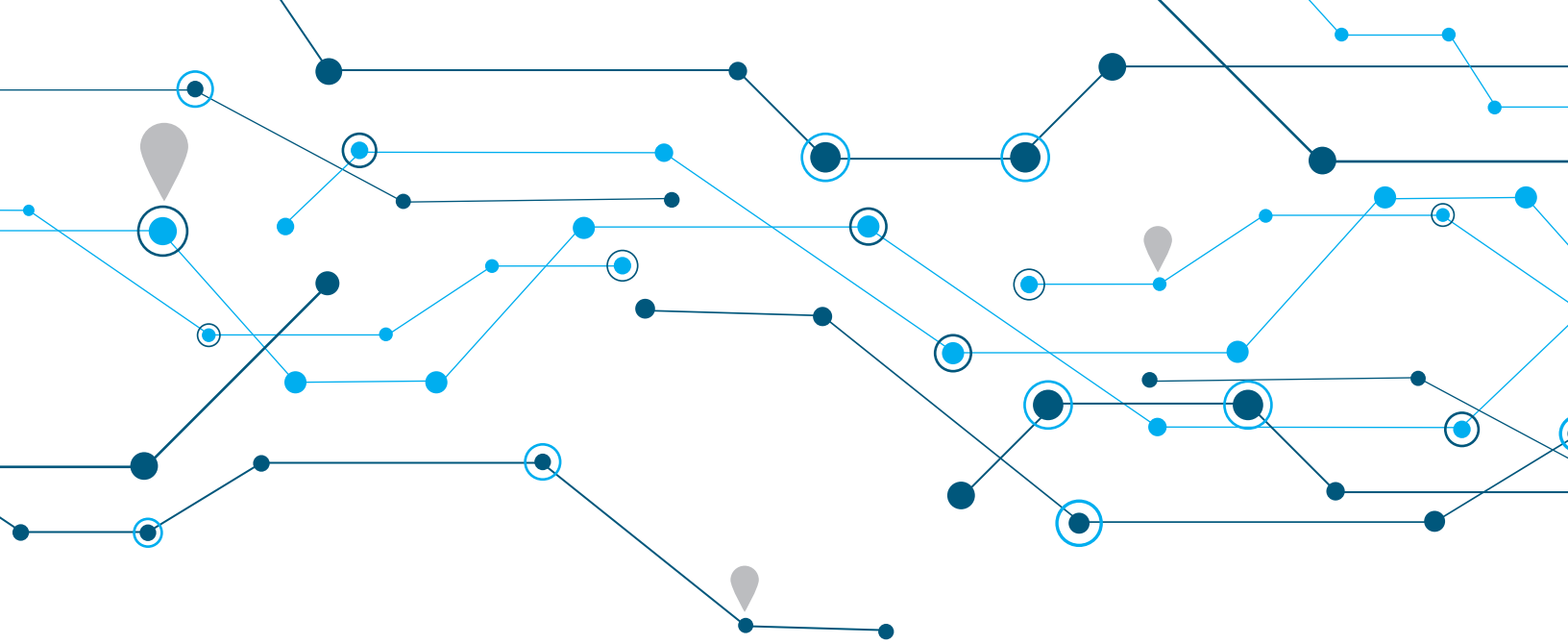
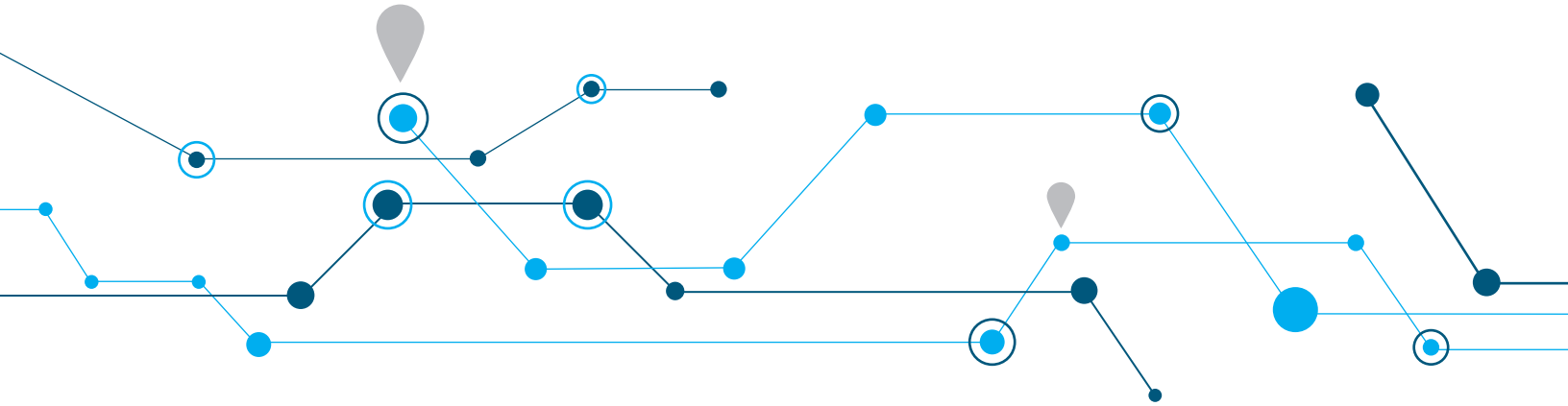


HARDWARE EDITION • NOVEMBER 2019

THE ROLE OF TECHNOLOGY IN THE STRATEGIES FOR POLICING INNOVATION PROGRAM:

Challenges, Solutions, and Lessons Learned

Michael D. White



Strategies for Policing Innovation

CNA

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Published November 2019

Policing Innovations: Research Snapshot

Effective use of technology is one of the core principles of the Bureau of Justice Assistance Strategies for Policing Innovation (SPI). Over the last eight years, SPI sites have deployed and tested a wide range of innovative technologies to support their crime reduction efforts, many of which have been documented in SPI Spotlight Reports (http://www.strategiesforpolicinginnovation.com/tta/publications). This SPI Spotlight Report, the first in a two-part series highlighting technology's role in SPI, focuses on hardware technologies. The report provides case study reviews of three SPI sites whose initiatives implemented three different hardware technologies: body-worn cameras (Phoenix, Arizona), closed-circuit television (Pullman, Washington), and gunshot location and detection systems (East Palo Alto, California).

Each case study review includes a brief description of the technology, the SPI site project goals, and the implementation of the innovation. The report then reviews the benefits offered by the technologies across sites, such as more efficient deployment of limited resources, enhanced understanding of high-crime places and people, and positive organizational impacts. The report also provides specific examples of the technologies' positive contributions to the Phoenix, Pullman, and East Palo Alto police departments.

