The Costs of Technology: An Analysis of the Community Concerns About the Use of ShotSpotter in Chicago

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ABSTRACT

While police agencies continue to rely heavily on technologies to perform the basic functions of law enforcement, research has largely ignored the community impacts of certain technologies. In Chicago, the gunshot detection tool ShotSpotter has raised concerns with community members that have gone unexamined and unrecognized by city officials. Through semi-structured interviews with Chicago community advocates, city officials, public defenders, and other stakeholders with knowledge about ShotSpotter, this paper explores the major concerns about the impacts of ShotSpotter and its use by CPD and law enforcement actors. In the absence of rigorous research about the effects of this technology, this paper relies on the findings of the 2021 Office of Inspector General report about ShotSpotter's operational effectiveness to provide implications for how these concerns should direct the City's actions with respect to their contract with ShotSpotter and future decisions about technology deployment. Analysis of these interviews revealed that community advocates were most concerned with ShotSpotter's contribution to the hyper-policing of majority Black and Latinx neighborhoods on the South and West sides of Chicago and its wrongful use as prosecutorial evidence in courts.

Ultimately, the concerns that community advocates and researchers expressed in this paper suggest that the City should cancel its contract with ShotSpotter and signal a shared desire for increased community investment, political representation, and government accountability.

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INTRODUCTION

> My particular problem with ShotSpotter is the government's reliance on their own [information] to show how effective it is, when the fact is, outside data shows the exact opposite. And for departments to still support it and invest in those sorts of programs, it's just really dismissive to the communities. We're doing really, really good work that don't involve this sort of stuff to make our communities feel safe.
>
> (Desmon Yancy, 2022)

Since the development of the taser in the 1960s, law enforcement agencies have turned increasingly to technology to help them achieve some of the basic functions of policing more efficiently and effectively. However, researchers and community advocates have complicated the common understanding of technology as an overall benefit to police agencies by highlighting the inaccuracies and biases that technology can perpetuate or introduce into police activities (Escamilla & Reichert, 2019; Lum et al. 2017). Factors including the engineering and procurement of technologies, the implementation and uses of technologies within law enforcement agencies, and the level of public transparency from the department all influence how technologies can impact individuals and potentially target and harm specific groups. These factors are also important to determine how and to what extent these impacts need to be examined and remedied (Joh, 2017; Moses & Chan, 2016).

The Chicago Police Department (CPD) has faced scrutiny from public and civil liberties groups many times in the past and present because its use of certain technological tools and the accompanying lack of transparency about how these technologies impact civilians (Kunichoff & Sier 2017; ACLU Illinois, 2019). Decisions about the adoption of certain technologies, where those technologies should be deployed, and how law enforcement stakeholders should use these

technologies have all contributed to community impacts for Chicagoans in the past. For example, in 2012 the Chicago Police Department launched a program called Strategic Subject List (SSL) which relied on an algorithm which used historical data about a person to assess her risk of becoming a victim or potential offender in a shooting or homicide (Richardson et al. 2019). Little is known about the department's use of the tool, but they argued that the tool was useful as an "investigative resource" (Kunichoff & Sier, 2017). A combination of factors, including the unfair and illegal police targeting practices towards people on the list, the disproportionate use of the tool on Black and Latinx individuals, the tool's flawed design, and the lack of transparency about the department's use of the technology compelled the department to disband the program in late 2019 (Gorner & Sweeney, 2020; Richardson et al. 2019).

More recently, public concern about the police's use of technologies has shifted to CPD's contract with ShotSpotter, an acoustic gunshot detection system that has been implemented in over 100 cities across the country. ShotSpotter works through a network of sensors installed in certain neighborhoods across the city. These sensors pick up noises that may be gunshots and these noises are then immediately reviewed by a ShotSpotter employee to determine if they sound like gunshots. If this determination is made, an alert is sent to the jurisdictional department for officer dispatch. This system is marketed to curb gun violence by helping officers respond more quickly to shootings, which often go unreported by civilians (Carr & Doleac, 2016). In 2018, the City of Chicago initiated a three-year, $33 million contract with ShotSpotter, the largest city contract in both scope and cost (Office of Inspector General, 2021). In 2021, the City[1] quietly renewed the contract, without input from the community or consideration for the accuracy and impacts of the technology (Hickey, 2021). Members of the Chicago community have been trying to hold the City

[1] The "City" with a capital "C" is used to reference the government of the City of Chicago.

accountable for considering ShotSpotter's impacts and reevaluate its use by the department, arguing that the government has a responsibility to prioritize community concerns.

ShotSpotter's efficacy as an operational tool for CPD has been audited by multiple organizations including the City's Office of the Inspector General (OIG) and the MacArthur Justice Center at Northwestern University. These findings are crucial for policymakers to consider how and if they should keep investing in the tool, but alone, they do not provide a full picture of ShotSpotter's impact or how it is used on the community. One vital aspect of the assessment of ShotSpotter's value for the City that has not been rigorously examined is the Chicago community's concerns about ShotSpotter's use by police and other law enforcement stakeholders. Many activists, journalists, and other stakeholders have raised issues about the value of this tool and its potential to negatively impact the rights of certain communities within the city (Stanley, 2021; Burke et al. 2021). This study will help to fill the gap in research of these concerns by answering two questions: **1) What are the major impacts of ShotSpotter's use on the community as reported by community stakeholders? 2) How do the findings of the 2021 Inspector General report about ShotSpotter contextualize these concerns so that they can inform how and if the City should continue to contract with ShotSpotter?** I determine these connections using interviews with community advocates, public defenders, city officials, and other related stakeholders.

I find that the major concerns about ShotSpotter as expressed by community stakeholders are its contribution to the surveillance and hyper-policing of marginalized communities around Chicago, its use as a prosecutorial tool despite its unreliability, and its use as a predictive policing tool. These concerns are interpreted partially using the findings of the OIG report, which suggested that ShotSpotter is not an operationally effective tool for the department. My findings provide

policy implications for CPD and the City of Chicago that will protect community members from ShotSpotter's harms and increase transparency and accountability on the part of the government towards its citizens.

BACKGROUND

Technology as a law enforcement tool

Policing strategies have developed and expanded over the course of recent decades with the help of technologies increasingly targeted at law enforcement agencies. As of 2016, over 90 percent of law enforcement agencies across the country use at least one type of technology (Strom, 2017). Technologies can range from body-worn cameras to facial recognition algorithms. The use of technologies appeals to police agencies because of the potential for these tools to increase operational efficiency and effectiveness (Meijer & Wessels, 2019; Strom, 2017).

Technologies are built to serve different purposes for law enforcement agencies. There are "hard technologies," which are tangible resources for police agencies, such as tasers, drones, and surveillance cameras. These technologies are usually classified as equipment that can help agencies expand their technical reach or protect their officers from violence (Escamilla & Reichert, 2019; Lum et al. 2016). "Soft technology" consists of the software and AI tools that agencies use to collect, organize, analyze, and predict future data outcomes (Escamilla & Reichert, 2019). Some software tools like license plate readers, acoustic gunshot detection systems, and facial recognition software analyze data to make informational determinations. For example, acoustic gunshot detection systems can pick up noises and determine if they are gunshots, which can help police locate and respond to potential incidents of gunfire in the absence of civilian reporting (Escamilla & Reichert, 2019). These kinds of technologies help officers save time and resources that they

would have otherwise spent combing through data, which can help them solve crimes more efficiently.

Another major type of soft technology is artificial intelligence (AI) which help officers predict crime patterns to inform resource deployment strategies. These tools fall generally into police agencies' predictive policing strategy. Predictive policing is a technology-based law enforcement approach that uses historical data to predict future crime outcomes in order to reduce crime proactively (Perry et al. 2013; Meijer, 2019). Predictive policing is generally either person-based or location-based. Person-based predictive policing uses software to predict individuals that are at a higher risk for being involved in crime, like SSL. Location-based predictive policing – generally referred to as "hotspot policing" – uses data patterns to predict geographic locations that are at a higher risk of experiencing criminal activity (Lazzati & Menichini, 2016). ShotSpotter's predictive policing add-on, ShotSpotter Connect, is an example of location-based predictive policing because it maps ShotSpotter alerts to predict areas with a higher risk of gun violence.

Technology informs many different parts of law enforcement's overall strategy and has helped police agencies innovate their crime-fighting techniques to respond to crime more efficiently and more holistically. However, these benefits do not come without corresponding risks. Technologies used for policing have been met with consistent pushback from civil liberties groups, academics, the media, and the public because of evidence about its potential to infringe on people's civil liberties and contribute to unequal and overbearing scrutiny and surveillance of civilians (Stanley, 2021; Burke et al. 2021). Moreover, the effectiveness of different technologies is disputed by many researchers and technology auditors (Abell, 2021; Najibi, 2020). These debates suggest there is a need for further public and academic interrogation about the value of using certain technologies to achieve police agencies' proclaimed goal of increasing public safety.

The history of ShotSpotter and gun violence in Chicago

In recent decades, rates of gun violence in Chicago have been particularly high compared to other US cities.[2] Between January of 2016 and the middle of August of 2020, 2,978 people died due to gun violence and another 12,387 were injured from shootings ("Our City, Our Safety," 2020). Crime rates in the city have been of particular interest to community members, media, and government officials, to name a few. In response to these high rates of gun violence, the City launched a multi-pronged violence-prevention strategy in 2020, which focused on investments in police resources and violence prevention programs for high-crime districts ("Our City, Our Safety," 2020). ShotSpotter technology is one of those investments. CPD representatives have referenced ShotSpotter anecdotally as an important part of their overall strategy to reduce gun violence in Chicago, arguing that it contributed to reductions in gun violence (Gunderson, 2021). However, up until this date, research about ShotSpotter in cities around the country, including Chicago, have not found evidence that ShotSpotter reduces gun violence significantly in those areas (Mares & Blackburn, 2021).

ShotSpotter was developed in 1996 and is currently used in over 100 U.S. cities (Gatens & Reichert, 2019). ShotSpotter works in multiple parts: first, the acoustic sensors use triangulation and multilateration to detect and compute the location of a sound. ShotSpotter software then runs an algorithm comparing the noise to previous gunshots in its database. From there a ShotSpotter employee -- called an "acoustic expert" -- at its corporate office reviews the reading and determines if the sound is a gunshot or another type of noise that may be mistaken for a gunshot (e.g. fireworks, cars backfiring) (Gatens & Reichert, 2019). If it is determined to be a gunshot, the appropriate police department is alerted, and they can dispatch officers to the scene (Office of Inspector

[2] See Appendix

General, 2021). The technology was first built using earthquake detection technology to help police agencies respond faster and more consistently to gun crimes (Sanburn, 2017). Agencies also use ShotSpotter so that they do not have to rely on civilian reporting, which has been inconsistent and unreliable in the past. A 2016 study using data from ShotSpotter and calls for service found that Washington D.C. residents called the police to report gunshots after only 12.4 percent of incidents where shots were detected in the city (Carr & Doleac, 2016).

ShotSpotter was first tested in Chicago in 2012, with sensors placed in only two districts in the city. In 2018, presumably having been satisfied by the results of this test, the City officially contracted with ShotSpotter, signing a 3-year, $33 million contract with the company that is still the biggest deal in the nation (Office of Inspector General, 2021). As a part of the deal, ShotSpotter sensors were installed in 25 districts across the city based on district crime levels (Office of Inspector General, 2021). In 2021, the City decided to extend the contract until August of 2023 and CPD requested a 5 percent increase in the cost per square mile per year of the contract (Office of Inspector General, 2021). 2018 was also the year that ShotSpotter entered the predictive policing landscape, acquiring the predictive policing company HunchLab, now called "ShotSpotter Connect." HunchLab software gave ShotSpotter the ability to incorporate AI models into its gunshot detection data for the purpose of predicting where and when crime will happen in the future (Burke et al. 2021). CPD has since incorporated ShotSpotter's predictive policing technology into their data centers, called Strategic Decision Support Centers (SDSCs) (Office of Inspector General, 2021).

Like many other policing technologies, the largest volume of research on ShotSpotter has been related to its effectiveness. Numerous studies from around the country have produced mixed results about the impact of ShotSpotter on gun violence, measuring the number of homicides,

arrests, or other related issues like pre-hospital time for people sustaining gunshot wounds before and after ShotSpotter was installed in their city (Doucette et al. 2021; Choi et al. 2013; Goldenberg et al. 2019). In August of 2021, Chicago's Office of Inspector General (OIG) published a report evaluating the ShotSpotter's operational effectiveness for CPD. Looking at the reported outcomes of ShotSpotter alert dispatches between January 2020 and May 2021, they found that only 9.1 percent of ShotSpotter alerts resulted in an investigatory stop or produced evidence of a gun-related crime (Office of Inspector General, 2021). While these results are important to understand if ShotSpotter is a worthwhile investment for the City, a full examination should include more information about how it is implemented and what its impacts are on the community. This paper will address these gaps by focusing on how the underlying processes of implementation and adoption of ShotSpotter can contribute to harms for individuals and communities throughout the City of Chicago.

