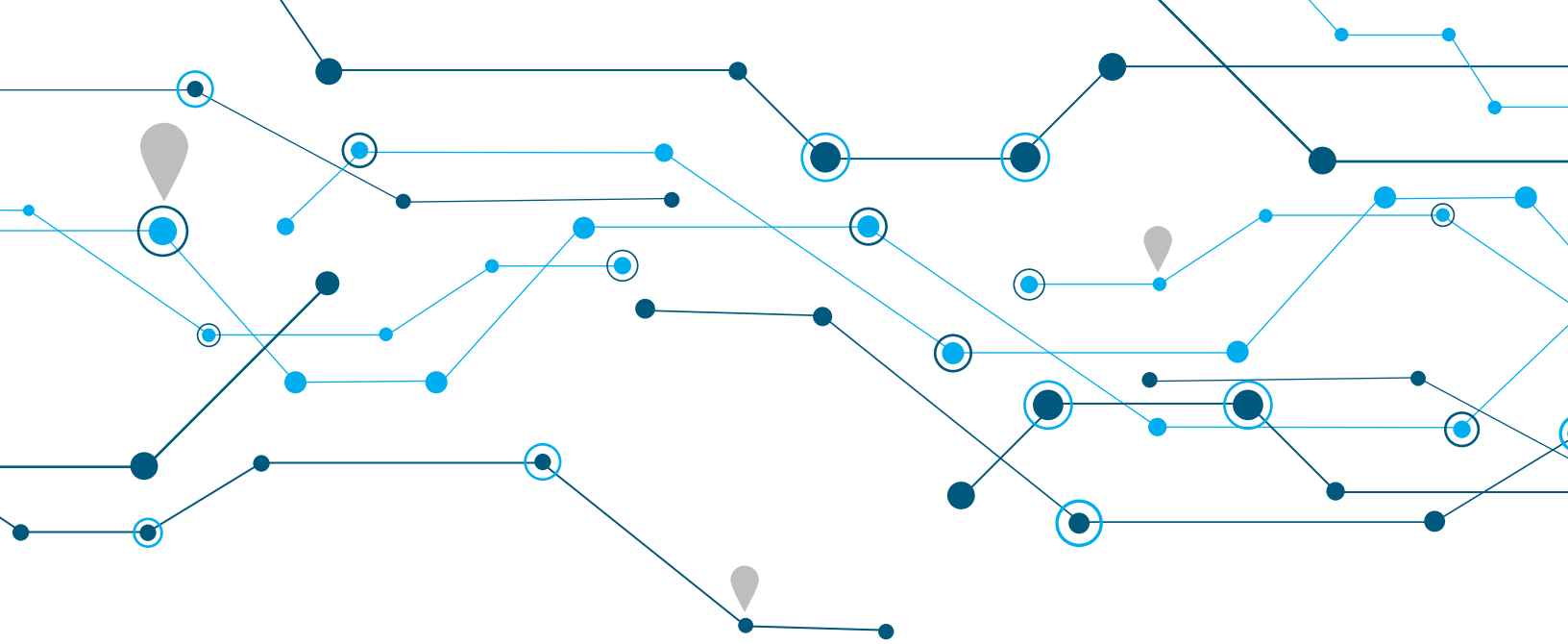

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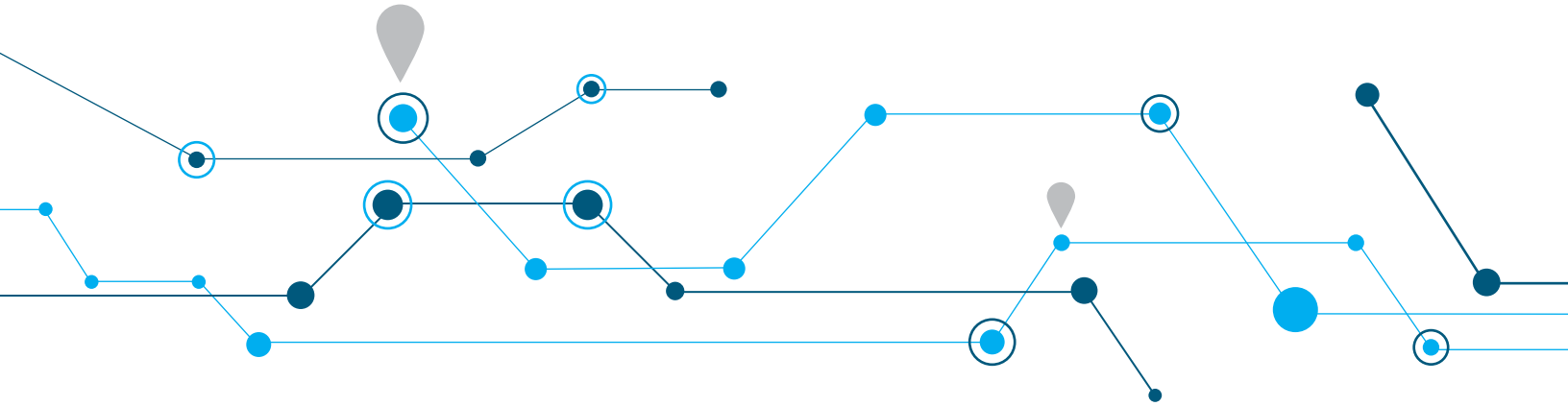
THE ROLE OF TECHNOLOGY IN THE STRATEGIES FOR POLICING INNOVATION PROGRAM:

Challenges, Solutions, and Lessons Learned

Andrew M. Fox, Christopher M. Sedelmaier, and Michael D. White



Strategies for Policing Innovation

CNA

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Policing Innovations: Research Snapshot

Effective use of technology is one of the foundational principles of the Bureau of Justice Assistance Strategies for Policing Innovation (SPI) program. Over the last eight years, SPI sites have deployed and tested a wide range of innovative strategies and tools to support their crime reduction efforts, several of which have been documented in SPI Spotlight Reports. Many of the sites have witnessed positive results from their SPI interventions—from reductions in crime and disorder to improved citizen perceptions of the police. Other sites have not achieved the expected results, largely because they struggled with proper implementation of their intervention or program.

This SPI Spotlight Report, the second in a two-part series highlighting technology's role in SPI, focuses on software innovation. The report provides case study reviews of four sites whose initiatives implemented two software technologies: risk terrain modeling (New Haven, Connecticut) and social network analysis (Cincinnati, Ohio; Glendale, Arizona; and Kansas City, Missouri).

Each case study review briefly describes the technology, the SPI project goals and implementation, and the impact on the targeted outcome (crime). The report then reviews the benefits offered by the software innovation across sites, including more efficient deployment of limited resources and enhanced understanding of high-crime places and people. In each case, the report offers specific, concrete examples of how the technology has made valuable contributions to the efficient and effective functioning of the SPI agencies.

However, the integration of technology comes with challenges, and the experiences of the SPI sites offer a number of lessons learned. This report delves into the challenges associated with unrealistic expectations about technology's impact and the problems created by unreasonable program objectives. The report also explores human problems that can derail implementation—such as a lack of buy-in at the line level. The deployment of new technology may present its own set of barriers—from cost and infrastructure requirements to the need for specialized training and staff. Some new technologies also face opposition from various stakeholders inside and outside the police department. Moreover, the implementation of new technologies are often difficult to evaluate, leaving researchers with tough decisions about how to best carry out rigorous evaluations. Last, sustainability can be a significant challenge, given shifting priorities and leadership change.

The report also offers a look ahead at other recently funded SPI sites deploying software technologies, including prolific offender identification (Toledo, Ohio), risk terrain modeling (Detroit, Michigan). The report concludes with some final thoughts on the important role of technology in contemporary policing to reduce crime and enhance police capabilities.

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

Andrew M. Fox, Christopher M. Sedelmaier, and Michael D. White

The last 30 years have arguably been the most innovative in the history of policing. Since the mid-1980s, a host of new strategies have emerged on the law enforcement landscape—from problem-oriented policing[1] and community-oriented policing to, more recently, hot spot policing; focused deterrence/pulling levers (for example, targeted offender strategies); intelligence-led policing; predictive policing; and now, through the Bureau of Justice Assistance (BJA) Strategies of Policing Innovation (SPI) program, a comprehensive effort to embrace analysis, research, and technology. The innovation in strategies has been supported by the development of new technologies, such as geographic information systems (GIS), advanced analytics, forensics, social network analysis, risk terrain modeling, license plate readers, less lethal alternatives (pepper spray, TASER), gunshot detection and tracking systems (NIBIN), and body-worn cameras.

The tremendous innovation in how police go about their daily business (strategies) and the tools they use to conduct that business (technologies) is reflected in the spirit of the BJA's SPI program. Innovation is one of the foundational principles of SPI, as funded agencies are encouraged to "develop and test new approaches to crime prevention and crime control, new applications of existing approaches, or applications of existing evidence-based approaches that have not been implemented previously in the funded jurisdiction."[2] 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 well-established law enforcement technologies, such as geographic information systems (GIS), closed-circuit television (CCTV), and gunshot detection systems. In other cases, SPI agencies have blazed a new trail as early adopters of technology—most notably, police body-worn cameras, social network analysis, and risk terrain modeling.

This Strategies for Policing Innovation Spotlight Report focuses on the role of software technologies in SPI and highlights its central importance through case study reviews of SPI sites. The featured technologies and respective sites include risk terrain modeling (RTM) (New Haven, Connecticut) and social network analysis (SNA) (Cincinnati, Ohio; Glendale, Arizona; and Kansas City, Missouri). Each case study review provides an overview of the technology, the project goals, the technology's implementation, and the impact on the targeted outcome (crime). The report then discusses the benefits produced by the technologies across SPI sites and some of the challenges and lessons learned from their deployment. Last, we look ahead to SPI sites in the early stages of deploying other innovative software technologies, including Toledo (OH), and Detroit (MI).

