case clearance, as it does not take into account potential spillover effects.

This study did not consider the impact of the SDSCs on the time taken to solve cases. Information on the dates when cases were cleared would have allowed for an assessment of whether SDSCs impact the length of investigations, but unfortunately, this data was not available. Future research could consider the date cases were cleared relative to when they were reported to determine whether the SDSCs impact time-to-clearance (Guerette & Przeszlowski, 2023).

Although beyond the scope of the current study, prior research has demonstrated that individual and incident-level factors, such as victim characteristics and witness cooperation, are associated with case clearance. Unfortunately, this research did not have access to individual-level data, which prevented inclusion of these characteristics in the analysis. There could also be factors influencing case clearance more broadly, such as investigative unit activity, that are not accounted for in the present analysis. Although this study attempted to account for citywide variation in case clearance, understanding the specific actions taken by detectives within investigations would have provided further insight as to the mechanisms by which the SDSCs enhance investigations.

Finally, this study only considered case clearance for broad crime categories, although prior literature suggests that clearance rates differ across crime types (Gottfredson & Hindelang, 1979). Analysis of specific offense types such as homicide and gun-related crime was attempted in this study, but given the scarcity of these outcomes, some units had zero counts, making a disaggregated analysis impossible (as exposure must be greater than zero). Future research could disaggregate different crime types to determine whether the effect of RTCCs varies for specific types of criminal investigations.

Despite these limitations, this study suggests Chicago's SDSCs are achieving CPD's objective of improving case clearance. Future research should attempt to identify specific mechanisms by which the SDSCs enhance case solvability, and which aspects of the SDSCs are most valuable for investigations. Importantly, future research should also explore the impact of Chicago's SDSCs on other stated objectives, namely, improved response times and officer safety. Finally, there is a notable gap in the literature regarding the cost effectiveness of investigative strategies, including police technology (Cook & Berglund, 2021). While a cost-benefit analysis was beyond the scope of the present study, future research should consider cost effectiveness in the context of RTCCs. This would be particularly valuable given the growing controversy surrounding the use of police surveillance technologies in many communities.

7. Conclusion

Law enforcement agencies across the country are continuing to invest in data-driven technologies, and it is important to evaluate the benefits of these technologies for crime control and investigative purposes. In particular, there is a dearth of evaluation research on RTCCs despite their growing popularity in recent years. The current study

attempted to fill knowledge gaps by contributing to the limited research base on RTCCs, and expanding on prior research by exploring their impact on case clearance in Chicago.

This study suggests that the integration of technologies and information provided by SDSCs enhances case solvability. However, these findings are specific to Chicago during the study period. The varying structure and functionality of RTCCs across agencies suggests that findings in one jurisdiction may not be generalizable to another. For example, agencies that use their RTCCs primarily to respond to calls for service in real time likely operate at a different capacity than agencies that use their RTCCs primarily for post-incident investigative support (Przeszlowski et al., 2022). Przeszlowski et al. also found that RTCC staffing differs across agencies, with some employing strictly sworn officers or detectives, some with crime or intelligence analysts, and some with external contractors. Differences in staffing and operating practices will undoubtedly have an impact on the crime control and investigative potential of RTCCs. Thus, future research should continue to explore the efficacy of RTCCs in other jurisdictions.

In sum, this study contributes to the literature by enhancing our understanding of the investigative potential of RTCCs. It contributes to the limited research on the efficacy of RTCCs, as well as the investigative benefits of police technology more generally. The consistency of findings across various model specifications and time periods provides a high level of confidence in the conclusion that the SDSCs positively impact case clearance. As other police departments continue to adopt RTCCs, it is important to document relevant outcomes to measure effectiveness, and to facilitate the evaluation of RTCCs across jurisdictions.

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CRedit authorship contribution statement

Rachael Arietti: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jcrimjus.2023.102145>.

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