Issues with technology procurement

The outsized power of technology companies compared to police agencies impacts how these tools are adopted and used by agencies and how much information can be shared with the department and the public. Private technology companies and universities have been generally responsible for building much of the technology infrastructure used by law enforcement (Escamilla & Reichert, 2019). In Chicago, for example, the University of Chicago Crime Lab has helped create much of CPD's technology infrastructure, including the data support centers where ShotSpotter alerts are sent to (Hollywood et al. 2021). In the relationship between private technology companies and police agencies, technology companies are usually the sellers and agencies are the consumers (Joh, 2016; Grabosky & Ayling, 2006). Many police agencies are flooded with requests from vendors to adopt their new technologies, and since these agencies

cannot accept all of these tools, they must make decisions about which ones will be the best investment. In theory, these decisions are often based on the agency's budget, goals, the utility of the technology, and other practical factors (Grabosky & Ayling, 2006). However, many studies have found that in practice, police agencies usually do not have general standards or plans for the adoption and implementation of policing technologies (Strom, 2017; Hendrix et al. 2017). Without standards for adoption, agencies may choose technologies that are not rigorously tested or decide to implement technologies in inefficient or harmful ways.

Technology vendors have significant control over the development of their products and the contracting process (Joh, 2017). While companies often test their technology products to make sure they perform the most basic functions, this kind of testing does not provide practical information that would help agencies understand how accurate the product is in the field. For example, ShotSpotter claims that its gunshot-detection systems are 97 percent accurate ("ShotSpotter Respond Q&A"). However, ShotSpotter sensors are tested as to how well they can pick up the sound of gunshots specifically – not any noise – which means that in practice they may pick up on different noises that are not gunshots at a rate that is unknown to ShotSpotter or any law enforcement agency ("ShotSpotter Respond Q&A"). Police agencies often use these products without proper testing because there are few federal or state requirements that companies test their technologies. As a result, agencies' employment of these technologies is vulnerable to inaccuracies, biases, and negative human impacts.

The influence of technology companies also affects the amount of control they have over contracting with cities and police agencies (Joh, 2017). Often, agencies bid on technologies, which increases the company's leverage. ShotSpotter has a virtual monopoly on the law enforcement acoustic gunshot detection system market, which gives them even greater control over law

enforcement agencies (Joh, 2017). The City of Chicago modeled their contract with ShotSpotter almost entirely off of Louisville, Kentucky's contract (Office of Inspector General, 2021). While the details of the contract negotiation are not publicly available, we do know that the agreement between the City and ShotSpotter does not require the company to share details about their gunshot detection algorithm because it is considered proprietary information (Contract Summary 71366). This means that neither the department or the public is aware of exactly how the tool works, which limits their ability to understand or investigate it as a potential source of impacts. Many of the concerns in this paper reflect how the City's willingness to contract with ShotSpotter without complete information about its reliability can contribute to community harms.

THEORETICAL GROUNDING

Theories of policing

There are a few policing theories that explain the Chicago Police Department's use of ShotSpotter technology and their related operations. One of the major advertised goals of ShotSpotter is to reduce gun violence, which relies on theories like deterrence theory. Deterrence theory is based on the idea that people will factor in the costs of committing a crime, which include the likelihood of getting caught, when they are deciding if they should commit a crime (Becker, 1968). In the case of ShotSpotter, the presence of sensors is supposed to increase the likelihood of police catching gunfire, which should deter people from committing gun violence according to Becker's analysis. However, it is the case that many people are unaware of what or where ShotSpotter sensors are, which could explain why ShotSpotter is not very effective in practice. Police also rely on theories about predictive policing to inform their use of tools like ShotSpotter Connect. Predictive policing relies on the notion that we use past crime information to help police better predict future crime patterns (Pearsall, 2010). Specifically, ShotSpotter's predictive policing

technology, ShotSpotter Connect, is guided by the theory that crime can be forecasted and that this is a good indicator of where police should deploy their resources, with the goal of proactively combating gun violence (Ferguson, 2019).

Racialized surveillance

The police's use of technologies is intertwined with law enforcement's historically racist practices, especially concerning police surveillance of Black and brown communities. The idea of surveillance was originally formulated using philosopher Jeremy Bentham's panopticon model of a prison. Popularized by Michel Foucault's critique of it, the panopticon model created an illusion in the minds of prisoners that they were being surveilled at all times, a design that was meant to enforce obedience (Galic et al. 2017). Thus, from its founding, surveillance was designed for the purposes of state control. One of the relevant branches of surveillance studies questions the operationalization of surveillance and specifically, the link between surveillance for the purposes of racial control. John Fiske's theory of racialized surveillance provides foundational context for this discussion. Fiske argues that in urban areas, "Surveillance is a technology of whiteness that racially zones city space by drawing lines that Blacks cannot cross and whites cannot see" (Fiske, 1998). Fiske argues that surveillance is a tool of white supremacy because it has historically been used to control the movement, and therefore advancement, of Black people . This theory suggests that surveillance is inherently a political tool that is both wielded and experienced differentially based on race. Fiske's thesis suggests that Black people and other racialized groups are surveilled and policed disproportionately to white people, often for the benefit or protection of white people.

This is supported by literature about slavery and the foundations of policing, which describe methods of racial subjugation during slavery like slave patrols as a form of surveillance and regulation of Black bodies (Browne, 2012; Parenti, 2003). Racialized surveillance theory,

combined with the increasing literature about policing technologies as a tool for large-scale state surveillance, suggests that the impacts of surveillance technologies are historically and politically raced (Brayne, 2017). ShotSpotter has often been described as a surveillance technology by researchers and the police, because of sensors' ability to monitor loud noises and because they are often used in tandem with cameras (Carr & Doleac, 2016; Babwin & Burnett, 2021). Fiske's theory and those of other surveillance scholars suggests that ShotSpotter's use as a tool for police surveillance is inherently racially biased against Black and brown individuals, because of the disproportionate use of surveillance technologies on Black and brown bodies and the unaccounted political history of surveillance as a method of racial subjugation.

Transparency, government responsibility, and police legitimacy

There are a few interrelated theories about transparency, government responsibility and police legitimacy that guide the conversations in this paper about the government's obligation to its citizens with respect to its use of technology. Robert Dahl's theory of democracy is one important stepping off point for understanding a democratic government's responsibility to their citizens. He argues that there are three primary requisites to a functioning democracy. He writes that citizens must be able "to formulate their preferences," communicate these preferences to the government and to other citizens through collective action or individual action, and to have the government consider these preferences equally, without regard to the source or content of their preferences (Dahl, 1971). This theory clearly articulates the responsibilities of the government to sustain a political environment with active and unmitigated civic participation and to be accountable for implementing the will of the people. Transparency, then, is key to fulfilling the fundamental requirements of democracy. Public access to information that is relevant to their lives and to the

functioning of government is necessary for civilians to be able to formulate informed preferences, which is one key part of a functioning democracy.

In the case of policing specifically, transparency has been a huge and pivotal topic of discussion in relationship to police legitimacy. Sociologist Max Weber described the role of the police within the structure of the nation-state, defining the nation state as a territory that "claims the monopoly of the legitimate use of physical force" (Weber, 1965). If the nation state depends on monopolizing legitimate physical force, the police occupy this space through its job to perform state-sanctioned violence (Seigel, 2018). However, scholars like political scientist Tom Tyler argue that the legitimacy of policing must be granted by the public in addition to the state for police to be able to do their jobs. He defines police legitimacy as the "belief that the police are entitled to call upon the public to follow the law and help combat crime and that members of the public have an obligation to engage in cooperative behavior" (Tyler, 2004, pp. 86-87). Police legitimacy is vital because officers must be able to retain the public's belief in the police's enforcement authority for them to be able to properly do their job.

Yet, scholars of policing like Egon Bittner have argued that the violence power of the police is so encompassing and potentially coercive, that transparency is vital to ensuring the police's legitimacy (Britten, 1970). Britten's theory has ushered in a wave of research studying the relationship between police legitimacy and departmental transparency efforts. There is a generally positive relationship between the public's trust in law enforcement and their efforts to increase transparency, whether it is through community policing initiatives, data portals, information requests, or other methods of increasing public access to information about police operations (Kochel & Skogan, 2021). The City and CPD have made efforts to improve government transparency in various ways. Chicago was one of the first cities to create an open data portal,, an

online resource with data information about the City's operations. The City also bought ShotSpotter alert data from the company and included it in the portal for the public to access, which not many other cities have done (Doleac, 2022). Although the portal still needs improvements related to its accessibility and clarity, the City's investment in online data resources suggests that they see the benefits to greater transparency about their own operations, including CPD activities. This establishes a starting point for a deeper conversation between the government and community advocates about increasing transparency beyond just data, to include qualitative information about operations and even contract negotiations.

LITERATURE REVIEW

Measuring the effects of ShotSpotter in the literature

In recent years, many researchers have measured the effects of ShotSpotter using different lenses. Most of the research about ShotSpotter has been related to its operational effectiveness and potential to curb gun violence, and these findings have been mixed. The study of St. Louis' acoustic gunshot detection systems found that they did not substantially reduce gun violence in the city (Mares & Blackburn, 2021). Their research also found that less than 1 percent of dispatched ShotSpotter alerts over a five-year period resulted in evidence of a gun-related crime (Mares & Blackburn, 2021). Another St. Louis study, which ShotSpotter commissioned, found that there was a relationship between ShotSpotter installation and the occurrence of gun crimes. After the installation of ShotSpotter, gun-related assaults dropped by around 30 percent in areas where ShotSpotter sensors were installed (The Policing Project, 2021). A study of 68 large metropolitan counties in the US from 1999 to 2016 focused on both the impact of ShotSpotter on the occurrence of gun violence and police outcomes. It found that the implementation of ShotSpotter technology "has no significant impact on firearm-related homicides or arrest outcomes" (Doucette et al. 2021).

Despite these mixed findings, most of the robust studies about ShotSpotter have provided evidence that ShotSpotter has not been a useful tool for police agencies to reduce gun violence.

Researchers have also assessed the impact of ShotSpotter sensor installation in urban settings on the reporting of gunfire by civilians. As previously stated, ShotSpotter was created in part because of reportedly low rates of civilian reporting about shootings. This information comes from a 2016 study of data from Washington D.C. and Oakland that found that only 12.4 percent of detected gunfire incidents in D.C. and 6.4 percent in Oakland resulted in a 911 call to report sounds of gunshots (Carr & Doleac, 2016). However, a study of St. Louis' acoustic gunshot detection systems found that after ShotSpotter was installed, there were consistent and substantial reductions in civilian calls for service for shots fired (Mares & Blackburn, 2021). Other relationships related to ShotSpotter that have been studied include the impact of ShotSpotter on people who have been injured by gunfire. One study focused on the impact of ShotSpotter alerts on prehospital times for gunshot victims. Using shooting data from Camden, New Jersey between 2010 and 2018, the authors found that ShotSpotter alerts increase the likelihood of police transport of gunshot victims and reduce police response times and transportation times for these gunshot victims (Goldenberg et al. 2019). This is evidence that supports ShotSpotter as a tool for helping gunshot victims survive potentially life-threatening injuries.

Very few studies have assessed the impact of ShotSpotter on community members. One research article examined the way that ShotSpotter was used to surveil and discriminate against Black residents of a Pittsburgh neighborhood, but its findings were not generalizable because they were related to the police's use of ShotSpotter as part of a specific murder investigation (Coleman & Brunton, 2016). In Chicago, the MacArthur Justice Center filed an amicus brief as part of a case involving a ShotSpotter alert as evidence that laid out some of the data about ShotSpotter's

discriminatory deployment ("End Police Surveillance"). However, most researchers have not qualitatively explored the potential community impacts of ShotSpotter. This study lays out some of Chicago community stakeholders' most pressing concerns about ShotSpotter in order to inform the City's decisions about technology deployment and to orient future research priorities with respect to ShotSpotter's community impacts.