[1] H. Goldstein, "Improving Police: A Problem-Oriented Approach," *Crime & Delinquency* (1979): 236–258.
[2] J. R. Coldren, A. Huntoon, and M. Medaris. "Introducing Smart Policing: Foundations, Principles, and Practice," *Police Quarterly* 16, no. 3 (2013): 275–286, p. 278.

I. POLICING INNOVATIONS: CASE STUDIES OF TECHNOLOGY IN ACTION

Risk Terrain Modeling: The New Haven SPI

THE TECHNOLOGY

Traditional methods of identifying high-crime areas rely on geographic crime analysis and PIN maps, whereby hot spots are determined by mapping locations of crimes known to police using computer programs to create near-real-time crime incident maps.[3] Research has demonstrated that hot spots can generate as much as 40 percent of serious crime in less than 4 percent of addresses.[4] This approach is at the core of hot spot policing. One disadvantage of this approach is that police are sometimes placed in a reactionary position simply "chasing the dots around the map."[5] Though some research suggests that crime-prone areas can be remarkably stable over time,[6] other studies have found that hot spots can be transitory and affected by the presence or absence of certain environmental features.[7] Moreover, the potential to change crime risk by altering the environment is the foundation of several criminological theories, such as situational crime prevention and crime prevention through environmental design (CPTED).[8] RTM takes a more holistic approach to the geography of crime by accounting for the locations of environmental factors and infrastructures that increase the risk of criminal activity. Grounded in criminology theory, RTM merges crime analysis with the confluence of risky environmental features such as "convenience stores, gas stations, ATM machines, and gang territories."[9] RTM provides police departments with a more informed and comprehensive picture of at-risk crime locations in officers' beats, allowing for better targeted deployment of resources and personnel.[10]

GOALS

In the mid-2000s, New Haven experienced an upsurge in youth violence, driven largely by an emerging gang problem. In 2011, New Haven witnessed its highest number of murders since the early 1990s, as well as a large number of shootings and firearm discharges. The violence was concentrated in one police district—the Newhallville neighborhood—and distrib-uted among multiple hot spots. The New Haven SPI team sought to address violence by identifying micro target areas in Newhallville through RTM and deploying supplementary officers on foot patrol to those micro hot spots. While on directed foot patrol in the RTM-identified hot spots in Newhallville, officers engaged in both problem-oriented policing[11] and community outreach and engagement.

> *New Haven's Newhallville neighborhood was a persistent trouble spot with regard to violent crime, particularly firearm-related offenses. New Haven's SPI team was directed to reduce violent crime and gun offenses in the Newhallville neighborhood using a combination of directed foot patrol and problem-oriented policing techniques incorporating risk-terrain modeling (RTM) as a method of prioritizing officer deployment.*
>
> Dr. Chris Sedelmaier,
> New Haven SPI Research Partner

[3] For a complete discussion of New Haven SPI, see C. Sedelmaier and N. Kroovand Hipple, *New Haven, CT, Smart Policing Initiative: Employing Evidence-Based Policing Strategies to Engage the Community and Reduce Crime,* Smart Policing Initiative Spotlight Report (Washington, DC: Bureau of Justice Assistance, 2016).

[4] L. W. Sherman Lawrence, "Repeat Calls for Service: Policing the 'Hot Spots,'" in *Police and Policing: Contemporary Issues,* ed. D. J. Kenney (New York, NY: Praeger Publishers, 1989), 150–65.

[5] C. Sedelmaier and N. Kroovand Hipple, *New Haven, CT, Smart Policing Initiative: Employing Evidence-Based Policing Strategies to Engage the Community and Reduce Crime,* Smart Policing Initiative Spotlight Report (Washington, DC: Bureau of Justice Assistance, 2016), 7.

[6] A. A. Braga, A. V. Papachristos, and D. M. Hureau, "The Concentration and Stability of Gun Violence at Micro Places in Boston, 1980–2008," *Journal of Quantitative Criminology* 26, no. 1 (2010): 33–53.

[7] L. M. Dario, W. J. Morrow, A. Wooditch, and S. G. Vickovic. 2015. The Point Break Effect: An Examination of Surf, Crime, and Transitory Opportunities. *Criminal Justice Studies* 28, no. 3 (2015): 257–279.

[8] R. Clark. "Situational Crime Prevention," in *Building a Safer Society: Strategic Approaches to Crime Prevention,* ed. M. Tonry and D. Farrington (Chicago: University of Chicago Press, 1995), 91–150. For CPTED, see: http://www.cpted.net/.

[9] C. Sedelmaier and N. Kroovand Hipple, *New Haven, CT, Smart Policing Initiative: Employing Evidence-Based Policing Strategies to Engage the Community and Reduce Crime,* Smart Policing Initiative Spotlight Report (Washington, DC: Bureau of Justice Assistance, 2016), 7.

[10] For more information on the use of RTM in policing, see http://www.riskterrainmodeling.com/risk-based-policing.html.