In addition, this report delves into the challenges that come with technology integration. These challenges range from unrealistic expectations about technology's impact to human problems that can inhibit implementation (for example, a lack of buy-in among line officers). New hardware technologies often bring their own set of barriers—from infrastructure requirements to ongoing costs associated with continued management of the technology. Finally, new hardware technologies are often difficult to evaluate, forcing researchers to explore creative methods for assessing implementation and impact.

The report concludes with a brief look ahead at other hardware technologies being deployed in recently funded SPI sites: specifically, body-worn cameras in Miami Beach, Milwaukee, and Phoenix. The report ends with some final thoughts on the important role of technology in contemporary policing.

The Role Of Technology In The Strategies For Policing Innovation Program: Challenges, Solutions, And Lessons Learned—Hardware Edition

Michael D. White

Technology has been a driving force for change in American policing for much of the last century. From the patrol car and two-way radio to DNA forensics and body-worn cameras (BWCs), technology has fundamentally advanced the policing profession in important and positive ways. Technology can not only improve the operational effectiveness of agencies, it can facilitate the building of community partnerships. "Implementing new technologies can give police departments an opportunity to fully engage and educate communities in a dialogue about their expectations for transparency, accountability, and privacy."[1]

Innovation is one of the foundational principles of the Bureau of Justice Assistance (BJA) Strategies for Policing Innovation (SPI). SPI agencies have implemented a host of innovative strategies, and advanced technologies have often been at the core of how law enforcement agencies implement their SPI projects. In some cases, SPI agencies have deployed technologies that are well established in the law enforcement field, such as geographic information systems (GIS) and closed-circuit television (CCTV). In other cases, SPI agencies have tested new technologies, such as police BWCs and predictive analytics.

This topical SPI Spotlight Report focuses on the role of hardware technologies in SPI and highlights its central importance through case study reviews of SPI sites. The featured sites and their technologies are Phoenix, Arizona (BWCs); Pullman, Washington (CCTV); and East Palo Alto, California (gunshot detection systems). Each case study review provides an overview of the technology, the project goals, and how the technology was deployed. The report then discusses the benefits produced by the technologies across SPI sites and some of the challenges and lessons learned regarding their deployment. Last, we also look ahead to SPI sites in the early stages of deploying other innovative technologies.

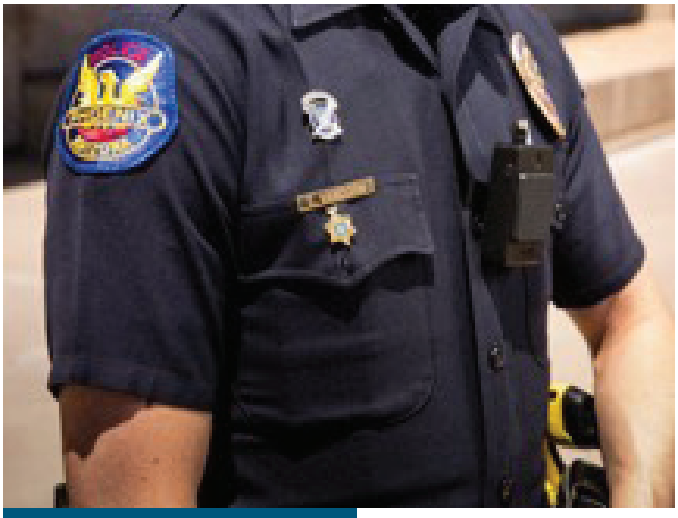
[1] President's Task Force on 21st Century Policing. 2015. Final Report of the President's Task Force on 21st Century Policing. Washington, DC: Office of Community-Oriented Policing Services. p. 31.

I. SPI CASE STUDIES OF TECHNOLOGY IN ACTION

The Phoenix (Arizona) SPI: Body-Worn Cameras

THE TECHNOLOGY

Police officer body-worn cameras (BWCs) are one of the most widely discussed technological innovations in policing today.[2] The BWC captures and records police activity, creating a digital video and audio recording of police encounters with civilians. Although law enforcement experimentation with BWCs dates back to as early as 2005, interest in the technology skyrocketed in 2014 after several highly publicized officer-involved shootings. These events sparked a national debate over police use of force against citizens and police accountability—with BWCs at the center of the debate. Congress and the U.S. Department of Justice have provided substantial financial support and resources for BWCs through the *Body-Worn Camera Policy and Implementation Program* (a funding program for police departments to purchase and implement BWCs) and the development of BJA's *National Body-Worn Camera Toolkit*.[3]



Phoenix Police Department Body-Worn Camera

GOALS

In response to a citywide blue ribbon committee exploring the department's relationship with minority communities, the Phoenix Police Department (PD) was an early adopter of BWCs (the committee actually recommended dashboard cameras, but Phoenix PD believed that BWCs had more potential for positive change). BJA awarded funding through SPI in 2011 to Phoenix PD and its research partners at Arizona State University (ASU) to purchase, deploy, and evaluate BWCs. The Phoenix SPI team examined the implementation and effect of BWCs in six critical areas:

1. Officer camera activation compliance.
2. Officer perceptions of the utility and use of BWCs.
3. Impact on officers' job performance.
4. Impact on public compliance and cooperation.
5. Impact on officer accountability.
6. Impact on domestic violence case processing and outcomes.