Algorithmic bias

Many policing advocates have celebrated AI as an objective tool to reduce officer discretion, which has been a source of racist policing practices and behaviors in the past. However, there are many technology experts who dispute this notion, arguing that biases are a common or even inevitable feature of AI (Danks & London, 2017). Biases are deviations from standards, and they are commonly understood as the irrational decision-making behaviors of humans that lead to outcomes that are less than optimal (Danks & London, 2017; Korteling et al. 2018). Biases are often associated with certain prejudices related to race, gender, sexuality, age, and other social categorizations. Many technologists and policy-makers have argued, however, that the same conscious and unconscious biases that impair human decision-making also impact the outcomes of AI technologies. They explain that this is because AI technologies are man-made and are therefore injected with human conscious and unconscious biases (Srinivasan & Chander, 2021). The notion of bias within algorithms challenges the idea that algorithms can effectively mitigate officer discretion. If algorithms are in fact injected with similar biases as humans have, not only is this not effective at reducing racist practices, but it makes biases less visible by hiding them within a system that is perceived as objective (Lum et al. 2016). Algorithmic bias is another possible way that technologies can fail, in addition to improper use by officers, civilians, and analysts.

Biases in algorithms have very real consequences for people, especially for those in marginalized groups. When the process of creating an algorithm involves biases – like in the data the algorithm is trained on – then it can result in better outcomes for certain groups and worse outcomes for others (Danks & London, 2017). One of the most well-known examples of a technology that has in disparate outcomes is facial recognition technology. Facial recognition has been found to be more inaccurate at identifying people of color and especially women of color (Grother et al. 2019; Lohr, 2018). This contributes to further marginalization, as many people who have been misidentified by facial recognition may suffer criminal consequences that they do not deserve. Importantly, the most marginalized people are also usually the people with the least amount of knowledge about these tools or pathways for recourse for the harms they experience (Deborah Raji, 11/10/21).

ShotSpotter is one technology that relies on an algorithm to provide services to cities across the country. The ShotSpotter system uses algorithms to determine both the location of a detected noise and also to compare a sound detected to the database of "known gunfire and other impulsive sounds" ("Platform Overview"). An algorithm is also used to drive ShotSpotter's predictive policing platform, ShotSpotter Connect. In theory, these algorithms are supposed to help improve the accuracy of alerts. However, ShotSpotter's algorithms are proprietary, which means that they do not give away that data to the cities that they contract with (Burke et al. 2021). The lack of transparency about algorithmic input makes it difficult for external auditors to determine the validity of ShotSpotter's methods. Additionally, external factors, such as the unequal placement of sensors throughout the city, can also result in biased findings based on ShotSpotter data. Thus, anyone interested in examining the efficacy of ShotSpotter alerts must consider the biases that may be present in the algorithms and the use of different technologies before making any conclusions.

METHODS

Strategy and Approach

To understand the impacts of ShotSpotter on different segments of the Chicago community, I used a qualitative approach which consisted of semi-structured interviews with different stakeholders that understand or have studied ShotSpotter and its uses in Chicago and supplemented with archived literature. At the beginning of my research, my intent was to gather information about the adoption and implementation of ShotSpotter technology within CPD. I started by interviewing a few individuals within the department who were aware of the agency's use of ShotSpotter. However, after conducting a few interviews, I shifted my approach to one that focused on gathering information about the concerns about ShotSpotter including the way it is used as evidence in court and how it increases contact between police and marginalized groups. By doing so, I focused on determining the concerns and worked deductively to understand a few of the sources of these impacts. Additionally, the sources of technology impacts are often hard to definitively pin down, which makes determining concerns a better place to begin (Deborah Raji, 11/10/21).

Participants

There are a variety of stakeholders who interact with or have expertise related to ShotSpotter and other forms of policing technology. It is difficult to gather information about the individual impacts of ShotSpotter from police use, since many people who may have had an encounter with police because of a ShotSpotter alert may not be aware that ShotSpotter was the reason for their encounter. Instead, I interviewed community members with knowledge of ShotSpotter's impacts and activists fighting against CPD's use of ShotSpotter, technology and gun violence research experts, public defenders, members of CPD, and other stakeholders for the

purpose of gathering information about community impacts and policy recommendations. The people interviewed for this study do not encapsulate the Chicago community's perspectives about or experiences with ShotSpotter nor do the community organizations I interviewed for this paper encapsulate the organizing space in Chicago around ShotSpotter or any other community issue.

Most of the questions I asked in my interviews were focused on gathering information about how ShotSpotter is used and how this may have impacts on the community. For each person my questions were tailored to their profession since it informed how they understood and interacted with ShotSpotter. For example, when I spoke with public defenders, I asked questions about how often ShotSpotter was used as evidence in court, how difficult it was for judges to dismiss ShotSpotter as evidence, and to what extent they observed the influence of ShotSpotter on court decisions. Through these questions, I was able to gather more information about impacts and potentially understand how different impacts of ShotSpotter may relate or share certain qualities.

Procedure and Analysis

In total, I interviewed a total of 17 people between November 2021 and March 2022. I spoke with many stakeholders who have interacted with or have experience studying the impacts of ShotSpotter technology. The interviews were conducted over Zoom and lasted between 30 minutes to an hour, with most lasting around 30 minutes. I started with set questions intended to extract information from my interviewees but often asked follow-up questions based on some of the answers that participants gave.[3] I used a mixture of snowball sampling and individual outreach over email or Twitter direct messages to secure interviews with different stakeholders. Interviews were conducted over Zoom and, with the consent of each individual, they were recorded and transcribed using an algorithmic audio-transcription service called Otter.ai. I communicated with

[3] See Appendix.

one individual entirely over email rather than Zoom. After collecting the recording transcripts, I coded each interview by hand. I was also invited to a ShotSpotter workshop over Zoom hosted by a community organization. With the written consent of each attendee, I wrote down the different comments expressed in the chat section throughout the meeting for the purposes of this paper, but left out any identifying information about any of the attendees.

I used codes to distinguish between information about different types of concerns across interviews. Generally, I did not cite the same person across multiple sections of my findings, so I coded within sections. For example, for interviewees that spoke about the concerns about ShotSpotter's impact on marginalized communities, I made codes based on the different potential impacts, which included impacts based on surveillance, increased contact between police and civilians, and specific impacts on the undocumented community.[4] Finally, I coded information about policy implications based on the different solutions or ideas that participants proposed.

Limitations

There were a few limitations to my approach that should be considered. First, my identity as a young, South Asian, female-presenting interviewer from an undergraduate academic background could have influenced the way I was perceived by participants over Zoom and thus, the answers and depth of information I received from participants (Frey 2018). I tailored my questions to the participant's relationship to ShotSpotter and tried to make my questions as direct and neutral as possible, but it is possible that bias could be inserted into my data based on our shared trust level or the way I articulated some of my questions in the interview. Similarly, while demographic information about participants was not collected, factors like race, age, class, and

[4] See Appendix.

ethnicity can and do influence the relationship between certain community members and their experiences with ShotSpotter.

Additionally, the findings of my study are not generalizable to the use of other or all technologies in Chicago. While the reported impacts of ShotSpotter in this study may be similar to the impacts of ShotSpotter in other cities and the implementation and use of ShotSpotter may be similar to the Chicago Police Department's implementation and use of technology generally, this must be examined in different studies. Topics for further or future research will be explored at the end of my policy recommendations section.

TABLE A: Interviewees

Name:	**Title:**	**Contribution**	**Date:**
Deborah Witzburg	Deputy Inspector General – Public Safety, OIG	*Evaluation/Implications*	11/03
Brendan Max	Chief of Forensic Science Division, Cook County Public Defender's Office	*Community Impacts*	11/03
Thomas (A)	Former High-Ranking CPD Officer	*CPD Implementation*	11/08
Jonathan Manes	Attorney, MacArthur Justice Foundation	*Community Impacts*	11/15
William (A)	Current CPD Officer	*CPD Implementation*	11/29
Andrea Ortiz	Director of Organizing, Brighton Park Neighborhood Council	*Community Impacts*	12/1
Veronica Rodriguez	Youth Organizer, Brighton Park Neighborhood Council	*Community Impacts*	12/1
ShotSpotter Workshop	Hosted by Brighton Park Neighborhood Council	*Community Impacts*	12/3
Interview 8[5]	N/A	*Background*	12/21
Freddy Martinez	Founder, Lucy Parsons Labs	*Community Impacts*	12/23

[5] This person is not cited in this study and wished to remain anonymous. However, they are included as a source because their testimony provided important and reputable guiding information about the processes of accountability for CPD and the City.

John Hollywood	Senior Operations Researcher, RAND	*Community Impacts*	1/14
Kimberley Smith	Director of Programs, Uchicago Crime Lab	*CPD Implementation*	11/18-2/1
Joe Ferguson	Former Inspector General, OIG	*Policy Implications*	2/2
Iván Arenas	Associate Director for Community Partnerships, Institute for Research on Race and Public Policy	*Community Impacts/Policy Implications*	2/3
Natalie Casal Alcaíno	Digital Organizer, OCAD Chicago	*Community Impacts*	2/18
Desmon Yancy	Organizer, Inner-City Muslim Action Network	*Community Impacts*	2/28
Jennifer Doleac	Associate Professor of Economics, Texas A&M University	*Policy Implications*	3/10

FINDINGS/DISCUSSION

Using the methods discussed above, I provide an interpretation and analysis of the findings of the Office of Inspector General's report on ShotSpotter and put this in conversation with interview data that I collected about the community concerns about ShotSpotter. The interviews I conducted with various community stakeholders revealed the major concerns about the consequences of ShotSpotter's use for residents. These concerns include ShotSpotter's contribution to increased surveillance and scrutiny of marginalized communities, its illegitimate use as prosecutory evidence in court trials, and the incorporation of ShotSpotter data into harmful predictive policing strategies. Throughout this section, I reference the findings of the OIG report to support or contextualize the concerns expressed by stakeholders.

I. ShotSpotter's Effectiveness as a Law Enforcement Tool

In the past few years, a few external agencies have reviewed ShotSpotter with respect to its effectiveness as a law enforcement tool. Majority of the findings of these evaluations suggest

that ShotSpotter is not effective for agencies, which informs many of the concerns discussed in the next sections. Chicago's Office of the Inspector General completed an audit of ShotSpotter in 2021, which is the most widely cited and reputable evaluation of ShotSpotter's operational effectiveness for CPD. The findings of this report represent the current understanding of how effective ShotSpotter's implementation has been in helping police reduce gun violence through increased enforcement. However, while the findings suggest that ShotSpotter is not an effective operational tool for the department, my interviews with members of the OIG's office and CPD outline multiple factors that influence the report's findings which are not covered in the report. These factors provide important information to help the public interpret the report, inform CPD about the potential implementation issues with ShotSpotter, and contextualize some of the community concerns about ShotSpotter discussed in the later sections.

In August of 2021, the OIG released a report detailing the effectiveness of ShotSpotter in uncovering evidence of gun-related crimes for CPD. They reviewed all of CPD's dispatched ShotSpotter alert data between January 1, 2020 and May 31, 2021 and matched these alerts to event numbers that resulted in either an investigatory stop, evidence of a gun-related crime, or both. Ultimately, they found that 2.1 percent of dispatched ShotSpotter alerts in this period resulted in an investigatory stop and 9.1 percent resulted in evidence of a gun-related crime (Office of Inspector General, 2021). These findings were similar to those from the MacArthur Justice Center's report about ShotSpotter released in May of the same year, which found that only around 11 percent of dispatched ShotSpotter alerts resulted in evidence of a gun-related crime (MacArthur Justice Center, 2021). These findings contributed to a rise in public pressure from community members and activist groups around Chicago who have been pressuring the City for years to cancel its $33 million contract with ShotSpotter (Schuba, 2021).

While the report serves as the primary source of information currently available about ShotSpotter's operational value, my interviews with individuals in the OIG and CPD outlined the missing context and some of the factors that influenced the report's findings. First, it remains unclear who or what is responsible for ShotSpotter's reportedly low efficacy rate. One possible issue is with data record-keeping. In my interview with Deborah Witzburg, the Deputy Inspector General for Public Safety, she explained:

> We did see examples of investigatory stop reports, which were related to a specific ShotSpotter alert…where they were not documented under a matching event number. So, there is sort of this record-keeping problem…there are sort of data quality problems there which impair the ability to match those two things together.
>
> (Witzburg, 2021)

Witzburg's team found errors in CPD's data collection processes that impacted the accuracy of the report's findings. In certain cases, for example, Witzburg noticed that there were reports of investigatory stops that were somehow not marked as dispatched alerts, so they were unable to include as a part of their findings. However, as Witzburg pointed out later in our conversation, "That's very hard to quantify… Because it's hard to know what we don't know" (Witzburg, 2021). The number of ShotSpotter alert or investigatory stop data collection errors are impossible for external auditors to detect from simply scanning the data. Therefore, while errors in record-keeping most likely impacted the results of the report, it is not possible for the OIG to know at what scale these errors occurred, or if they contributed to an overestimation or underestimation of their findings.