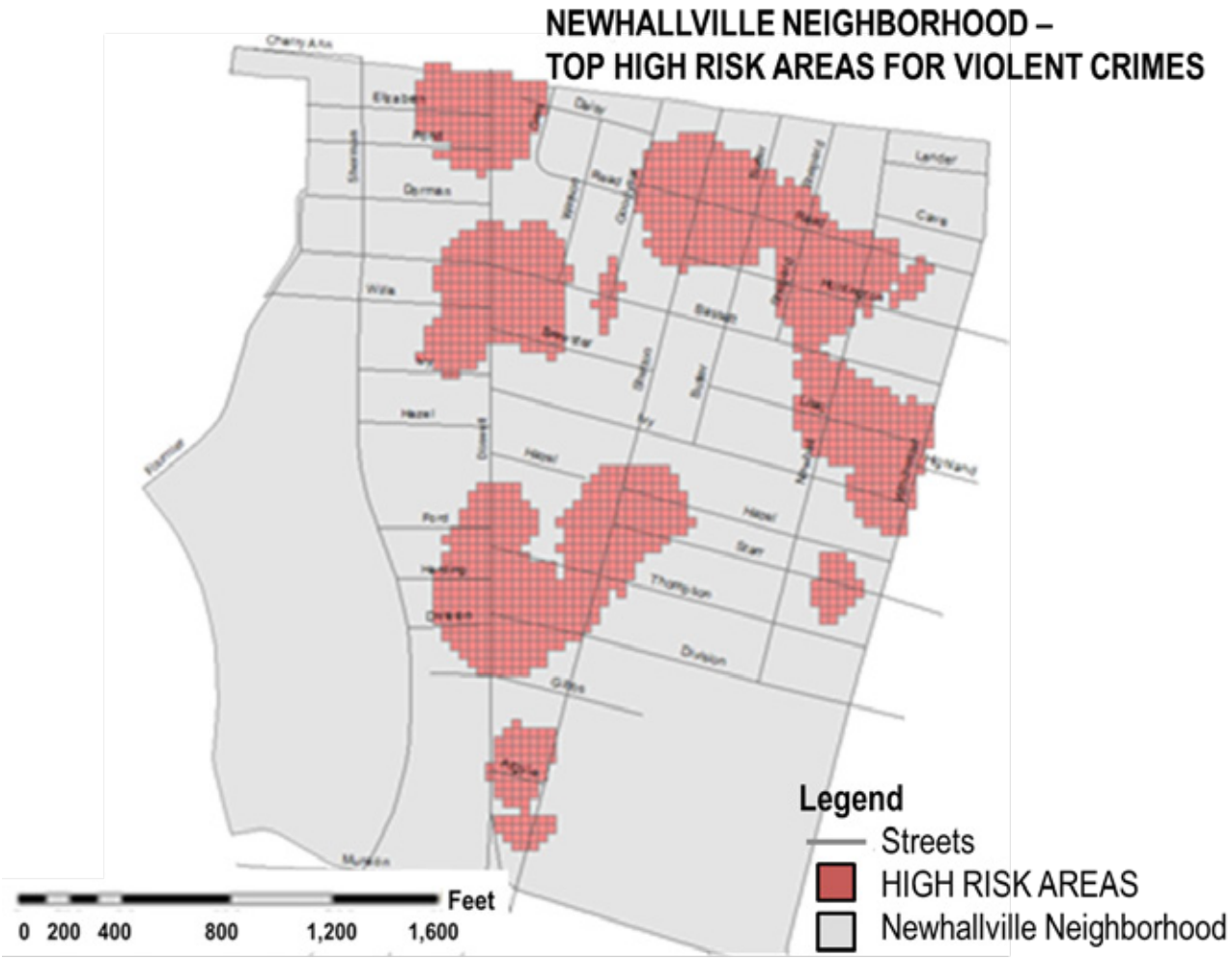
[11] The New Haven SPI team implemented a modified form of the SARA model (scanning, analysis, response, assessment) whereby line officers engaged in scanning only and the first-level supervisors (sergeant, lieutenant), crime analysts, and research partner carried out the remaining phases. See C. Sedelmaier and N. Kroovand Hipple, *New Haven, CT, Smart Policing Initiative: Employing Evidence-Based Policing Strategies to Engage the Community and Reduce Crime,* Smart Policing Initiative Spotlight Report (Washington, DC: Bureau of Justice Assistance, 2016).

IMPLEMENTATION

The New Haven SPI team, led by the crime analysts and research partner, carried out the RTM analyses in Newhallville using violent and property crime data, quality-of-life calls for service, the location of risky infrastructural services (such as convenience stores, restaurants/cafes, package and liquor stores, bars, banks, and gas stations), locations of bus stops and schools, and the known home addresses of ex-offenders (parolees, probationers, and other former prisoners). The identified risk areas, accounting for about one-fifth of the land area in Newhallville, were micro hot spots ideally suited for foot patrol (Figure 1). Using RTM, the SPI team further identified four neighborhoods to serve as comparison areas (Edgewood, Fair Haven, Hill, and West River). The comparison neighborhoods were similar to Newhallville in population density, percentage of residents below the poverty line, minority population, and median income. In July 2013, the New Haven SPI team began 13 weeks of supplementary directed foot patrols in the RTM-identified hot spots in Newhallville.[12] Officers were given two responsibilities during the four-hour supplemental foot patrol shifts: scan and analyze for problems and engage with residents.