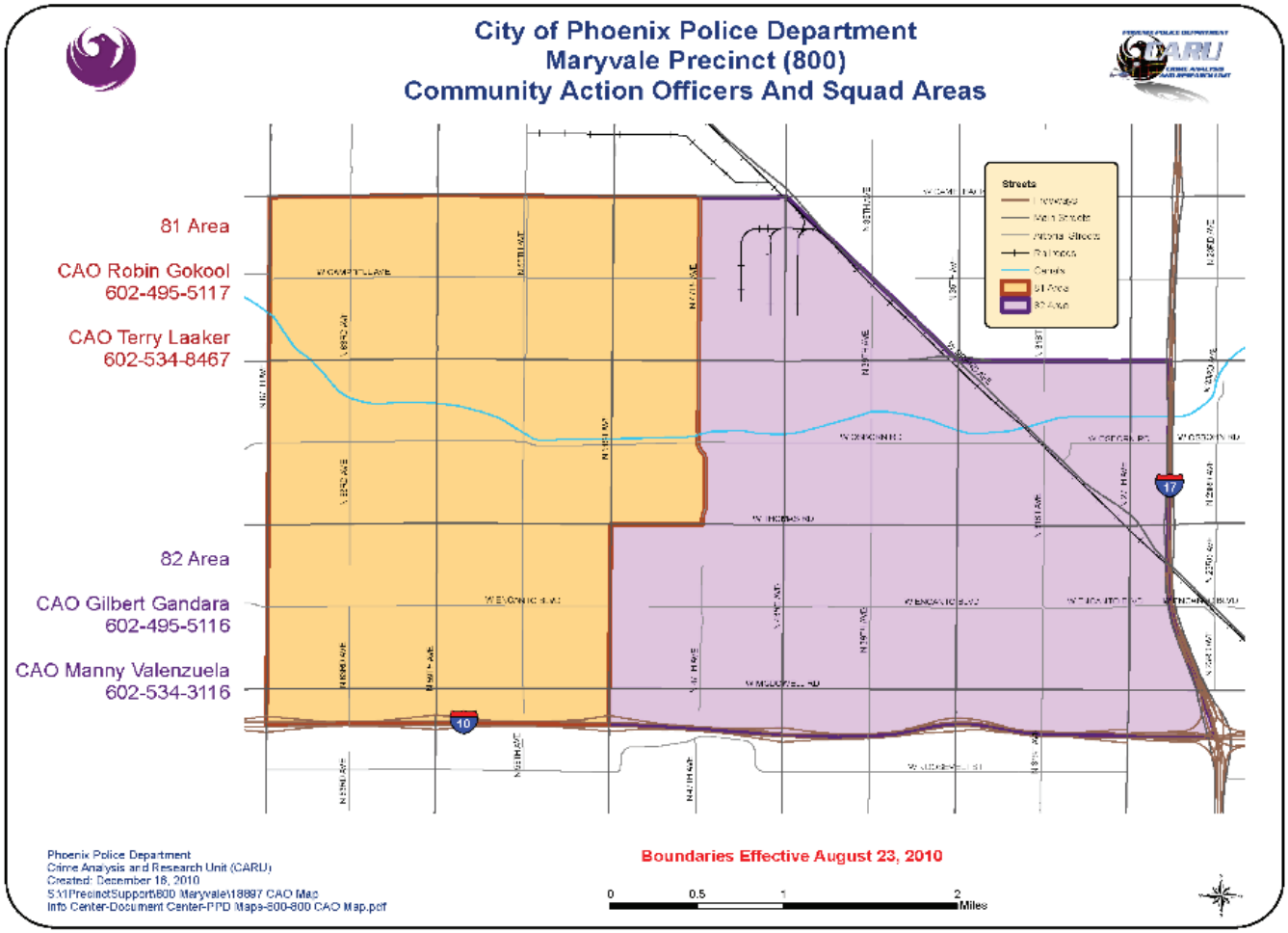
[2] For a complete discussion of the Phoenix SPI, see C. M. Katz, M. Kurtenbach, D. E. Choate, and M. D. White. 2015. *Phoenix, Arizona Smart Policing Initiative: Evaluating the Impact of Police Officer Body-Worn Cameras.* SPI Spotlight Report. Washington, DC: Bureau of Justice Assistance.

[3] See http://www.cops.usdoj.gov/policingtaskforce and https://www.bja.gov/bwc/.

IMPLEMENTATION

The design and implementation of the Phoenix SPI study included the purchase of 56 body-worn camera systems. Beginning in April, 2013, Phoenix PD deployed BWCs to all officers in Area 82 of the Maryvale Precinct, which served as the target group for the study; approximately 50 officers in Area 81 served as the study's comparison group (no BWCs issued—Figure 1).[4] The equipment provided for simultaneous coverage seven days a week, during all three shifts. The study period covered approximately 134 weeks, from January 1, 2012, through July 31, 2014, and the SPI team compared officers who were assigned to wear BWCs with officers who were not assigned to wear BWCs across the six aforementioned outcomes.[5]

FIGURE 1. MARYVALE PRECINCT IN PHOENIX – BWC DEPLOYMENT



[4] In comparing Areas 81 and 82, the SPI team identified some demographic and socioeconomic differences between the two squad areas. Target Area 82 was slightly smaller than Area 81 in population (56,630 vs. 71,676), had a larger percentage of Hispanic residents (82.5 percent vs. 71.1 percent), and had a lower mean household income ($44,895 vs. $53,646). The areas were very similar in terms of crime.

[5] For more detail on the Phoenix SPI, see also the Phoenix SPI Spotlight Report: http://www.strategiesforpolicinginnovation.com/tta/spotlight-reports/phoenix-az-site-spotlight. The Phoenix Police Department recently received another SPI grant to expand their BWC program.

The Pullman (Washington) SPI: Closed-Circuit Television

THE TECHNOLOGY

Closed-circuit television (CCTV) is a technology "in which a number of video cameras are connected in a closed circuit or loop, with the images produced being sent to a central television monitor or recorded."[6,7] Such systems are most commonly used to surveil public places, and CCTV surveillance systems can be either passive or active. In a passive system, the cameras record and store images, although no one is actively monitoring the system; in an active system, the cameras are monitored in real time.[8] The objective of a CCTV system is to prevent crime through deterrence: a would-be offender sees the CCTV and avoids committing a crime because of the perceived risk of apprehension. Welsh and Farrington (2008: 3) conducted a systematic review of more than 40 CCTV evaluations and concluded that "CCTV has a modest but significant desirable effect on crime."[9]

Pullman Police Department Closed-Circuit Television

GOALS

The city of Pullman experienced steadily rising violent crime rates from 2002 to 2007. During that time the Pullman Police Department (PD) implemented a variety of strategies to address the crime problem, but the trend persisted. In fact, between 2008 and 2010, violent crime increased by 45 percent.[10] Violent assaults were especially troubling in the College Hill area, home to Washington State University (WSU). In 2012, the Pullman PD and its research partners at WSU received an SPI grant to implement and evaluate the *Pullman Police Department's Smart Polic[ing] Safety Camera Initiative* (SCI). The SCI centered on the installation of five CCTV safety cameras in pre-identified crime hot spots in the College Hill neighborhood (based on call for service data). The CCTV software allowed for live camera feeds that could be monitored by officers and volunteer WSU students. The goals of the SCI were to "(1) deter individuals from engaging in criminal behavior in the target area, (2) enhance criminal investigations, including investigation of previously unreported crimes, and (3) provide actionable intelligence to support interventions and responses to developing situations."[11]

[6] For more detail on the Pullman SPI, see J. W. Cork, M. J. Gaffney, Z. R. Hays, G. L. Jenkins, D. A. Makin, and E. D. Spencer. 2014. *The City of Pullman Safety Camera Initiative: Resolving Neighborhood Disorder through Innovative Technology and Community Collaboration.* Pullman, WA: Pullman Police Department.