Record-keeping errors can contribute to an inappropriate measure of some of the community's concerns that are explored in later sections. For example, while community members

expressed concerns that ShotSpotter contributes to increased contact between civilians and the police – which include stops, searches, and other contact –, the record-keeping errors and limitations about investigatory stops that Witzburg described may contribute to an overall underestimation of the true scope of police-civilian interactions due to ShotSpotter. Jonathan Manes, a lawyer from the MacArthur Justice Center who performed his own analysis of ShotSpotter alert data, supported the possibility of an underestimation of stops related to ShotSpotter, saying:

> My understanding is that the standard [CPD report] form doesn't include ShotSpotter as a reason [for a stop]…I know of cases where police have stopped a person and just didn't write it up. So, the data is almost certainly underinclusive.
>
> (Manes, 2021)

Manes' points to another, potentially larger, issue with record-keeping, which is that on the stop report form, the department does not list ShotSpotter as a reason to conduct a stop. Officers must write in ShotSpotter as a reason for a stop, and Manes knows of at least a few who have not done so in the past. These errors suggest that there are more stops due to ShotSpotter alerts than what the OIG's findings found, which would provide more support for the concerns that community members have about ShotSpotter's contribution to greater numbers of stops.

Moreover, while the low numbers coming from the report's findings could suggest ShotSpotter's technological inaccuracy, Witzburg countered that, "[The OIG] did not set out to look at technological accuracy, which is to say, we do not comment on how good the audio sensors are at identifying and discerning sound of gunshots" (Witzburg, 2021). The results of OIG report do not suggest anything about how well ShotSpotter can pick up loud noises. Rather, it is an assessment of how impactful ShotSpotter has been as an operational tool for CPD. For example,

it could be the case that ShotSpotter sensors are very accurate at detecting gunshots, but that the perpetrators of these gunshots generally are able to escape the scene before officers arrive, which would still explain the report's disappointing findings. One CPD officer I spoke with, who I will call William, reported that from what he has seen or heard, it is "increasingly rare" for officers to come across a shooting that was *not* picked up by a ShotSpotter sensor, suggesting that the sensors do not underperform (William, 2021). However, there is some evidence to suggest that the sensors may overperform. For example, an investigation conducted by the Associated Press found that the system can classify noises like fireworks and backfiring cars as gunfire (Babwin & Burke, 2021). The mixed understanding of ShotSpotter's accuracy and the company's unwillingness to allow independent audits of their sensors is one of the major concern for communities who are worried about how seriously law enforcement stakeholders may use ShotSpotter to arrest or prosecute individuals.

Additionally, ShotSpotter's cited ineffectiveness could be related to the inconsistent process of recovery for gunshots. William provided context about how officer behavior and constraints can contribute to lower rates of gunfire evidence recovery. He said,

> There's a lot going on on a given day and we have certain manpower issues within our department that we're addressing... And well, in an ideal world, you would respond to a one round, two round, three round ShotSpotter [alert] in the middle of the street or in the middle of a vacant alley, and you would have officers come the area for evidence. If nobody's hit, nobody's showing up to the hospital. Officers aren't necessarily going to feel motivated to comb the area – you're effectively looking for a needle in the haystack. A shell-casing can be as small as the eraser on a pencil.

(William, 2021)

Police processes are important to consider when interpreting the results of the OIG report. As William points out, officers' main concerns when they arrive on a scene is if someone is a threat or if someone is hurt. If a scene is not active, William argues that officers may be less inclined to check for a gun crime, which does not necessarily mean that a gun crime did not occur. Future research would be helpful to determine if any of these sources are responsible for the low efficacy rate in the OIG report. However, until this research is done there is not a clear path for policymakers to follow to improve how the technology is used by the department. As Witzburg explained in our interview:

> The purpose of our ShotSpotter analysis was really to better inform this cost benefit analysis that should be happening among policy stakeholders, and to make sure that all the stakeholders in that conversation are playing with the same deck in terms of a clear-eyed analysis of what the data can show and what it can't.
>
> (Witzburg, 2021)

The findings from the OIG's report provide important evidence for officials and residents to consider in their evaluation of ShotSpotter's utility for the city. While more research would be worthwhile to explore the causes of the report's findings, the current evidence about ShotSpotter's operational effectiveness suggests that ShotSpotter is not currently useful for the City in terms of reducing gun violence. This conclusion is also important considering the many reported negative impacts of ShotSpotter on community members. Community stakeholders argue that if ShotSpotter is harming communities in many different ways but has not also helped to significantly reduce the very pernicious problem of gun violence, the City must reevaluate its investment in the

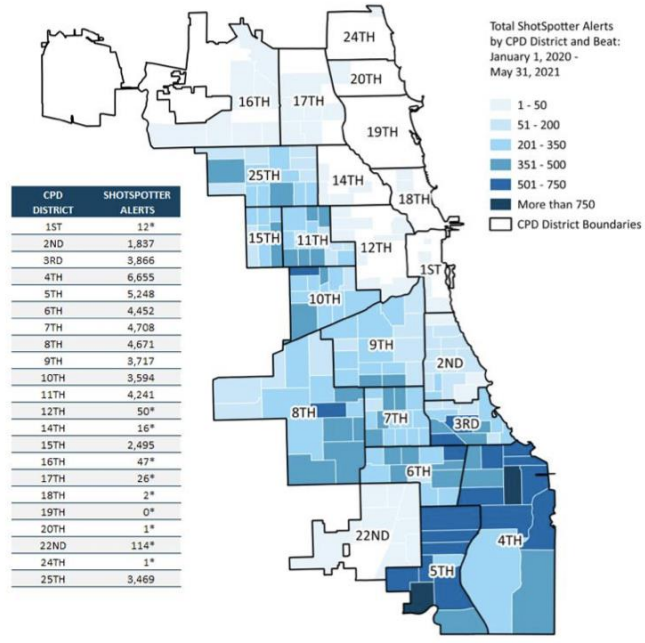
technology. In my interviews with community stakeholders, the OIG's findings reinforce the importance of many of their concerns about ShotSpotter.

II. Major Community Concerns About ShotSpotter

ShotSpotter's Contribution to Greater Policing of South and West Side Communities

Many of the concerns about ShotSpotter's impact on the community were related to its contribution to the greater scrutiny of South and West side neighborhoods, which has various negative implications for different marginalized groups in these areas. As of May 2021, ShotSpotter sensors were installed in 12 of Chicago's 22 police districts, specifically in districts 2 through 11, the 15th district, and the 25th district (Office of Inspector General, 2021). The OIG report found that between January 1, 2020 and May 31, 2021 there were a total of 50,176 ShotSpotter alerts sent to CPD that resulted in an officer being dispatched to the scene. The report included a visualization of all the alerts by CPD district and beat, as shown below:

FIGURE 3: SHOTSPOTTER ALERTS BY CPD DISTRICT AND BEAT[39]



CPD DISTRICT	SHOTSPOTTER ALERTS
1ST	12*
2ND	1,837
3RD	3,866
4TH	6,655
5TH	5,248
6TH	4,452
7TH	4,708
8TH	4,671
9TH	3,717
10TH	3,594
11TH	4,241
12TH	50*
14TH	16*
15TH	2,495
16TH	47*
17TH	26*
18TH	2*
19TH	0*
20TH	1*
22ND	114*
24TH	1*
25TH	3,469

Source: OIG analysis.

Looking at the map, it is clear that the number of ShotSpotter alerts is much higher in the police districts on the South and West sides of Chicago than those in the northern districts. The placement of ShotSpotter sensors around the city influences these findings. Most of ShotSpotter sensors are centralized in the South and West sides of Chicago and most of the districts on the north side do not have any ShotSpotter sensors located within their boundaries. Therefore, it makes sense that many of the northern districts have zero or one alerts while the southern and western districts often have over 3,000 alerts. The department placed these sensors in the areas with the highest recorded crime. However, geographic crime statistics are greatly influenced by the patterns of police presence, reporting, and enforcement, which have historically been highest in these districts as well (Buil-Gil et al. 2021; Lum & Isaac, 2016). Placing technology using crime rates, therefore, contributes to a cycle of over-policing in certain neighborhoods.

Many community advocates expressed frustration about this cycle, because these "high crime" neighborhoods become breeding ground for new technologies and strategies that target residents and introduce even greater policing into these areas. In the case of ShotSpotter, the centralization of sensors in the South and West side of Chicago and the resulting skewed distribution of ShotSpotter alerts across the city contribute to a greater number of police dispatches to these neighborhoods (Office of Inspector General, 2021). This is particularly frustrating to the community members that I spoke to because of the disproportionate impact this has on Black and Latinx residents. In our interview, Freddy Martinez from The Lucy Parsons Lab observed that, "The cameras are placed wherever there's been under-investment in the communities. And that contributes to that history: the neighborhoods with ShotSpotter are majority Black and brown and no majority white neighborhoods"[6] (Martinez, 2021). All the neighborhoods where ShotSpotter

[6] See Appendix.

sensors are installed have a majority of Black and Latinx residents (MacArthur Justice Center, 2021). These areas often experience greater disinvestment from the government and have a higher population of low-income residents, which partly explains the higher rates of gun violence (Husain et al. 2020). The placement of sensors in areas with a disproportionate number of non-white people introduces racial bias into the population of people who are impacted by ShotSpotter alert dispatches.

The possible consequences of these alerts are particularly concerning to community members. One major consequence is the increased potential for interactions between civilians and the police. When police officers are dispatched to a scene based off a ShotSpotter alert, they will often question people in the area if they arrive on a scene with no clear perpetrator (William, 2021). This can help officers determine if a shot was fired and to potentially get a description of the perpetrator. Although William acknowledged in our interview that a ShotSpotter alert is not sufficient evidence for the police to arrest someone, as public attorney Brendan Max pointed out in our interview, ShotSpotter is often used as the justification for stops and searches (William, 2021; Max, 2021). Stops and searches were one of the primary concerns of community advocates I spoke with. Veronica Rodriguez from the Brighton Park Neighborhood Council (BPNC) expressed concern for the general harassment that may occur from police interactions, especially considering that the OIG's findings suggests that these alerts often do not lead to arrests for gun-related offenses. She said, "On an average day in Chicago, there are more than 61 ShotSpotter initiated police deployments that turn up no evidence of any crime.[7] So, every day there are more than 61 police officers deployed to our communities that only lead to harassment and targeting of

[7] This number is according to a report done by the MacArthur Justice Center that found that ShotSpotter sent an average of 71.4 alerts to officers each day during the period studied with, on average, 61 of these dispatches resulting in dead-end searches.

our community members" (Rodriguez, 2021). Rodriguez highlighted how ShotSpotter alerts contribute to increased deployments into majority Black and brown neighborhoods, which can lead to more interactions between the police and civilians and further scrutiny of these communities. Rodriguez argues that these unnecessary interactions with members of law enforcement can lead to harassment.

Desmon Yancy, another organizer I spoke with, illustrated Rodriguez's point when he told me about an experience he had of police harassment. Yancy, a Black man, described a time when he was walking down the street, passing a group of young, Black kids, when he heard a police officer start to sing a song on his loudspeaker that had racist undertones. The interaction made Yancy feel uncomfortable, but he did not know how to respond because he did not want to create a dangerous situation with the officer (Yancy, 2022). In this example, an officer harassed Yancy and the other Black people near him, without even stopping them. It is likely that the officer felt he could behave this way because his position gave him authority over Yancy and the other kids. In this case, police presence created a negative interaction, and it would not have even shown up in any kind of data collection. These kinds of racist, hurtful, and potentially dangerous situations likely become more common with increases in police presence in marginalized communities.

Interacting with the police can be an inconvenience but it can also turn into a dangerous or hurtful situation if it escalates. Although there have not been any major studies that explore the relationship between ShotSpotter alert dispatches and police use of force or civilian complaints, ShotSpotter's contribution to increased interactions with the police and civilians are a major concern for the Black and Latinx residents in these neighborhoods because of the history of violence between the police and Black and brown residents. For example, a 2022 OIG study of CPD stop data and use of force reports found that Black people were much more likely than any

other racial group to be stopped by the police and that CPD use force disproportionately against Black residents. Moreover, the same study also found that Black residents are more likely to be subject to more severe use of force by police officers (Office of the Inspector General, 2022). These findings – which have been replicated in Chicago and many other cities across the country – support the foundation of concerns about the negative consequences of increased police presence in majority Black communities due to ShotSpotter alerts.