[12] The New Haven Police Department had already implemented foot patrols citywide. The SPI project targeted additional foot patrols to the RTM-identified hot spots in Newhallville. Each supplemental foot patrol lasted four hours.

FIGURE 1. RTM-IDENTIFIED HOT SPOTS IN NEWHALLVILLE



New Haven Police Department officer on a foot patrol

IMPACT

The New Haven SPI project documented significant crime declines in Newhallville both during and after intervention. Sedelmaier and Kroovand Hipple note:

> Over the 13-week intervention period, Newhallville saw a 19 percent reduction in violent crime neighborhood-wide and a 36 percent reduction in violent crime within the high-risk areas over the same period. In the 13 weeks following the intervention, there was a further 41 percent violent crime drop at the neighborhood level and a 56 percent drop in the high-risk areas. Newhallville was the only neighborhood in the study to see period-over-period reductions in violent crime at both levels.[13]

> *In the 13-week intervention period, violent crime (homicide, robbery, aggravated assault, and firearm discharge) decreased by 19% in the Newhallville neighborhood as a whole and by 36% in the RTM-identified high risk areas. Identifying these areas through RTM guided officer activity toward the very blocks where it might have the most impact. Given the perpetual need to "do more with less," RTM proved most useful in increasing return on investment of departmental re-sources.*
>
> Dr. Chris Sedelmaier,
> New Haven Research Partner

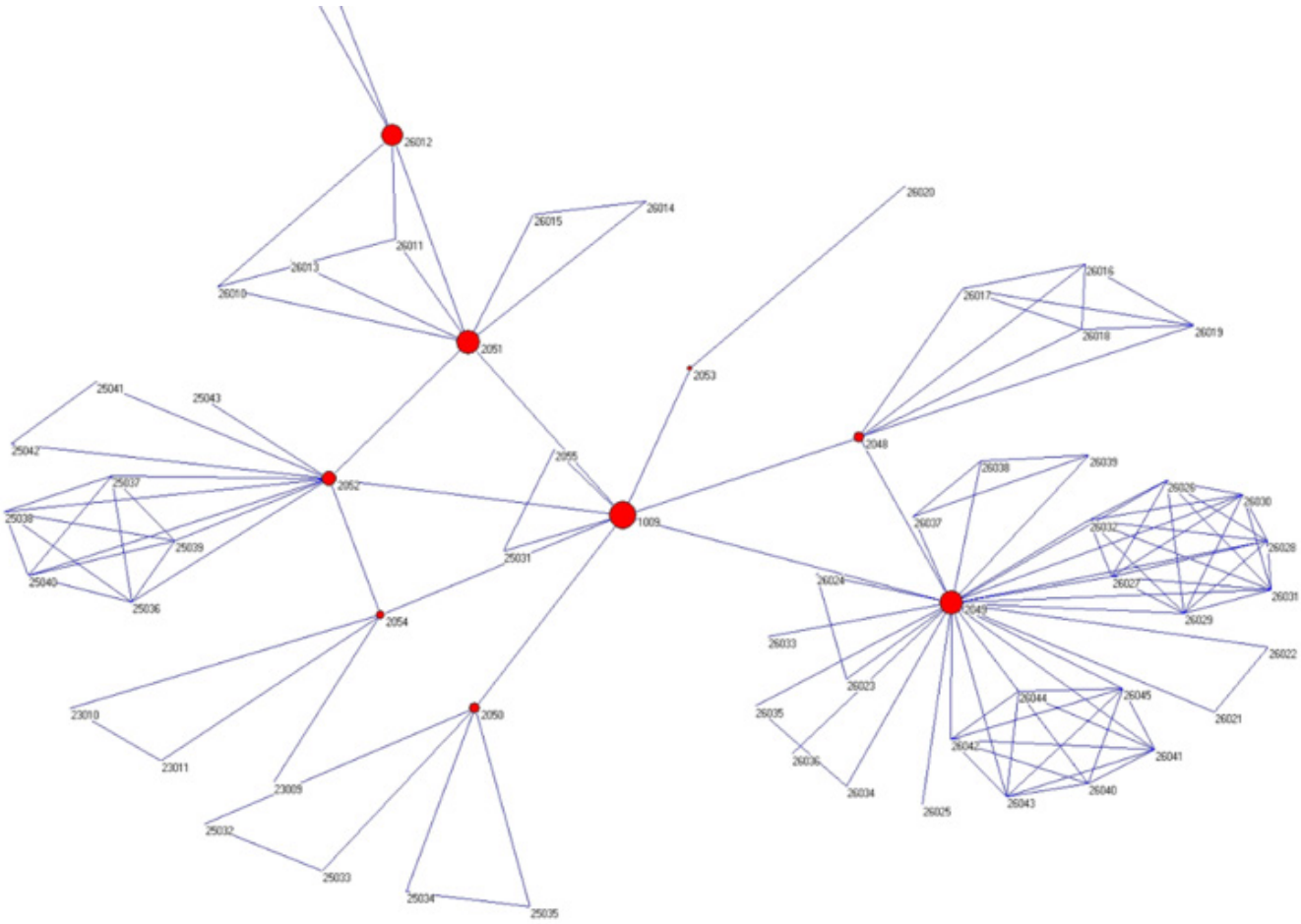
[13] C. Sedelmaier and N. Kroovand Hipple, *New Haven, CT, Smart Policing Initiative: Employing Evidence-Based Policing Strategies to Engage the Community and Reduce Crime,* Smart Policing Initiative Spotlight Report (Washington, DC: Bureau of Justice Assistance, 2016), ii.