[7] B. J. Goold. 2004. *CCTV and Policing: Public Area Surveillance and Police Practices in Britain.* Oxford: Oxford University Press. For more detail on CCTV, see J. Ratcliffe. 2011. *Video Surveillance of Public Places.* Center for Problem-Oriented Policing Response Guide. Washington, DC: COPS Office.

[8] J. Ratcliffe. 2011. *Video Surveillance of Public Places.* Center for Problem-Oriented Policing Response Guide. Washington, DC: COPS Office

[9] B. C. Welsh and D. P. Farrington. 2008. *Effects of Closed Circuit Television on Crime.* Campbell Systematic Review. Oslo, Norway: Campbell Collaboration.

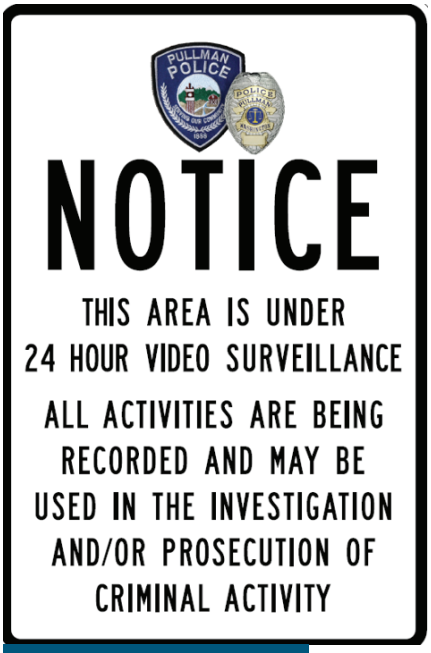
[10] J. W. Cork, M. J. Gaffney, Z. R. Hays, G. L. Jenkins, D. A. Makin, and E. D. Spencer. 2014. The City of Pullman Safety Camera Initiative: Resolving Neighborhood Disorder through Innovative Technology and Community Collaboration. Pullman, WA: Pullman Police Department.

[11] J. W. Cork, M. J. Gaffney, Z. R. Hays, G. L. Jenkins, D. A. Makin, and E. D. Spencer. 2014. The City of Pullman Safety Camera Initiative: Resolving Neighborhood Disorder through Innovative Technology and Community Collaboration. Pullman, WA: Pullman Police Department. p. 2.

IMPLEMENTATION

The five safety cameras were installed in areas specifically identified through analysis of calls for service, Uniform Crime Reporting (UCR) data, and stakeholder interviews. Procuring and installing the system involved considerable effort. The Pullman SPI team also conducted an intensive public awareness campaign that included media stories, presentations at public meetings, and surveys/interviews of citizens and key stakeholders.

The cameras went live in February 2013. The original design did not include real-time monitoring of the cameras, but during the project planning and implementation, the SPI team developed an undergraduate student internship program with WSU whereby criminal justice students received course credit for real-time monitoring of the live camera feeds. Student volunteers underwent background investigations and training, and by the end of the project, more than 100 students had participated in the program. The Pullman SPI evaluation tested the effect of the cameras on criminal activity in the target areas, as well as public perceptions of both the camera program and the Pullman PD more generally (The image below shows an image captured on the SPI CCTV cameras).



Warning Sign for Posted CCTV Cameras

Image of Criminal Suspects Captured on SPI CCTV Cameras

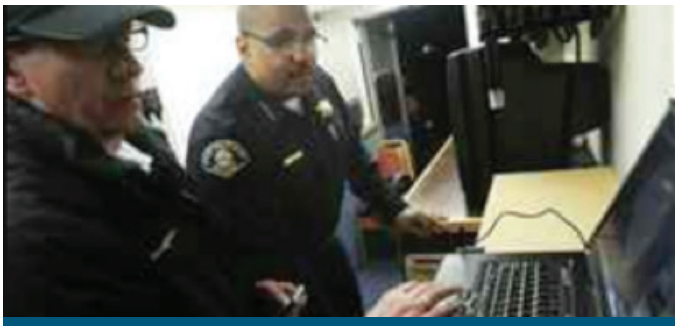
The East Palo Alto (California) SPI: Gunshot Location and Detection Systems

THE TECHNOLOGY

Beginning in the mid-1990s, gunshot location and detection systems (GLDS) emerged as a tool for law enforcement agencies to better track and respond to shots fired in their jurisdictions.[12] "GLDS provide police departments with a more comprehensive understanding of the volume and nature of shootings as they provide real-time, round-the-clock information about shootings including the numbers of rounds fired, the precise location of the incident, and the time and duration of the incident."[13] GLDS includes a series of acoustic sensors placed throughout a jurisdiction that capture and assess sounds.

A GLDS system uses acoustic sensors that are strategically placed in an array of 15-20 sensors per square mile in order to reliably detect and accurately triangulate gunshot activity. Each sensor captures the precise time, location, and audio snippet associated with boom and bang sounds (impulsive noise) that may represent a gunshot. These data are first filtered by sophisticated machine algorithms that are then further qualified by an expertly trained and staffed 24x7 Incident Review Center to ensure the events are in fact gunfire. In addition, they can append critical intelligence to the alert, such as whether a fully automatic weapon was fired. This process takes less than 45 seconds between the actual shooting and the digital alert (with a precise location dot on a map) popping onto the screen of a computer in the 9-1-1 call center.[14]

In one of the few empirical evaluations of GLDS, Mazerolle and colleagues (2000) tested a GLDS by firing blank rounds from several different types of firearms in 32 locations across Redwood City, California.[15] The researchers found that the GLDS technology effectively detected approximately 80 percent of the gunshots and accurately triangulated location (within 25 feet) for 84 percent of shots detected.[16]



East Palo Alto Police Department Using Gunshot Location and Detection Technology
PHOTO CREDIT: HTTP://WWW.THEOAKLANDPRESS.COM/ARTICLE/OP/20090322/NEWS/303229981

GOALS

East Palo Alto is a diverse community of 29,000 in the San Francisco Bay area, encompassing just 2.5 square miles. Despite its small size, East Palo Alto has struggled with gun violence for several years. In 2013, East Palo Alto's violent crime rate of 1,193 per 100,000 was nearly triple the California state average, and over the last several years the police department received, on average, 500 calls for service a year for gun-related incidents. The East Palo Alto Police Department (PD) initially deployed GLDS in the mid-2000s as a rapid response tool. Analysis of the data indicated that many shots fired incidents were not coming to the attention of the police. For example, from 2009 to 2011, there were more than 2,000 activations annually, or an average of 5.77 activations a day.[17]

In 2012, East Palo Alto received an SPI grant to employ a more strategic approach with GLDS. The East Palo Alto SPI was designed to use data from the GLDS system to better understand the nature and location of shots fired and to identify hot spot locations for gunfire. The East Palo Alto SPI team used a problem-oriented policing approach to address gunplay in the identified hot spots. The East Palo Alto SPI team identified seven goals for their project:

1. Document how GLDS had been used by the East Palo Alto PD since its launch in 2009.
2. Understand how PD staff and dispatchers felt about the GLDS systems.
3. Gain an in-depth understanding of shootings over time.
4. Identify chronic shooting hot spots.
5. Use shooting data to help design and implement problem-oriented policing tactics and strategies.
6. Assess the effectiveness of those data-driven problem-oriented policing tactics and strategies.
7. Reduce shootings in chronic hot spots.[18]

[12] For more detail on the East Palo Alto SPI, see S. Lawrence. 2015. *Using a Place-Based Technology to Address Shootings in East Palo Alto, California.* University of California, Berkeley School of Law, Warren Institute on Law and Policy. Smart Policing Initiative Final Report.