Additionally, community advocates have expressed concern for the consequences of the police's lack of context when they respond to ShotSpotter alerts. ShotSpotter alerts are only suggestive of shots fired and often do not include information about what the potential perpetrator looks like or any other information about the situation. Without complete information, officers generally arrive on the scene on high alert for a possible perpetrator (William, 2021). Iván Arenas from the Institute for Research on Race and Public Policy described the effects of this attitude well in our interview, saying,

> What does it mean for police to interact with neighborhoods that have ShotSpotter in them, when they presume that at any moment anybody walking down the street could have been that person that ShotSpotter called about? Whether or not a gunshot actually occurred. It does create an even higher level of surveillance and suspicion in those neighborhoods.
>
> (Arenas, 2022)

Arenas expresses a specific concern about police behavior when officers arrive on a scene. Since ShotSpotter alerts alone do not provide context for officers, if they arrive on a scene where it is unclear if there is perpetrator or who she may be, officers must proceed with caution. This means that officers may treat everyone around them with the suspicion of having a gun. An experience

that an attendee of BPNC's ShotSpotter workshop shared exemplified what this could look like for people present in the area of a ShotSpotter alert. The attendee wrote in the chat, "I was walking to my car and the police came out of nowhere. There were around 30 cars and they said that they had gotten a [ShotSpotter] alert. They surrounded me and asked to check my bag" ("ShotSpotter Workshop," 2021). Officers treated this random individual near the location of an alert like a suspect because CPD had no knowledge or context corresponding to the alert they were given. Their behavior created a stressful environment for the resident, who was innocent and oblivious to gunshots that may have been fired near where they were.

Increased officer suspicion can also increase the potential for racial or gender profiling, as one community advocate mentioned (Ortiz, 2022). In the absence of full information, implicit bias may cause officers to suspect certain individuals based on their race, gender, and other physical characteristics. Previous research has shown racial and gender disparities in CPD's enforcement of certain crimes, which is likely due to profiling and racially biased police presence patterns. Recent studies looking at CPD stop data, use of force, and other enforcement characteristics have all found that CPD officers unfairly and disproportionately target Black and Latino men compared to other demographics (Office of Inspector General, 2022; Fan, 2018). ShotSpotter alerts often require officers to use their own judgement to scope out a possible perpetrator, which creates opportunities for racial profiling to occur, harming Black and brown residents the most.

Furthermore, in situations where ShotSpotter is used in tandem with cameras, concerns about surveillance have also been raised, especially considering how cameras can lead to more arrests and incarceration of marginalized people. After installing ShotSpotter in 2018, the City integrated many of the sensors into its existing network of surveillance cameras. As of 2019, there are around 40,000 surveillance cameras throughout the city that work with ShotSpotter sensors

(Finn, 2018). While the use of cameras generally gives officers more context and lessens the need for them to question or profile residents, the city's network of surveillance cameras has been the source of major backlash from community members. The audio-video recording capabilities of the cameras used with ShotSpotter concern community members because of the potential for police to use this footage to target individuals for other offenses that are not related to gun violence. Additionally, certain cameras still incorporate the use of facial recognition technology, through CPD's remaining partnership with Dataworks Plus, which makes it easier for CPD to identify and arrest individuals (Hamburger & Schmidt 2021). The consequences of increased policing practices and incarceration brought on by ShotSpotter-related cameras limit opportunities for individual and collective growth for the mostly Black and brown communities that are impacted.

Increased surveillance and police contact due to ShotSpotter sensors and corresponding cameras can have even more serious consequences for the undocumented community in Chicago. Three of the people I spoke to work for organizations that have specific programs that aid undocumented people in Chicago. They all expressed concerns about the specific danger that ShotSpotter sensors and the accompanying cameras poses to the already precarious condition of undocumented residents in Chicago. In 2021, Chicago passed a law called "The Welcoming City Ordinance," officially designating the city as a "sanctuary city" for undocumented immigrants. The legislation guarantees that the City "will not ask about your immigration status, disclose that information to authorities, or, most importantly, deny you City services based on your immigration status" ("FAQ – Sanctuary Cities"). However, there are protections that the ordinance does not include that continue to make undocumented people vulnerable to deportation.

As Natalie Casal Alcaíno from Organized Communities Against Deportations (OCAD), a movement that fights against the criminalization of undocumented Chicagoans, said to me,

research about the ordinance has found that certain CPD activities remain unregulated and information about undocumented people can still be reported to U.S. Immigration and Customs Enforcement (ICE). As she states:

> There are still many ways in which ICE and the Department of Homeland Security more broadly and CPD are in collaboration. There's this report that OCAD helped co-write around the digital deportation machine that dictates the different ways in which CPD uses surveillance technology, like license plates and cameras that assess people's identities and use social media to find people. All that data can still be shared collaboratively with ICE.
>
> (Casal Alcaíno, 2022)

"The Welcoming City" ordinance does not completely prevent CPD from collaborating with federal immigration agencies like the Department of Homeland Security to locate, arrest, and deport undocumented immigrants. Specifically, the statute allows CPD to provide information to external agencies including ICE if the agency request includes a "criminal predicate," which is a tern that is not defined (Hamburger & Schmidt 2021). This means that CPD could still provide agencies like ICE with surveillance data if it was any way related to an ongoing criminal investigation. The report specifically recognizes the impacts of cameras and CPD's multiple centralized data networks on the privacy and security of information about undocumented residents in the city. The report specifically notes that the surveillance data that CPD analysts collect from cameras – including those associated with ShotSpotter – can be used to target undocumented people at protests, for example, and can cause undocumented residents psychological harm (Hamburger & Schmidt 2021).

Resident's lack of awareness about ShotSpotter sensors was a major concern expressed in my interviews as well, because the insidious nature of technologies like ShotSpotter prevents people from knowing the ways they are being surveilled and therefore, limit their ability to fight back against these systems. The nature of the political organizing work that the people I interviewed were engaged with meant that many of them were aware of the OIG report and the calls for the cancellation of ShotSpotter. But when I asked them if they had heard complaints from their communities about ShotSpotter, many of them said no and said it was because people did not know about ShotSpotter sensors. ShotSpotter sensors and cameras are not big enough to be visible to pedestrians and CPD does not put up signs or provide information to people living in areas with sensors that will inform them about ShotSpotter and how it is used. Even for people who may be questioned or arrested because of a ShotSpotter alert, they may not be informed about what ShotSpotter is or how it contributed to their encounter with officers. This means that most people are unaware of ShotSpotter sensors unless they follow the news about ShotSpotter.

The community's unawareness about ShotSpotter was exemplified in a BPNC's ShotSpotter workshop. In this workshop, members of BPNC educated around forty community members in Brighton Park and surrounding neighborhoods about how ShotSpotter works and how it is used by CPD. Many of the attendees of this event seemed to be frequent participants of BPNC workshops, but when asked if they knew about ShotSpotter, most of them reported that they did not. Once the hosts of the meeting laid out the facts about ShotSpotter's operation and some data about its efficacy in Chicago, many attendees expressed their frustration with the City's investment in technology in the chat section of Zoom (ShotSpotter Workshop, 2021). It is clear that once these people understood what ShotSpotter was, they felt strongly that it was not an asset to this neighborhood. Although this is not necessarily the way that all or even majority of community

members could react to hearing information about ShotSpotter, knowing about these technologies is the only way to formulate an opinion about them, good or bad and to fight against their use. The lack of community awareness about ShotSpotter furthers the marginalization of these communities and the continuation of policing strategies that use ShotSpotter because community members do not have the information to fight back.

Ultimately, the concerns of community members I spoke with about ShotSpotter's impact on the hyper-policing of marginalized communities generally related to a frustration with the City's approach to gun violence in these areas. Interviewees often expressed frustration because they felt there were ways for the government to reduce gun violence that would help their communities thrive. Punitive responses like policing have been historically unsuccessful at reducing crime long-term because they do not generally address the root causes of violence, like poverty or trauma. Moreover, ShotSpotter is mostly a reactive tool that does not provide long-term solutions for communities to reduce gun violence or any of the other issues that result from disinvestment. Many community members I spoke to referenced the high price tag of the ShotSpotter, arguing that this money was being wasted because ShotSpotter has not significantly helped reduce gun violence or even helped to catch the perpetrators of gun crimes. Instead, they argued that the $33 million spent on ShotSpotter would make an incredible difference in the hands of community organizations, especially those engaged in violence prevention efforts.

ShotSpotter as Unreliable Court Evidence

In May of 2020, a man named Michael Williams was giving a young man named Safarian Herring a ride home when another man drove up and shot at Williams' car. The bullet missed Williams but hit Herring. In disbelief, Williams rushed Herring to St. Bernard Hospital, but doctors pronounced Herring dead on June 2, 2020 (Burke et al. 2021). On the night of the shooting,

ShotSpotter sensors detected a noise that was triangulated to 5700 S. Lake Shore Drive, exactly where camera footage placed Williams' car (Burke et al. 2021). Three months after Herring's death, Williams was approached by officers who later interrogated him about his involvement in Herring's death and charged him with first-degree murder. The main evidence in the case against Michael Williams was the ShotSpotter alert. The prosecutor in Williams' case would use the alert to argue that Williams had shot Herring inside of his car (Burke et al. 2021).

Williams' case is one of the most publicized examples of ShotSpotter being used as a prosecutory tool in courts. Brendan Max, Michael William's defense attorney, noted in our interview that these kinds of cases are fairly common in Chicago:

> Over the course of the last, let's say, year, [the Cook County Public Defender's Office has] encountered over 20 cases in Chicago alone involving ShotSpotter. My guess is that ShotSpotter is used quite a bit… There are private attorneys who handle a lot of that litigation as well.
>
> (Max, 2021)

More and more prosecutors are referencing ShotSpotter data to help decide the fate of defendants involved in cases related to criminal gun activity. Additionally, Max notes that when prosecutors decide to use ShotSpotter evidence in courts, it is very difficult to get the evidence dismissed by the judge or to fight against it (Max, 2021). This makes ShotSpotter a powerful tool that is very difficult for defendants to challenge. Working at the Public Defender's Office, Max often represents low-income clients who do not have the financial means to adequately push back against unfair evidence, either through audits or through legal maneuvers (Max, 2021). However, lawyers like Max are trying to challenge the use of ShotSpotter alerts in fundamental ways that would invalidate the use of ShotSpotter against all defendants, regardless of their income level.

Ultimately, Max argues that ShotSpotter data is not reliable enough to provide evidence for a case. While Williams' incarceration was wrong based misinterpreted camera footage, Max used his case to file a motion challenging the use of ShotSpotter in courts overall. The main issue that he focused on is that ShotSpotter is not properly tested. As Max explained,

> There is a basic method by which forensic evidence, or forensic methods have to be shown to be reliable. Whether it's a gunshot detection system like ShotSpotter, or a DNA system, or a fingerprint system, in order to prove to others the level of performance of that system, its weaknesses and limitations, when we should trust it, and when we shouldn't trust it, the developers of those forensic methods have to do something called validation testing. Meaning, they have to test the system under controlled circumstances, and see the outcome and be able to… say something about the level of reliability.
>
> (Max, 2021)

For a technology to be used in court, Max argues, it should meet certain standards of reliability using a method called "validation testing." This kind of testing would allow users of the technology to understand how accurate the technology is under controlled conditions so they can assess how to what level they should trust the technology. Max elaborated on what validation testing would reveal about ShotSpotter:

> ShotSpotter has never done the basic validation that you would expect…So, because of that, there is no data about the most important metric of that system, which is how often does ShotSpotter trigger and give an alert on something that's not actually gunfire: a false alert…the police when they respond, and the prosecutors when they use that evidence, they have no idea how often ShotSpotter

> gives false alerts and because of that, that system should not be used because of that. We have no idea about the reliability.
>
> (Max, 2021)

Without validation testing, Max explains, it is not currently possible to know the rate at which ShotSpotter produces false alerts. Validation testing would allow users of the technology like CPD to understand the accuracy of the system and to account for this inaccuracy in their operation, if possible. This kind of testing would also need to occur independently, in a controlled setting, so CPD cannot test it based on how it works on any given day in Chicago.

In addition, even if ShotSpotter's accuracy was properly and independently tested and the technology was determined to be accurate, the tool would remain unreliable because of the error-prone process of marking gunshots. When a ShotSpotter alert is sent to ShotSpotter headquarters, a ShotSpotter employee is responsible for determining if the noise is a gunshot. Although this individual must undergo training, these employees are not required to have any kind of special skills that would make them better at detecting gunshots than the average person (Burke et al. 2021). Therefore, there judgements are prone to human error and the scope of these errors in unknown. Additionally, a few reports have raised concerns about the integrity and accuracy of the location determination of alerts after a review of court documents showed that some ShotSpotter employees altered the location of alerts at the suggestion of police (Burke et al. 2021). Moreover, there is no formal process for policing technologies to be audited or certified by external bodies. This means that there are no formal standards that technology companies must comply with to sell their products to agencies and no standards that agencies can measure before implementing these technologies. Until these issues can be remedied through legislation or other methods of accountability, the dismissal of ShotSpotter evidence in court should become common practice.