The Strategies for Policing Innovation and Social Network Analysis

THE TECHNOLOGY

SNA provides a method for visually and analytically understanding the social and structural organization of high-risk groups such as gangs, terrorist organizations, and organized crime groups. The technique can also identify previously unknown and unobserved relationships and connections. Focusing on interactions between people and groups, SNA graphically displays relationships in the form of a sociogram (Figure 2). The groups' visual depiction can show the density of a group's connections, clarify the role individuals play within the group, reveal who is connected to whom, and identify the most influential members in the group.[14] The most common approach for generating a criminal network using SNA is to start with a list of known offenders. The network is then built out by pulling all available police data on the known offenders to identify their associates, relying on data from field interviews, department reports, arrest reports, and other sources: Who was known offender A stopped with? Who was known offender A arrested with? The same process can be applied again with the associates of the known offenders, thereby identifying the "associates of the associates" (who are a step removed from the original known offenders). Once all the offenders, associates, and their connections have been identified, the SNA software is used to map the relationships and produce the sociogram.[15] The computer-generated sociogram can then be used by police to target specific offenders or groups of offenders with tailored interventions, such as arrest, a focused deterrence message, or social services.

FIGURE 2. EXAMPLE OF A SOCIOGRAM GENERATED BY SOCIAL NETWORK ANALYSIS



[14] For more detail on SNA, see J. M. McGloin, "Policy and Intervention Considerations of a Network Analysis of Street Gangs," *Criminology and Public Policy* 4 (2005): 607–636; C. Morselli, "Assessing Vulnerable and Strategic Positions in a Criminal Network," *Journal of Contemporary Criminal Justice* 26, no. 4 (2010): 382–392; A. Papachristos, "Murder by Structure: Dominance Relations and the Social Structure of Gang Homicide," *American Journal of Sociology* 115 (2009): 74–128.

[15] For example, Pajek (http://mrvar.fdv.uni-lj.si/pajek/), Gephi (https://gephi.org/), ORA (http://www.casos.cs.cmu.edu/projects/ora/), UCINET (https://sites.google.com/site/ucinetsoftware/home).

GOALS

Three SPI agencies have employed SNA to identify and intervene with prolific offender groups.

Glendale

The Glendale, Arizona, SPI team included two separate department sectors, the Foothills sector and the Gateway sector. The Foothills team used SNA to target property offenders tied to one large apartment complex (6201 West Olive), and the Gateway team used SNA to target violent offenders tied to several micro hot spots. The apartment complex, composed of more than 750 units, generated a disproportionate amount of calls for service involving property crimes, especially automobile theft. For example, from 2008 to 2011, 6201 West Olive generated, on average, 570 calls for service per year, or about 1.5 calls per day. The Glendale SPI team used SNA to construct a network of property and drug offenders who live at or near the complex, with the goal of disrupting the network and thereby reducing property crime at the location. In the Gateway sector, the SPI team identified several micro hots spots and then conducted SNA with known violent offenders tied to those hot spots.

Kansas City

In Kansas City, police were struggling with a serious violent crime problem that overwhelmingly involved guns. From 2010 through 2013, Kansas City ranked among the worst of the 50 largest cities in the United States for homicide, averaging more than 20 per 100,000 (five times the national average). To address violence in the city, the Kansas City SPI team implemented a focused deterrence/pulling levers strategy—called the Kansas City No Violence Alliance (KC NoVA)—to target criminal groups.[16] Offenders were identified for the focused deterrence intervention through SNA conducted by researchers at the University of Missouri–Kansas City.[17] To get an understanding of the networks operating in the high-crime patrol divisions, all incidents and field interviews were pulled over a two-year period. Every report provided relational information (location, associates, vehicles, residence, cell phone numbers). After all the reports were connected, known violent offenders were highlighted in the network. This approach allowed Kansas City officers to identify the socially connected violent offenders, as well as those who might be susceptible to violent offending and victimization in the future.