[13] S. Lawrence. 2015. *Using a Place-Based Technology to Address Shootings in East Palo Alto, California.* University of California, Berkeley School of Law, Warren Institute on Law and Policy. Smart Policing Initiative Final Report. p. 8.

[14] S. Lawrence. 2015. Using a Place-Based Technology to Address Shootings in East Palo Alto, California. University of California, Berkeley School of Law, Warren Institute on Law and Policy. Smart Policing Initiative Final Report. p. 8.

[15] L. G. Mazerolle, J. Frank, D. Rogan, and C. Watkins. 2000. *A Field Evaluation of the ShotSpotter Gunshot Location System: Final Report on the Redwood City Field Trial.* Washington, DC: U.S. Department of Justice.

[16] L. G. Mazerolle, J. Frank, D. Rogan, and C. Watkins. 2000. *A Field Evaluation of the ShotSpotter Gunshot Location System: Final Report on the Redwood City Field Trial.* Washington, DC: U.S. Department of Justice.

[17] S. Lawrence. 2015. *Using a Place-Based Technology to Address Shootings in East Palo Alto, California.* University of California, Berkeley School of Law, Warren Institute on Law and Policy. Smart Policing Initiative Final Report.

[18] S. Lawrence. 2015. *Using a Place-Based Technology to Address Shootings in East Palo Alto, California.* University of California, Berkeley School of Law, Warren Institute on Law and Policy. Smart Policing Initiative Final Report. p. 9.

IMPLEMENTATION

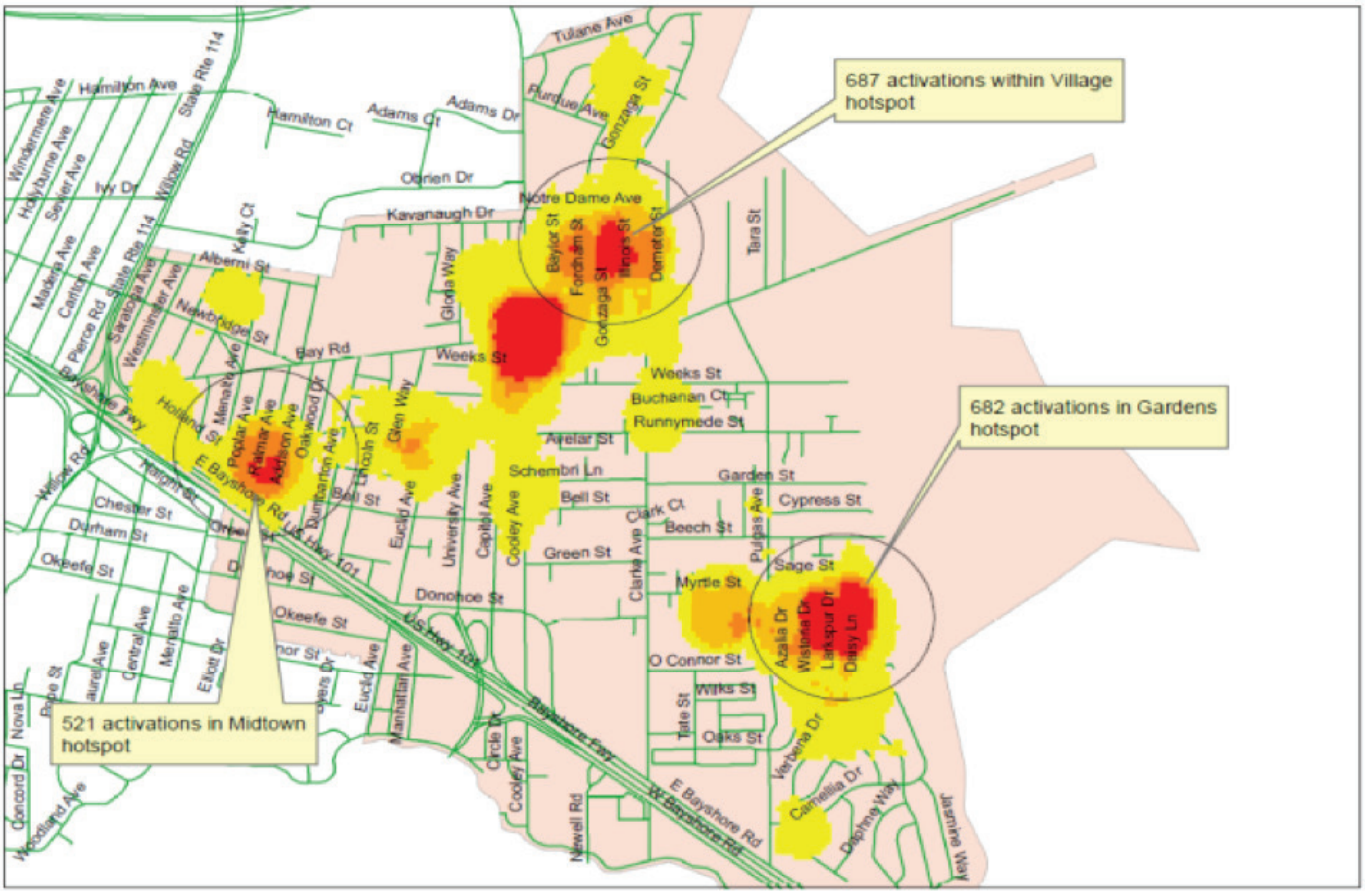
The East Palo Alto SPI team conducted a temporal and spatial analysis of GLDS data from 2009 to 2013. Although gunfire occurred throughout the entire city during this time, the East Palo Alto team identified three persistent hot spots for gunfire: Midtown, University Village, and Gardens. The three hot spots accounted for 13 percent of the land mass in the city but 25 percent of the shootings during the four-year study period (Figure 3). The identified hot spots were stable over time, and temporal analysis showed concentration in gunfire by both day of the week and time of day.[19] Celebratory gunfire on holidays, especially New Year's Eve and the Fourth of July, was also identified as a significant problem.