The use of ShotSpotter in courts can have damaging impacts for community members who are prosecuted based on ShotSpotter alert evidence. Imprisonment has serious consequences for people, no matter if it is a few days or for a lifetime. Spending even a few nights in jail can have serious individual ramifications including job loss, eviction, or loss of child custody. Individual effects are often exacerbated based on the length of time spent in jail in addition to factors like race, gender, age, and medical history. Having a criminal record can also create barriers to employment, housing, and welfare services, which can seriously impact a person's life opportunities ("The Impacts of Arrests"). Michael Williams' case exemplifies the extent of some of these harms. As Brendan Max described,

> Consider the fact that Michael Williams was wrongfully incarcerated for about 11 months before he was exonerated. He got sick while he was in the jail. He suffered some really, really severe mental health issues, and 11 months in jail for a 64-year-old, innocent man, because of faulty ShotSpotter evidence was very tragic for him and his life. And that plays out I'm sure over and over around the country when prosecutors and police rely on unvalidated ShotSpotter evidence and attempt to incarcerate and convict citizens around the country.
>
> (Max, 2021)

Williams' time in jail caused a lot of health damage, among other personal consequences. His experience highlights the life-threatening potential of incarceration and implicates ShotSpotter in this cycle of incarceration. While the ShotSpotter system is unreliable and should undergo further testing, the use of ShotSpotter as prosecutory evidence represents a real failure on the part of the courts. Since Max's attempt to end the practice of using ShotSpotter evidence in courts was ultimately unsuccessful, it is still up to individual judges to decide if ShotSpotter evidence is

permissible as evidence. The incorporation of unreliable evidence in high-stakes situations like criminal prosecution is a major concern for community members because of the consequences. Community advocates like Brendan Max argue that untested tools like ShotSpotter should have no place in the criminal legal system, no matter if it is used to defend or to prosecute an individual.

SDSCs and "ShotSpotter Connect": ShotSpotter as a Predictive Policing Tool

One major concern that community advocates expressed was about CPD's use of ShotSpotter as a part of their predictive policing strategy. CPD monitors and analyzes ShotSpotter data within their Strategic Decision Support Centers (SDSCs). SDSCs are district-level command and control centers that use software tools to achieve a multitude of goals, including to inform decision-making about police resource deployments (Hollywood et al. 2021). As of 2018, SDSCs can be found in all police districts in Chicago. Certain districts with lower crime rates have "SDSC-Lites" instead, which have a lower technological capacity. Analysts working in SDSCs are the ones who receive ShotSpotter alerts and will usually dispatch officers to the location of the alert (Hollywood et al. 2021). CPD also uses ShotSpotter's geospatial predictive policing software, "ShotSpotter Connect," which also operates out of SDSCs. ShotSpotter Connect, formerly known as "HunchLab" and then "ShotSpotter Missions," uses historical ShotSpotter alert data to identify locations that have an elevated risk for a specific type of crime in a given shift. Analysts can also print maps with this data for patrol officers to use to figure out where they should patrol and for how long (Hollywood, et al. 2021).

The community concerns about ShotSpotter Connect relate to many of the concerns outlined in the previous sections. The main community concern about ShotSpotter Connect is how ShotSpotter data contributes to an increased deployment of police resources into marginalized neighborhoods. This is similar to the concerns about the impact ShotSpotter alert data, except that

concerns about ShotSpotter Connect are more related to the long-term shifts in police strategy due to aggregate ShotSpotter alert data, rather than the impact of increased police-civilian contacts. In my interview with William, he mentioned that "If [officers] saw an increase in shots fired, calls, and ShotSpotter alerts, that would draw more attention to that area than other areas of the district" (William, 2021). ShotSpotter Connect has been a helpful tool for officers to track which areas have higher gang-activity. As William suggested, the neighborhoods with higher gun activity would experience greater police scrutiny.

This police scrutiny concerns community members, especially considering the racially biased placement of sensors. Freddy Martinez highlighted the individual consequences for Black and brown community members, saying, "The fact that [police] are using historical data as a justification for stop and frisks is a huge concern of [our organization]" (Martinez, 2021). ShotSpotter Connect – like most other predictive technologies – marks certain geographic locations as high-risk for gun violence, which leads police to treat residents in this area with greater suspicion. Shifts in strategy due to aggregate ShotSpotter data have an additional impact on the amount of policing felt by the majority Black and brown residents in these neighborhoods. The department is collecting data that is biased against non-white residents, with more data about potentially "criminal" behavior being recorded in areas with greater numbers of Black and Latinx people and other marginalized groups. CPD's biased infrastructure influences racially disparate policing and contributes to further stereotyping of these neighborhoods as vastly more "dangerous" or "criminal" than others.

However, in my conversation with John Hollywood, a RAND researcher who is studying the use of SDSCs in Chicago, he pointed out that many of these concerns about ShotSpotter Connect specifically, do not accurately reflect the extent to which ShotSpotter Connect is used in SDSCs.

He told me in an interview that analysts in SDSCs do not actually use ShotSpotter Connect very often since the program relies on a different software system than their main predictive data software, Citigraf. Hollywood described how during his study of SDSCs he noticed that:

> A major issue at the time, was that [ShotSpotter Connect] wasn't really integrated into other systems. So, the shots would come up… but because the shot locations weren't directly integrated into the Citigraf displays. And this wasn't one of the things that was by default, being screenshotted and put into the daily briefings…ShotSpotter [Connect] was kind of secondary.
>
> (Hollywood, 2022)

According to RAND's analysis, ShotSpotter Connect was not used significantly in SDSCs compared to other technologies, mostly due to issues with its ease of access. In daily crime briefings and other pattern data reports that analysts produced, ShotSpotter Connect data was often not included. In fact, ShotSpotter Connect is the technology that is most often omitted in the SDSC-Lites mostly because of this fact (Hollywood et al. 2021; Hollywood, 2022). This information could help ease some concerns about ShotSpotter's contribution to CPD's predictive policing strategy. However, predictive policing is still a major component of CPD's enforcement strategy which continues to worry community members, even if ShotSpotter is not a big part of it in practice.

Hollywood's comments about the infrequent use of ShotSpotter Connect raise separate concerns about the amount of money the City spends on ShotSpotter, especially related to their other predictive policing technologies. While there are different reports about the official price tag of ShotSpotter Connect, Hollywood did disclose that the cost of ShotSpotter Connect is higher than any of the other predictive policing technologies used in SDSCs (Hollywood, 2022).

Considering the fact that it is also the least used predictive technology, it does not seem reasonable for the City to be paying the most amount of money on a technology that is not used day to day.

Community members frequently mentioned their concerns about ShotSpotter's price. Iván Arenas spoke about how important the money going to ShotSpotter could be for communities instead, for example, saying, "What stands out [to me] is what would [community organizations] do with $11 million a year in these communities [with ShotSpotter]? That [money] could be going to something that might actually be getting more at the root causes of challenges with gun use or just even safety in those neighborhoods" (Arenas, 2022). Arenas believes that the money going towards ShotSpotter would have a much larger impact on violence prevention if it was in the hands of community members. Combined with the fact that part of the overall cost of ShotSpotter is dedicated to funding a predictive technology that is largely unused, Arenas' argument for better resource allocation becomes even stronger. Overall, the City's funding of ineffective and inefficient policing tools like ShotSpotter Connect frustrates community members who believe that the government should be allocating more dollars to solutions that do not threaten their communities.

Finally, a major concern that a few community stakeholders speculated about was the potential for law enforcement agencies to be using unconfirmed ShotSpotter alert data as part of their predictive policing strategy. As the OIG report found, only 9 percent of ShotSpotter alerts reveal evidence of a gun-related crimes. However, as Hollywood confirmed in our interview, ShotSpotter Connect data does not filter out the roughly 91 percent of alerts that do not result in evidence of a gun-related crime (Hollywood, 2022). This undetermined data is dubbed "dirty data" by researchers, and the name refers to the untrustworthy or "unclean" nature of data that is being used to influence police deployment strategies (Richardson et al. 2019). In this case, using unconfirmed

ShotSpotter alert data inflates the magnitude of gun-activity in the areas of the city with ShotSpotter sensors. Yet, these exaggerated numbers are the measures which help determine which areas the police should surveil. This raises implications not only about ShotSpotter as a good source of data for the predictive policing strategies, but about the level of standards that CPD has in place for using technologies in a predictive capacity.

ShotSpotter Connect is concerning to community members for many reasons including the biased and unreliable nature of its input data, the high cost of the service relative to its use, and its contribution to the already very high level of policing in marginalized areas in the city. The City invests a large amount of money into a technology that is not used very often, and even when it is, community advocates feel frustrated by the way it is used to generate more police activity and suspicion of Black and brown residents. Meanwhile, the unreliable and biased data that is being funneled into the software suggests that the department either does not care about ShotSpotter's accuracy or is unwilling to admit that they are relying on an inaccurate system. While many of these concerns in this section are about ShotSpotter specifically, they ultimately implicate CPD's racially biased predictive policing system because of the disparate and detrimental consequences of predictive policing for people living in neighborhoods that experience already high levels of policing.

POLICY IMPLICATIONS

The OIG report about ShotSpotter's effectiveness and the community's concerns about its use have fostered political tension among community stakeholders and advocates of CPD and ShotSpotter. The available data and the perspectives discussed in this paper inform many implications for the City about how they should move forward with the contract and improve their relationship with the community. For each implication, I recommend a policy pathway for

achieving that outcome. Finally, for this section I chose to focus on policies and practices that can be enacted by the City and CPD, rather than actions that the company ShotSpotter could take. This is because without pressure from clients like the City of Chicago, there are few economic incentives for ShotSpotter to modify their technology or allow for external audits or testing.

I. Cancel the Contract Between ShotSpotter and the City of Chicago

Based on the comments expressed by various community stakeholders and the supporting literature about the operational value of ShotSpotter for CPD, the City of Chicago should cancel its contract with ShotSpotter. Currently, the City is paying upwards of $30 million on a technology that does not substantially impact clearance rates for gun-related offenses and has worried many community members because of its use by law enforcement stakeholders and its lack of reliability. Meanwhile, neither the City nor CPD have given a compelling argument as to why ShotSpotter should stay implemented that addresses these concerns. In fact, data that a ShotSpotter representative pointed to found that there were similar clearance rates for 911 calls about gunshots, which suggests that calls for service are just as reliable as ShotSpotter alerts (Byrne, 2021). Therefore, current data does not suggest that cancelling the ShotSpotter contract would be significantly detrimental to gun violence clearance rates for the CPD.

CPD must make the decision to cancel the contract. One of the main ways that the community can put pressure on CPD to do this would be by holding public hearing and allowing representatives from the community and other stakeholders to speak publicly about the issues with ShotSpotter. However, past hearings about the City's use of technology, including ShotSpotter, have not gathered a lot of attention and have sparked very little change in CPD practices (Hickey 2021). Part of the reason for this is because the City Council's Committee on Public Safety, which is in charge of holding these hearings, generally adheres to the desires of the mayor, who has

expressed support for the contract before (Gunderson, 2021). One of the main ways to get around the City Council would be to wait for the newly formed Community Commission for Public Safety and Accountability to be inaugurated. Created as part of a July 2021 ordinance, the Commission will be made up of seven elected civilians and it will have the authority to oversee and approve the policies and practices of CPD and the mayor. Specifically, the Commission has the authority to veto new CPD policies that do not align with community standards, and these policies would only be able move forward if the Chicago City Council overrides the Commission's decision with a two-thirds vote ("Substitute Ordinance," 2021). Additionally, since the Commission will be elected by the people rather than appointed by the mayor, they are more likely to adhere to community needs.

The Commission would be unable to revoke the ShotSpotter contract or any of its related policies since they predate the creation of the Commission, but it would be able to call a public hearing to allow community members and council members to debate and discuss the merits of ShotSpotter and its impacts (Ferguson, 2022). However, there are a few factors to consider for this hearing to both occur and be impactful. First, the formation of the Commission is important to ensuring the political will of the people is enacted. The Commission could be an important step to fighting against the bureaucratic dominance of career politicians in city government, but only if the election process is able to draw a group of interested, uncorrupted, and dedicated civilians and if those civilians are able to capture the larger share of the vote. Moreover, advocates for the cancellation of the ShotSpotter contract would need to continue to put pressure on government officials and the police department about their use of ShotSpotter to make this issue visible to members of the Commission. This could also help attract attention from the media which would further public awareness of ShotSpotter and its impacts.