Cincinnati

The Cincinnati Police Department (CPD) and their research partners at the University of Cincinnati received SPI funding in 2010 to address robbery in a concentrated 1.5-mile corridor that generated approximately 28 percent of all robberies in the city. The Cincinnati SPI "proposed to analyze robberies in the corridor in an innovative way that considered all sides of the problem-solving triangle (victims, offenders, and places)."[18] The Cincinnati SPI team conducted a comprehensive investigation of the robbery problem, which included SNA with known robbery offenders (conducted by CPD crime analysts).

> *SNA really resonated with the officers. They saw the technique as a valuable tool for identifying connections between individuals and for ranking offenders in terms of their importance to the network. Bigger dot means bigger player.*
>
> Dr. Michael White, research partner, Arizona State University

[16] For more detail on Kansas City SPI, see K. J. Novak, A. M. Fox, and C. N. Carr, *From Foot Patrol to Focused Deterrence: Kansas City's Smart Policing Initiative* (Kansas City, MO: Department of Criminal Justice and Criminology, University of Missouri-Kansas City, 2015).

[17] For a description of focused deterrence, see D. M. Kennedy, "Old Wine In New Bottles: Policing and the Lessons of Pulling Levers," in *Police Innovation: Contrasting Perspectives*, ed. D. Weisburd and A. A. Braga (Cambridge, UK: Cambridge University Press, 2006), 155–70.

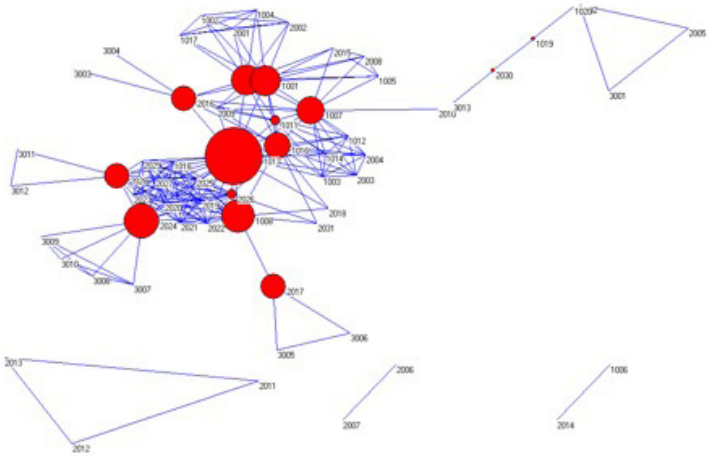
[18] For a description of Cincinnati SPI, see J. E. Eck and K. Gallagher, *Cincinnati Police Department Robbery Reduction Initiative, Year 2 Evaluation* (Cincinnati: University of Cincinnati, 2012).

IMPLEMENTATION

Glendale

The Glendale Foothills team nominated nine known drug and property offenders at the target location, and team members pulled all department records on each of those offenders, dating back three years. Each report for a nominated offender was reviewed to determine if additional people were mentioned in the event (that is, the nominated offender's associates). Each person was added to the network as an associate. The Glendale Foothills SPI team then pulled all department records for each of the newly identified associates to identify a "third cut" of offenders in the social network. The process produced three layers of the social network: the original nominated list of offenders (n=9), the associates of the nominated offenders (n=43), and the associates of the associates of the nominated offenders (n=110). The Glendale Foothills SPI team then identified the top 15 influential offenders in the network and targeted them for intervention, which included a focused deterrence message,[19] surveillance, and periodic contact for several months. The Glendale Gateway team followed a similar process to identify 65 violent offenders in the targeted micro hot spots (Figure 3).

FIGURE 3. SOCIAL NETWORK ANALYSIS OF VIOLENT OFFENDERS TIED TO MICRO HOT SPOTS IN GLENDALE



Kansas City

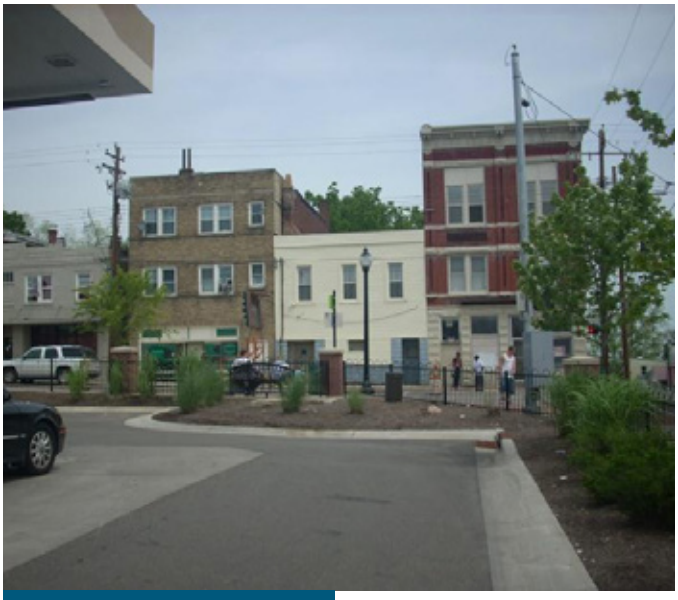
In Kansas City, the SPI team implemented their focused deterrence program, KC NoVA, in 2014. Starting with a group audit, [20] the Kansas City SPI team identified 64 criminal groups comprising 884 offenders. SNA was conducted to identify the most central offenders and to identify additional offenders who might have been missed in the group audit. With this information, the team conducted four call-ins with a total of 149 attendees. Offenders were identified for a call-in invitation based on their SNA centrality scores. More than 600 offenders had face-to-face meetings with social service providers through either a call-in or a custom notification, and 142 offenders received social service assessments. The SPI team also carried out six enforcement operations to target offenders for arrest and prosecution.