The East Palo Alto SPI team deployed a problem-oriented policing strategy in the identified hot spots. A Gunshot Reduction Team conducted case reviews of shootings in the hot spots to get a better understanding of the nature of gunfire incidents. The SPI team deployed their intervention, called "Operation Silent Night," from April 24, 2014, through January 31, 2015. The intervention included additional patrols targeted by time and location based on analysis of the shooting data, enhanced searches of probationers and parolees living in the hot spots, and community education and outreach. Although the comprehensiveness of the intervention's enforcement component was limited by department resources (only 60 of the 93 target days during the intervention period actually received additional patrols), the community outreach effort was robust.

The East Palo Alto SPI team focused specifically on celebratory gunfire around the holidays.

On six occasions between May and November 2014, police department staff conducted door-to-door outreach in the targeted areas. Information about GLDS activations and the PD's efforts to reduce gunfire was also distributed at 12 beat meetings. In addition, the PD shared information about Operation Silent Night at five community events. As part of these community education efforts, police officers began leaving fliers at houses that were close to a GLDS activation. While canvassing the area and knocking on doors, officers left fliers that said, "Dear residents, a gunfire incident was reported in your neighborhood on [date] at [time]. If you have any information regarding this incident, please contact the East Palo Alto Police Department."[20]

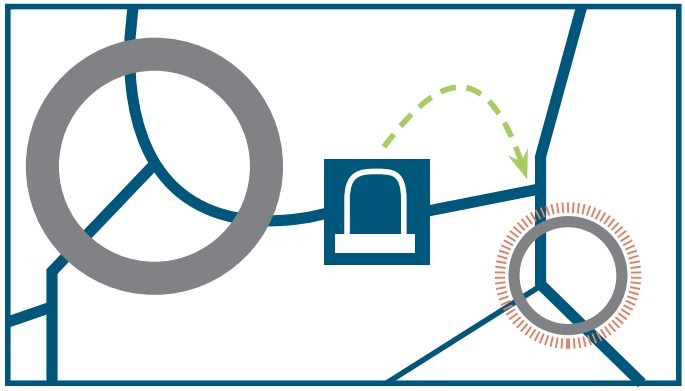
FIGURE 3. EAST PALO ALTO SHOOTING HOT SPOTS, JULY 2009–JUNE 2013



[19] S. Lawrence. 2015. *Using a Place-Based Technology to Address Shootings in East Palo Alto, California.* University of California, Berkeley School of Law, Warren Institute on Law and Policy. Smart Policing Initiative Final Report.

[20] S. Lawrence. 2015. *Using a Place-Based Technology to Address Shootings in East Palo Alto, California.* University of California, Berkeley School of Law, Warren Institute on Law and Policy. Smart Policing Initiative Final Report. p. 26.

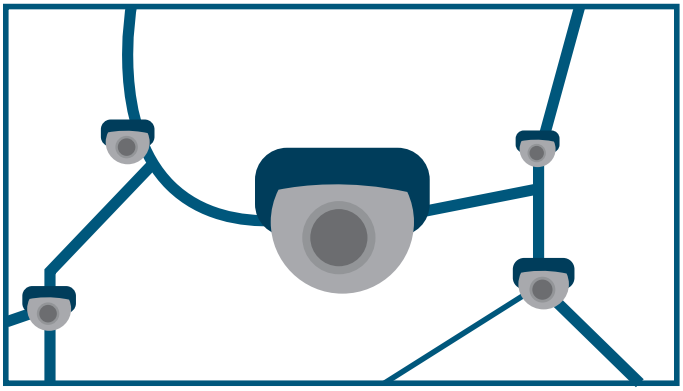
II. BENEFITS OF TECHNOLOGY ACROSS SPI SITES



Targeted Deployment of Limited Resources

One of the benefits of the technologies described in this report involves more efficient deployment of limited police resources, a primary goal of SPI. For example, analysis of GLDS data in East Palo Alto allowed the SPI team to target Operation Silent Night to three concentrated areas in the city where gunfire was most prevalent. The East Palo Alto SPI team focused their intervention both spatially and temporally. Additional patrols occurred Thursday, Friday, and Saturday from 6:00 p.m. to 4:00 a.m., and the community outreach efforts were deployed on, during, and after specific holidays when celebratory gunfire was most common (in the identified hot spots).

The Phoenix SPI deployed a limited rollout of BWCs in one patrol area of one precinct. This limited deployment benefitted the department in two main ways. First, since Phoenix was an early adopter of BWC technology in 2012–13, the knowledge base on implementation, impacts, and consequences of BWCs was quite small. The limited deployment allowed the SPI team to effectively manage implementation challenges as they arose. Second, the Phoenix Police Department received an additional SPI grant in 2016 to deploy and study a much larger, citywide rollout of BWCs. The initial limited deployment provided numerous insights and lessons learned as the Phoenix SPI II goes to scale.



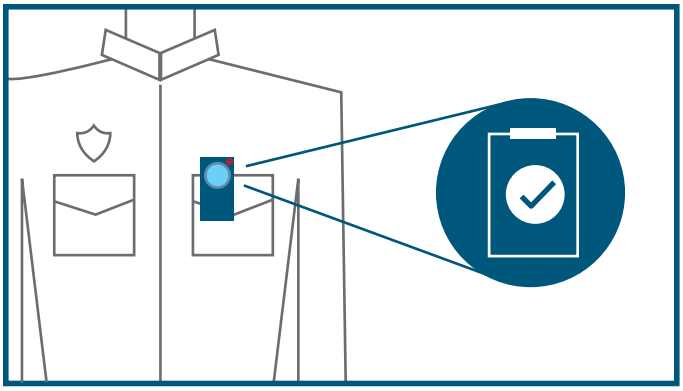
Enhanced Understanding of High-Crime Places and People

The technologies described in this report clearly provided SPI teams with a more complete understanding of crime in their jurisdictions. In East Palo Alto, the SPI team used GLDS as a strategic intelligence tool to identify and target gunfire hot spots both spatially and temporally. Moreover, once the hot spots were identified, the SPI team conducted case reviews of gunfire incidents using available police reports and UCR data. This additional level of analysis improved their understanding of both the locations and likely offenders in those locations, as well as the days and times when gunfire was most likely to occur.