Even if the community is successful at convincing the Commission to hold a hearing, however, there are a few issues that may still arise that would prevent the hearing from making an impact. As Natalie Casal Alcaíno from OCAD suggested in our interview, community members are at times not alerted about hearings well enough in advance to properly prepare. Additionally, she discussed factors like the time and location of meetings also impact the likelihood of high community attendance, since many people have other obligations that might make it difficult for them to attend a meeting in the afternoon, for example. The Commission should consider these factors by publicizing the event well in advance and scheduling it at a time that would be most convenient for the most amount of people interested in attending the meeting. One of the other obstacles Casal Alcaíno mentioned was the number of other topics to be discussed at the hearing. She described going to a community meeting that was supposed to be about the gang database but said that the most of the time was taken up discussing a different topic that was on the agenda which limited the number of community members who were able to publicly speak about the negative impacts of the database (Casal Alcaíno, 2022). To prevent this from happening, the Commission should make ShotSpotter the sole topic of the hearing.

Even if the hearing goes well, however, CPD does not have to take any action about the contract. The idea behind holding a hearing would be to increase public awareness about the injustices associated with ShotSpotter, which would increase public pressure to cancel the contract. However, CPD does not have any legal obligation to respond to public pressure. Currently, CPD has not indicated that they would be willing to cancel the contract. However, it is important to note that other cities around the country have canceled their contracts with ShotSpotter before, including San Antonio, Texas and Charlotte, North Carolina (Davila 2017; Vandergriff 2016).

These cities have set an important precedent and their decisions further suggest that ShotSpotter is not an essential tool for police agencies in major metropolitan areas.

If the City cancels the ShotSpotter contract, CPD should continue to collect data about outcomes of civilian reporting of gun crimes and monitor the data about gun crimes to evaluate the impact of eliminating ShotSpotter sensors. After a period of two or more years – similar to the length of the original ShotSpotter contract – the department should interpret this data to help them determine whether or not to re-invest in this technology. If clearance rates for civilian-reported gun activity dip significantly below the averages for ShotSpotter alerts, then that could be evidence that the City can resume their partnership with ShotSpotter. However, as much of the data in this paper suggests, the decision to potentially resume the contract with ShotSpotter should be done with community impacts in mind. City officials should also make a concerted effort to investigate and test less punitive approaches to reducing gun violence before they decide to return to using a less tested and controversial prevention method like ShotSpotter.

II. Increase Government and Public Oversight of Technology Adoption and Use

When speaking with community advocates about the impacts of ShotSpotter, many of them expressed frustration with the way that the City was making decisions about violence prevention in general. The City's decision to extend the contract with ShotSpotter felt like a betrayal of the interests of South and West side communities because it was done without input from their residents or consideration of the impacts of this technology on their lives (Hickey, 2019). Yet, the City's decision reflected a long history of political abandonment felt by residents from the South and West sides. All the community activists I spoke with work with organizations that were formed out of some form of need that is not satisfied by government services. For example, Andrea Ortiz explained:

> [BPNC was] founded in 1997, by a group of community members who were just tired of being ignored by our elected officials, all of our demands went unanswered, so as a result, we responded by organizing our blocks… and really holding…[the City's] feet to the fire…We saw that if we organized and stuck together, then we could actually win things that we needed.
>
> (Ortiz, 2021)

Residents from Brighton Park realized that they could get a lot more done if they were able to work together rather than passively relying on elected representatives to advocate for their needs. Community organizing in general is born out of a need for greater representation and advocacy from the government. Overtime, organizations like BPNC have leveraged their collective power to press the government for greater services and, in the absence of government action, they have filled in some of the gaps in services through funding from different people and organizations (Ortiz, 2021). However, there are ways to proactively improve the relationship between the City and residents to increase methods of government accountability. One way of increasing accountability in relation to the ShotSpotter contract would be to empower the legislative branch of City government with the authority to approve all contracts established between the City and outside agencies.

Currently, the Department of Procurement Services (DPS) handles all contracts with the City, including the ShotSpotter contract. The head of DPS is appointed by the mayor with the approval of the City Council, but the negotiation, processing, and approval of contracts is largely out of the public purview (Mayor's Press Office, 9/13/2021). In the middle of 2021, city officials decided to extend the ShotSpotter contract based on private conversations with representatives from the Chicago Police Department. Other members of the government, including the City

Council and the members of Inspector General's Office who were working on the report about ShotSpotter, were unaware of this action when it first occurred (Ferguson, 2022; R2021-991). The lack of awareness about these actions only highlights the lack of government oversight of contractual practices, which is especially concerning given the very real impacts these contracts can have on the community.

The Chicago City Council would be powerful a vehicle, in this instance, to increase government accountability and public scrutiny into decisions made about contracts like the one with ShotSpotter. In many other cities, city councils have been entrusted with aprroving ShotSpotter contract extensions. Through public activism and media reporting, these decisions have brought the conversation to the public (Alford, 2021; Rubino, 2022). In Sacramento, for example, the vote to extend their ShotSpotter contract was delayed after City Council official expressed concerns about ShotSpotter's effectiveness, so that officials could more closely assess the value of the system for the city (Alford, 2021). In Chicago, the City Council is made up of aldermen from the city's 50 wards, many of whom have expressed varying opinions about the ShotSpotter contract based on the tool's demonstrated effectiveness and impact on the community. However, when the contract was extended, the City Council was not informed or allowed to vote. A few aldermen expressed public concern about the City Council's lack of involvement in the decision. Carlos Ramirez-Rosa, the alderman from the 35th ward, introduced a resolution after news of the extension became public that to hold a hearing about ShotSpotter concerns (Resolution 2021-991). This hearing eventually took place but was absorbed into a larger and less productive discussion about CPD's use of policing technology in general.

The City should pass legislation that would place them in charge of approving contract extensions with external vendors. A few aldermen reported in an interview that they were creating

an ordinance that would require the "renewal or extension of any city contract over $1 million to come before the City Council for discussion first" (CBS Chicago 2021). This would, in practice, work similarly to the way that the City Council is involved in police misconduct settlements. For police misconduct settlements valued over a certain amount, the City Council is responsible for approving them. Similarly, this legislation would make the City Council a public check on the executive office's power so that these officials do not make large budgetary allocations without the consent of the public. This would also enable city officials to negotiate specific points of the contract, which could help reduce the City's spending. For example, the City Council should negotiate CPD's use of ShotSpotter Connect in SDSCs, because of its harms and its waste of agency resources.

Like many of the other recommendations, however, it is important that the public keep pressure on city officials to cancel the contract. While the City Council has had reservations about the contract, it is not clear if there are currently enough aldermen opposed to ShotSpotter to cancel it. Moreover, in many other cities that require city council approval, city council officials have mostly chosen to extend the contract, despite similar community concerns (Alford, 2021). Therefore, for this policy change to alter the City's contract with ShotSpotter, more organizing and awareness needs to occur for aldermen to be swayed to vote against ShotSpotter's future extension.

III. Redirect Money Towards Community Organizations Working Towards Violence Prevention

Many of the community activists I interviewed expressed support for cancelling the ShotSpotter contract and channeling money generally allocated to policing technologies like ShotSpotter towards community organizations that are focused on violence prevention efforts.

Most of them argued that the major underlining issue with CPD's investment in tools like ShotSpotter is that these tools do not contribute to solving the root causes of gun violence that could make their communities safer and more prosperous long-term. Veronica Rodriguez explained this, saying, "…we see the ShotSpotter cameras… they're in every corner. And we have also seen that violence has not decreased in our community, and we're still not getting the resources" (Rodriguez, 2021). The City has allocated money to install policing tools like sensors and cameras which have had little established impact on gun violence, but has not provided community groups like BPNC with similar resources to do their violence prevention work, which – even without this funding – has been able to help people in their neighborhoods find economic opportunities. Rather than invest in technologies that further marginalize communities, community advocates believe a better solution is to use this money to empower communities. Desmon Yancy from the Inner-City Muslim Action Network summarized this sentiment saying,

> It costs a lot of money [to implement] programs like [ShotSpotter]. These tech programs are often deployed in communities of color and poor communities, and without making an impact.…Most of my work over the last five years has been around… thinking of alternative ways for communities to feel safe.
>
> (Yancy, 2022)

Through his work with the Council, Yancy understands that money is a vital resource for communities experiencing economic disinvestment. There are many ways to engage in violence prevention work that do not involve punitive strategies like policing. It is disheartening for Yancy and the other members of his organization to see that so much of the government's money is currently being funneled into ineffective and frightening policing strategies, which include ShotSpotter. Most of what Yancy and other community activists have been fighting for is for this

money to be reallocated to community-supported programs that would make communities safe in the long run.

In Chicago, members of the organization GoodKids MadCity have identified strategies for government investment in gun violence prevention organizations in the form of their Community Restoration Ordinance. Otherwise known as the Peace Book Ordinance, this draft legislation would intervene in youth incarceration. The ordinance would establish a resource directory to identify economic opportunities for young people that would prevent them from turning to gun or gang violence. It would also establish neighborhood "Peace Commissions," which would give communities more authority over the handling of violence in their communities. These Peace Commissions would recruit and train community members to become violence interrupters. They would also create violence prevention models that can address the specific concerns of each neighborhood. Members of the movement to cancel ShotSpotter have endorsed the Peace Book Ordinance as an appropriate and more effective alternative to ShotSpotter ("Cancel ShotSpotter and support community-led solutions"). There are a few aldermen who have already expressed support for this ordinance, but more pressure needs to be added from activists, community members, and aldermen to get this ordinance in front of the City Council.

The Peace Book Ordinance would cost approximately $35 million, roughly the cost of the original ShotSpotter contract (Del Vecchio, 2020). The funding for the Peace Book Ordinance or alternative grant-based community organization investments should come from the police budget. This is not only because of the shared safety goals between policing and violence prevention community organizations, but because CPD's massive budget means that taking money from it would have a comparatively smaller impact on their operations than taking the same amount of money from a different department. In 2021, the City of Chicago's allocated 12.6 percent of their

total proposed budget, or roughly $1.6 billion, to CPD, the most out of the other government departments by far.[8] The $35 million that the Peace Book Ordinance costs is only about 2 percent of CPD's annual budget, making it an ideal source of funding. The choice to redirect funding would also create a great opportunity for CPD to examine the inefficient areas of investment within their budget, such as the ShotSpotter contract or certain types of officer training.

The City should also create measures for evaluating investments into violence prevention work like the Peace Book Ordinance. The goals of initiatives like Peace Commissions are to interrupt violence, especially among youth. It is not possible to measure the number of people who, without these initiatives, would have engaged in gun violence. However, there are other ways for the City to evaluate the successes and failures of community violence-prevention initiatives and organizations. The primary way of evaluating organizations would be to mandate regular reporting from Peace Commissions or community organizations about their implementation progress, success stories, and data about the utilization of their resources. These could be public, similar to the format of annual reports, and should summarize the services these groups provide, budget allocations, and data about how many people these organizations have reached. It could also be private, in the form of City audits or internal audits of these organizations, with interviews and surveys of staff and community members about how these organizations can improve the quality of services and help more community members access them.

[8] This assessment doesn't include Chicago Public Schools or its sister agencies, which are allocated money separately from government departments like CPD.

IV. Increase Public Awareness About CPD's Use of ShotSpotter and Other Relevant Technologies

Community stakeholders consistently lambasted CPD's lack of transparency about its officers' use of ShotSpotter and other technologies. Less police transparency has often been linked to less legitimacy which can negatively impact officers' enforcement ability. One of the major concerns about ShotSpotter has been the lack of public awareness about the sensors. Many people do not notice if there are ShotSpotter sensors in their area since they are not generally visible to people walking down the street. Without the basic understanding of ShotSpotter's presence in the city, residents cannot know about its uses and impacts, and they cannot form opinions about it based on this information. To increase transparency, the department should hold monthly public meetings to explain the current technologies the department employs and answer any questions from residents about how the department uses these technologies.

One way the department should encourage public awareness is through public meetings between CPD officers and the community. Each month at a specific and convenient time for residents, a designated CPD officer should visit each district and speak with residents about all the major policing technologies that are used in their neighborhoods. The officers should describe how the technology works, how the department employs it, and provide informational resources for community members. In the case of ShotSpotter, for example, officers should provide maps of where the sensors are within their neighborhood or direct people to the city's data portal for information about ShotSpotter alerts. Officers should also be available to answer questions from residents about the various uses of the technologies. This would not only help residents become aware of technologies like ShotSpotter, but also allow a dialogue to form between residents and officers about their concerns about these technologies.