In Pullman, the CCTV project was specifically designed to improve the police department's awareness of criminal activity in the target area through identification of unreported crimes, as well as through intelligence that would lead to interventions by police with developing situations—both criminal and otherwise. In their final report, the Pullman SPI team noted:

Over the course of this project, camera operators have reported a range of public safety and crime issues to the emergency dispatch center and to the Department, including such recurring observed crimes as assaults and public intoxication, as well as other situations requiring medical intervention. The observation and notifications provided by the interns have enhanced response through both independent notification of events and logging of video evidence through active camera control, benefits confirmed by officer interviews. [21]

[21] J. W. Cork, M. J. Gaffney, Z. R. Hays, G. L. Jenkins, D. A. Makin, and E. D. Spencer. 2014. *The City of Pullman Safety Camera Initiative: Resolving Neighborhood Disorder through Innovative Technology and Community Collaboration.* Pullman, WA: Pullman Police Department. p. 38.



Organizational Impact

SPI sites experienced significant positive impacts from deploying new technologies. The Phoenix study found that BWCs amplified arrest activity, as camera-wearing officers increased their average daily arrests by 42.6 percent, nearly triple the increase observed among comparison group officers (14.9 percent). This finding contradicts concerns that BWCs may cause officers to become more passive.[22] Also, BWCs appeared to significantly reduce complaints against officers (23 percent drop) when compared with officers in the other squad area (10 percent increase). Last, BWCs improved the processing of domestic violence incidents, as cases with video were more likely to be charged and successfully prosecuted (Table 1).[23]

The Pullman SPI produced several positive effects. Most notably, the CCTV system provided prosecutors with direct evidence of criminal activity—used, for example, in a high-profile case involving a violent assault on a WSU professor. More generally, "The SCI cameras did regularly capture criminal conduct, both reported and unreported, and allowed officers to initiate or enhance investigations. Additionally, reports made by the student observers from the WSU intern program allowed the police to intervene early in situations involving behaviors that might have led to serious crimes or posed a safety risk."[24] The research partners in Pullman also found a link between deployment of the SPI cameras and increased citizen satisfaction with police (based on citizen surveys).

TABLE 1. DOMESTIC VIOLENCE CASES: CASE FLOW, BY OFFICER GROUP (APRIL 2013–JULY 2014)

	Post-Deployment			
	Target Group (BWC Video)		Comparison Group (No Video)	
	N	%	N	%
Number of Domestic Violence–Related Contacts	252	100.0	933	100.0
Cases Initiated	103	40.9	320	34.3
Charges Filed	90	37.7	243	26.0
Case Furthered (Not Dismissed)	32	12.7	58	6.2
Pled Guilty	11	4.4	11	1.2
Guilty at Trial	11	4.4	9	0.9

[22] The increase in arrest activity could also signal an impact on police officer discretion (i.e., officers are more likely to handle encounters formally than informally when assigned BWCs). This is a valid concern that warrants additional study.

[23] C. M. Katz, M. Kurtenbach, D. E. Choate, and M. D. White. 2015. *Phoenix, Arizona Smart Policing Initiative: Evaluating the Impact of Police Officer Body-Worn Cameras.* SPI Spotlight Report. Washington, DC: Bureau of Justice Assistance.

[24] J. W. Cork, M. J. Gaffney, Z. R. Hays, G. L. Jenkins, D. A. Makin, and E. D. Spencer. 2014. *The City of Pullman Safety Camera Initiative: Resolving Neighborhood Disorder through Innovative Technology and Community Collaboration.* Pullman, WA: Pullman Police Department.

III. CHALLENGES AND LESSONS LEARNED

Unrealistic Expectations

Many assume the latest technological innovation will solve police problems or drastically reduce them. For example, some thought the introduction of the taser and other conducted electrical weapons (CEWs) would eliminate the need for police to use deadly force. And the development of early intervention systems was supposed to put an end to police misconduct. Each of the aforementioned technologies has improved policing, but they are not "silver bullets" that single-handedly eliminate the targeted problems. The actual impact of an innovation is shaped by a wide range of issues that are specific to each agency, each community, and each technology. Moreover, technology vendors can be very aggressive in their marketing efforts, and it is important for police departments to be educated consumers.

The technologies reviewed here are no different. BWCs, for example, produce substantial benefits and clearly have the potential to positively redefine police encounters with citizens. Nevertheless, there are limits to what a BWC program can achieve—especially in communities where the police-citizen relationship is one of longstanding anger and distrust. BWCs on their own cannot alter that relationship. Expectations for the impact of BWCs must be reasonable. Results from a handful of early studies have demonstrated dramatic declines in citizen complaints against police and officer use of force, but those effects are not the norm.[25] And in Pullman, the notion that CCTVs will reduce crime rests on deterrence theory—would-be offenders become aware of the CCTV and, through a rationally thought-out cost-benefit analysis, decide that the risks of committing crime exceed the benefits. However, empirical evidence in support of deterrence theory is modest at best.[26] For example, people are not always aware, or fully aware, of the new technology, or they might not believe the police will react swiftly to an offense.

In sum, technologies such as BWCs, gunshot detection systems, and CCTV can benefit policing, but users of the technology must be realistic about its benefits. The SPI teams in Phoenix, Pullman, and East Palo Alto worked diligently to educate and inform all stakeholders about the technology, to answer questions and concerns, and to keep open lines of communication throughout the course of the project.

Human Problems

New technologies can present a host of "human" challenges for police departments, the biggest of which is buy-in among rank-and-file officers. In simple terms, technologies that are not well accepted or well understood will not be used effectively. The Phoenix SPI presents the best example of this point. Phoenix adopted BWCs several years before the technology became widely promoted as a police accountability tool. And perhaps not surprisingly, officers were skeptical about the technology. As a consequence, acceptance of BWCs in the Phoenix SPI was mixed. An examination of activation compliance found that officers frequently did not turn on the BWCs when policy dictated that they should: officer compliance was under 30 percent overall and varied significantly by call type (between 6 and 48 percent). As a consequence, the department has altered its approach to monitoring activation, and has adopted a more formal approach to BWC policy violations.

In Pullman, the potential impact of the CCTV system was initially limited because of the resources required for real-time, proactive observation of the cameras. Although the student internship program provided undergraduate volunteers for proactive observation, problems were still encountered, as interviews with Pullman officers indicated:

The cameras did not always meet officer expectations, and sometimes did not provide important information because of the way they were positioned or controlled. We heard several times that cameras had "just missed" a critical event because they were pointed in the wrong direction, or that a student intern operator had inadvertently zoomed in too far to provide a useful overview of a developing situation.[27]

Resource problems limited the impact of the intervention in East Palo Alto as well. The supplemental patrols in the gunfire hot spots were scheduled for Thursday, Friday, and Saturday nights over a period of 41 weeks, and of the 93 scheduled deployment days, the department had available manpower for additional patrols on only 60 of those days (65 percent of the total).

Experiences from all three sites highlight the importance of remaining nimble when it comes to technology implementation. Problems can emerge quickly and derail a project. Agency leaders must be vigilant to identify problems early on, and then quick to develop solutions to address those problems.

[25] B. Ariel, W. A. Farrar, and A. Sutherland. 2015. The Effect of Police Body-Worn Cameras on Use of Force and Citizens' Complaints against the Police: A Randomized Controlled Trial. *Journal of Quantitative Criminology,* 31(3): 1–27; Mesa Police Department. 2013. *On-Officer Body Camera System: Program Evaluation and Recommendations.* Mesa, AZ: Mesa Police Department.

[26] T. C. Pratt, F. T. Cullen, K. R. Blevins, L. E. Daigle, and T. D. Madensen. 2006. The Empirical Status of Deterrence Theory: A Meta-analysis. In *Taking Stock: The Status of Criminological theory.* pp. 367–395 in F. T. Cullen, J. P. Wright, and K. R. Blevins (Eds.), *Taking Stock: The Empirical Status of Criminological Theory—Advances in Criminological Theory.* Volume 15. New Brunswick, NJ: Transaction.

[27] J. W. Cork, M. J. Gaffney, Z. R. Hays, G. L. Jenkins, D. A. Makin, and E. D. Spencer. 2014. *The city of Pullman Safety Camera Initiative: Resolving neighborhood disorder through innovative technology and community collaboration.* Pullman, WA: Pullman Police Department. p. 33.

Technology Problems

The deployment of new technology may bring its own set of challenges. For example, BWCs are relatively easy to purchase and deploy on officers, but the issues surrounding BWCs are tremendously complex, ranging from questions of policy and training to data storage, records retention, and public access to video.[29] Katz et al. note that "A BWC program affects all units in the police department, as well as numerous outside stakeholders including prosecutors and defense attorneys. Any police chief who is contemplating the creation of a BWC program should carefully consider its resource implications."[29]

In Pullman, the SPI team encountered a range of technological difficulties—from dense foliage, hardware installation issues, and limited telecom support to problems with cellular connectivity and providing secure viewing access to student volunteers.

In East Palo Alto, the deployment of GLDS technology also encountered technological difficulties. In their final report, the East Palo Alto SPI team acknowledged some concerns with the data quality:

> The technology provides a new measure of gunfire that is probably a closer estimate of the universe of shootings relative to more traditional data sources such as calls for service…. Despite these strengths, using GLDS data in the aggregate should be approached with some caution. Raw data taken directly from the system is not necessarily "clean" and an in-depth examination of the records will help identify outliers, such as the system being down for days for maintenance or temporary, "artificial" hot spots from construction sites. An overall quality assessment is warranted when using GLDS data in the aggregate.[30]

Gunshot detection systems also come with a substantial financial commitment. Though estimates vary, costs reportedly run from $40,000 to $60,000 per square mile annually, with an additional $10,000 one-time activation fee.[31] Cost also presents a substantial barrier for BWCs, especially for long-term data storage. The key is for agency leaders to "do their homework" so costs and other technology challenges can be identified early and accounted for in the larger implementation plan.

Evaluation Difficulty

Researchers may face numerous challenges when evaluating the implementation and impact of new technologies. Rigorous research designs, such as randomized controlled trials, often must be modified or, in some cases, abandoned. Comprehensive process evaluations are essential to fully understand the difficulties surrounding the proper planning and deployment of the technology.

Ethical and practical concerns arise with the rigorous evaluation of BWCs and other technologies. For example, a randomized controlled trial, the gold standard of research designs, requires that some officers will NOT receive BWCs. Does depriving some officers of BWCs place them at greater risk of negative outcomes, such as receiving citizen complaints? Does the decision to deploy BWCs in some areas (or on some shifts) but not others deprive citizens in those "control" areas of the benefits of BWCs? Should adherence to principles of rigorous research be sacrificed for practical concerns, such as the mandatory assignment of BWCs to certain at-risk officers or certain units? The randomization process is also complicated by movement of officers throughout the department (shift re-bid, promotions, retirements, etc.).

The same concerns arise with GLDS. For example, in a randomized controlled trial some gunfire hot spots would serve as control areas and would not receive an intervention. What about the people who live in those control hot spots? Are they being placed at risk through the application of a rigorous research design? These are difficult questions that must be resolved collaboratively among the researchers and department leadership. In many cases, the desire for a randomized controlled trial will have to give way to practical concerns. In the Phoenix, Pullman, and East Palo Alto projects, the SPI teams devised quasi-experimental designs that still offered reasonable assessments of the interventions.

[29] C. M. Katz, M. Kurtenbach, D. E. Choate, and M. D. White. 2015. *Phoenix, Arizona Smart Policing Initiative: Evaluating the Impact of Police Officer Body-Worn Cameras.* SPI Spotlight Report. Washington, DC: Bureau of Justice Assistance. p. 13.

[30] S. Lawrence. 2015. *Using a Place-Based Technology to Address Shootings in East Palo Alto, California.* University of California, Berkeley School of Law, Warren Institute on Law and Policy. Smart Policing Initiative Final Report. p. 36.

[31] S. Lawrence. 2015. *Using a Place-Based Technology to Address Shootings in East Palo Alto, California.* University of California, Berkeley School of Law, Warren Institute on Law and Policy. Smart Policing Initiative Final Report.

IV. LOOKING AHEAD

The SPI projects in Phoenix, Pullman, and East Palo Alto have been completed, but new SPI sites funded in 2014 and 2015 also have embraced technology as a core feature of their projects. BJA funded three agencies in 2015 to deploy and evaluate BWCs: Miami Beach, Milwaukee, and Phoenix. All three are employing rigorous research designs (randomized controlled trials) to investigate important questions about the impact of BWCs on a range of outcomes, from complaints and use of force to criminal case processing and citizen perceptions. Notably, two of the sites (Miami Beach, Milwaukee) are conducting cost-benefit analyses that will provide important insights on the net value of BWCs for a law enforcement agency.

V. FINAL THOUGHTS

The case studies in this report demonstrate two important points about effective utilization of technology, a central principle of SPI. First, hardware technologies such as BWCs, CCTV, and gunshot detection systems come with both promise and challenges. Agency leaders should proceed cautiously and consider the consequences and costs (financial and otherwise) of deploying a technology. As with any innovation, implementation should be defined by a collaborative planning process.

Second, the technologies described here have clearly benefitted the SPI agencies in several ways, from more efficient deployment of resources to enhanced understanding of crime-prone people and places. The experiences of SPI sites with BWCs, CCTV, and gunshot detection systems thus offer important insights to other agencies about the limitations and benefits that can be expected when deploying such technologies.

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