The department could incorporate these meetings into their current community policing strategy to increase efficiency considering CPD's recent officer staffing shortages. Currently, the department participates in two different community-policing initiatives. One initiative, the Chicago Neighborhood Policing Initiative (CNPI), is organized by a nonprofit called the Policing Project and is focused more on establishing one-on-one relationships between officers and community members (Northwestern Neighborhood & Network Initiative, 2020). The Chicago Alternative Policing Strategy (CAPS) is a CPD-run initiative from the 1990s which experienced a resurgence after the 2019 federal consent decree. A major component of CAPS' strategy for community policing is holding meetings with the community to create a healthy dialogue between the public and the police. CAPS holds regular meetings between officers and the communities from each of the 277 police beats in the city. These beat meetings create opportunities for community members to ask questions about police activity, provide feedback to the department about ways it could improve, and foster greater trust between the Chicago community and CPD.

Currently, beat meetings operate as an open forum, where officers give a brief presentation about their work and answer questions from community members. Officers should incorporate explanations about the different kinds of technologies they use so that community attendees can learn about these technologies and ask questions about its use. Not only would this increase community awareness about ShotSpotter, but having officers explain how ShotSpotter is used can create less confusion and secrecy about what ShotSpotter does and how the department uses it. Moreover, increased awareness about ShotSpotter could have benefits besides transparency for both the police and community members who are interested in canceling the contract or reforming ShotSpotter's use. According to deterrence theory, increased awareness of ShotSpotter sensors could deter individuals from participating in gun violence since they know there is a detection

system in place. On the community's side, increased awareness would be helpful for coalition building against the ShotSpotter contract, since currently only a few activists with intimate knowledge of policing activity know and feel strongly enough about ShotSpotter to organize for its removal. These benefits should incentivize the department to implement these changes to create a more informed discourse about ShotSpotter.

There are still challenges associated with this policy change that CPD officials should be aware of and try to mitigate through other kinds of policy solutions. Community meetings are not the most ideal way of disseminating information because they require people to have enough awareness about the existence of these meetings to seek out information about them. In other words, only people who are aware of beat meetings would attend these meetings, which would still miss much of the impacted population. The media could help spread awareness about beat meetings and what topics were covered but that would still only reach people who read local news and understand English. Additionally, the department's website does not currently provide clear and updated information about when and where these meetings are held. The department should investigate different ways to advertise these meetings to a broader population, which could include mailing flyers to every address, partnering with local organizations to help spread the word, or creating a clear, consistently updated, and accessible website with information about upcoming beat meetings.

The time and location of meetings would also prevent some interested parties from attending meetings. Similarly to the attendance issues associated with holding hearings, individual commitments like work and family responsibilities could prevent people from being able to attend beat meetings depending on when they are held. Constraints related to time and money as well as personal disability could also prevent people from traveling longer distances to get to meeting

locations. The department should consider scattering the time and location of meetings so that more people could make it to at least one meeting. They should also survey people in each district to find out which times and places would be most convenient for people in the area. These kinds of measures would help the department reach a greater population and provide the public with greater information about the impacts and advantages of policing technology.

V. Encourage Future Research about the Impacts and Use of ShotSpotter

The findings of this paper and the OIG report highlight the need for greater research about the use and impacts of ShotSpotter in Chicago. The OIG report laid out the data about how effective ShotSpotter is at helping CPD catch perpetrators of gun violence and help victims of shootings. However, much of the reasoning for their conclusions is missing. For example, it is unclear why so many ShotSpotter alerts end up with no evidence of a gun crime. It could be that there was no gun activity, but it could also be because officers did not find the evidence that could determine that a gun was shot. Moreover, there are reasons for this, including time and resource constraints. Further research could be done into determining how different implementation strategies could improve clearance rates for gun crimes detected by ShotSpotter.

There are a few approaches that the department should test. One example of an approach could be a temporary department rule change wherein a random subset of officers are required to get out of their car and spend a certain amount of time looking for shell casings every time they are dispatched to a scene based off of a ShotSpotter alert. This could be helpful to understand if there is a relationship between the collection of gunfire evidence – which could help catch people who are guilty of committing gun-related offenses – and officers' time spent searching. If officers in this random subset do uncover more evidence of gunfire than those who generally do not spend that amount of time, this would suggest that ShotSpotter is actually more effective than the OIG's

report suggested and could inform policy changes that would give each officer more time to make these searches or create requirements that officers spend a certain amount of time looking for evidence when they are not needed elsewhere. Understanding the impact of different implementation strategies on the production of gunfire evidence could help the department increase the utility of ShotSpotter, especially if they are unwilling to stop investing in ShotSpotter.

Additionally, more research must also be done to determine the extent of the impacts of ShotSpotter on communities that were expressed by stakeholders in this paper. For example, there has been no major research done to examine the relationship between ShotSpotter alerts and use of force records or civilian complaints. While determining the number of dispatches due to ShotSpotter alerts that have resulted in use of force or civilian complaints would give an idea of if ShotSpotter alerts have in any way contributed to negative consequences for community members, it would be worthwhile to do a difference-in-differences study to understand *the extent* to which ShotSpotter contributes to use of force and complaints, especially compared to other kinds of interactions or areas. This kind of study would be more challenging, since there would need to be variation in the study to determine the specific impact that ShotSpotter has on use of force or complaints. One way to measure this would be to count the number of complaints or the number of use of force reports resulting from dispatches related to ShotSpotter alerts versus dispatches related to other kinds of offenses (Doleac, 2022). Other comparisons could include measuring ShotSpotter alert dispatches versus dispatches because of 911 calls for service about gunfire.

More research would be more feasible with greater cooperation from ShotSpotter. Jennifer Doleac, one of the leading researchers in the country examining the relationship between crime and technology, told me that she led a charge for many years to get ShotSpotter to be more cooperative with external researchers with respect to the use of their sensors for studies. However,

she said that since the company was so successful in the market, they had very little incentive to cooperate with her and other researchers' requests (Doleac, 2022). It could be the case that if there was pressure from the City or CPD – ShotSpotter's biggest client – ShotSpotter would be more inclined, from an economic perspective, to lend their sensors to studies that would give cities more information about the utility of sensors. Still, if ShotSpotter does not want to cooperate, there are studies that researchers can do with existing data or using the current ShotSpotter infrastructure.

Finally, research about court's use of ShotSpotter is less necessary unless ShotSpotter decides to perform further testing. There are a few relationships that could be further studied – for example, researchers could examine the strength of ShotSpotter evidence in court decisions by studying and interpreting transcripts of cases that use ShotSpotter as evidence – but ultimately, this does not address the major community concern about ShotSpotter that it is currently not reliable enough to be used as evidence at all. Further research would not relate to solving this problem except for the possibility for these studies to create pressure for ShotSpotter to do more of their own testing. Therefore, greater emphasis should be placed on testing the technology further or eliminating the use of the technology as it stands currently as legal evidence, rather than investing in future research.

CONCLUSION

The Chicago stakeholders I spoke with shared their many concerns about CPD's use of ShotSpotter and the larger implications that these concerns have about government transparency and accountability. The City's decision to extend its contract with ShotSpotter in 2021 despite missing evidence of its operational effectiveness reflected a concerning lack of interest about the ways in which ShotSpotter was not only a waste of money for the City but also a source of harm for community members from different areas in the City. This paper provided an overall collection

and analysis of the many concerns that Chicago residents have about the use of ShotSpotter in policing and prosecution to emphasize the community ramifications of the City's decision to extend the contract and identify pathways for CPD to improve, modify, or terminate their use of ShotSpotter to prevent future harms.

Based on my interviews with community members, I determined three major concerns about ShotSpotter. Community advocates expressed worry about the increased police presence in majority Black and Latinx neighborhoods because of often dead-end ShotSpotter alerts. There is evidence to suggest that the racially biased placement of sensors in majority Black and brown neighborhoods contributes to the cycle of hyper-policing and surveillance of these neighborhoods. They also pointed to the concerning use of ShotSpotter alerts as prosecutory evidence, given its unreliable and potentially inaccurate gunshot classification process. Moreover, the wrongful use of ShotSpotter in courts has led to very negative consequences for people convicted of gun crimes based on this evidence. Community advocates' overall concerns about ShotSpotter's contribution to hyper-policing and the use of biased and unreliable data were the source of the final major concern about CPD's use of ShotSpotter as a part of their predictive policing strategy.

The analysis of my interviews suggested that the best course of action for city officials is to cancel the contract with ShotSpotter. While there are ways for CPD to improve their handling of ShotSpotter through increasing public awareness about ShotSpotter or removal of ShotSpotter Connect from SDSCs, the stakeholders I spoke with emphasized the fundamental issues with ShotSpotter's reliability and potential to curb gun violence that make it an ineffective use of money for the City. Community interviews also suggested that the City should create policies that encourage greater oversight over contract extensions and to redirect money towards community organizations that are working to prevent gun violence long-term without relying on punitive

responses like policing. The City's unexamined investment in technologies like ShotSpotter point to a need for city officials to investigate the needs of communities and prioritize solutions that promote community healing instead of further criminalization.

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APPENDIX

[2] Chart of the "Annual homicide rate of Chicago and peer cities, 1889-2019." *Our City, Our Safety 2020*, https://www.chicago.gov/content/dam/city/sites/public-safety-and-violenc-reduction/pdfs/OurCityOurSafety.pdf.

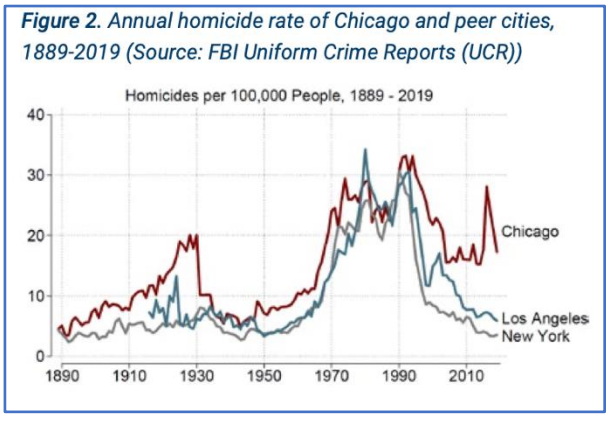

Figure 2. Annual homicide rate of Chicago and peer cities, 1889-2019 (Source: FBI Uniform Crime Reports (UCR))

[3] Interview Question Scripts

Community Organizers:

1. Can you tell me a little bit more about the work that you do for the [organization]?
2. Can you tell me more about the history of gun violence police presence in your neighborhood(s)?
3. What prompted your organization to file the amicus brief about ShotSpotter in the Michael Williams case?[9]
4. What are some of the major issues with ShotSpotter that you are concerned about based on your work? How have they impacted community members?
5. Can you tell me generally what kind of violence prevention work your organization does? What are the goals of this work?
6. What are some of the challenges you have faced in achieving these goals?
7. What is the value of community organizing, specifically as it relates to policing?
8. From conversations with community members about ShotSpotter, is there an awareness of ShotSpotter sensors and is there a lot of community activism in your neighborhood?

CPD Officer:

1. What is the purpose of ShotSpotter within the department? How has ShotSpotter served you?
2. How do you use ShotSpotter technology in your day-to-day operations? How often do you interact with ShotSpotter in your job?
3. What is the procedure or protocols when responding to a ShotSpotter alert?
    a. What usually happens when you respond to a ShotSpotter alert?
    b. Is there a certain justification that needs to be made to arrest someone at a scene? For example, if someone is close to a scene of a crime, what would be the criteria they need to meet to arrest them?
        i. Have there been issues that you know of with this?
    c. Is there specific training that accompanies ShotSpotter? Do you think this training is sufficient for understanding how to respond to ShotSpotter alerts? Is there anything that the training misses or is unable to cover?
4. Are you familiar with the way that ShotSpotter is used as part of the Strategic Decision Support Centers?
5. Are there any limitations to the way that the department can use ShotSpotter that you know of?
6. Are there any standards for using technologies in a predictive capacity? For example, theoretically, could the department decide to use a certain technology in a predictive capacity?
7. When police use predictive policing technology like ShotSpotter's data and they notice that detected shots have gone up in a certain location, what is the general response to this?
8. Based on your experiences, do you believe that ShotSpotter is a useful tool for the department?
    a. What would you improve about your experience using ShotSpotter? What works well, in your opinion?

[9] This was specifically in the case of BPNC, OCAD, and the Lucy Parson's Lab

[4] Coding Concerns About ShotSpotter (Findings Section II)

1) Consequences of sensors in neighborhoods
    a. Racially biased placement
    b. Surveillance concerns
    c. Increased police-civilian contact (stops/searches)
    d. Racial profiling
2) Consequences of ShotSpotter use in courts
    a. Unreliability
    b. Incarceration Risks
3) Consequences of ShotSpotter Connect
    a. Increased police presence
    b. Racially biased data
    c. Dirty data
    d. Expensive

[6] Chart from "ShotSpotter is deployed overwhelmingly in Black and Latinx neighborhoods in Chicago." *End Police Surveillance*. https://endpolicesurveillance.com/burden-on-communities-of-color/.