Kansas City Police Department speaking at a Kansas City NOVA call-in.

> *With unlimited resources and personnel our strategies to combat violent crime would look different than what we realize today. Working smarter, not harder has to be a goal of any organization if they want to be effective and properly utilize the resources available. Using Social Network Analysis we look at information we already have, in a different way and use it as a tool to guide us in the direction we need to go and makes us more effective in our endeavor to combat violent crime in our city.*
>
> Captain Ryan Mills
> Kansas City Police Department

[19] The focused deterrence message is as follows: "The police department knows who you are and is aware of the crimes you have been committing. We will be watching you and those you associate with, and if you continue to commit crimes, we will arrest you and your associates. We realize that you may need help with education, getting a job, drug treatment, or other issues. We can connect you with service agencies that can help you with those problems and can help you to stop committing crimes. This is your one and only warning. Commit crime and you will be arrested and sent to jail. Ask for help, and we will make sure you get it."

[20] The group audit is a facilitated process during which the team's law enforcement representatives meet to document what each one knows about violent groups, their members, and their relationships.



SPI target neighborhood in Cincinnati, OH.

Cincinnati

In Cincinnati, the SPI team implemented a series of interventions that targeted specific prolific offenders and sought to educate victims and "target harden" places vulnerable to robbery—addressing all three sides of the problem-solving triangle. The Cincinnati SPI team used a process similar to that used in Glendale and Kansas City to conduct SNA, though their focus involved known robbery offenders in the target area. The offender and victim interventions were grounded in the SNA results. The offender-focused response was primarily enforcement oriented, including additional patrol of the robbery corridor, "knock and talks" with known robbery offenders, and reallocation of investigative resources. The victim- and place-based interventions were more preventive, such as placement of closed-circuit television (CCTV) cameras in high-risk robbery locations, engagement with local businesses to improve place management (for example, using better lighting), and a public prevention program to increase awareness of victimization risk.

IMPACT

Glendale

In Glendale, the interventions targeting offenders identified through SNA led to several benefits in the target areas. In Foothills, the social and physical condition of the apartment complex improved notably. Moreover, the team's efforts led to a short-term 15 percent drop in calls for service at the targeted apartment complex (the decline lasted for about 18 months; calls increased during the final six months of the study period). In Gateway, the strategy led to the identification and targeting of prolific offenders and generated short-term, notable declines in several micro hot spots.

Kansas City

In Kansas City, the use of SNA led to positive impact at two levels. First, the Kansas City SPI team used focused deterrence and SNA as the foundation for a large reorganization of the department. The department reassigned 28 officers from patrol to the violent crimes division to implement the enforcement side of the focused deterrence strategy. Also, crime analysts in the Kansas City Police Department (KCPD) were trained by the research partners to conduct SNA in a continuous, ongoing process. Second, the use of SNA generated crime control benefits. The SPI team conducted interrupted time series analysis to assess impact and found that the focused deterrence strategy produced statistically significant decreases in homicide (40 percent) and gun-related aggravated assaults (19 percent). The crime decline effects were largest immediately after implementation and weakened over time.[21]

Cincinnati

The Cincinnati SPI project led to an improved understanding of the nature of robbery in the target area. For example, the team discovered that there was "(1) not a strong network of robbery offenders and most robbery offenders were not robbery specialists, (2) the victim-offender overlap was not as great as expected, and (3) because of the lack of connectivity and specialization among robbery offenders, there were no apparent convergent settings for robbery offenders."[22] Robberies declined by 15 percent in the target area during the intervention, though as in Glendale, the crime reductions did not last.

[21] K. J. Novak, A. M. Fox, C. M. Carr, J. McHale, and M. D. White, *Kansas City, Missouri, Smart Policing Initiative: From Foot Patrol to Focused Deterrence* (Washington, DC: CNA/Bureau of Justice Assistance, 2015).

[22] J. E. Eck and K. Gallagher, *Cincinnati Police Department Robbery Reduction Initiative, Year 2 Evaluation* (Cincinnati: University of Cincinnati, 2012), 28–29.

II. BENEFITS OF TECHNOLOGY ACROSS SPI SITES

Targeted Deployment of Limited Resources

One of the primary benefits of the technologies described in this report involves the more efficient deployment of limited police resources. In New Haven, for example, the SPI team recognized that foot patrol is a resource-heavy strategy. Officers are limited in the area they can cover, and as part of the New Haven strategy, officers walked in pairs for four-hour shifts during high-crime times. The RTM technique allowed the SPI team to target the supplemental foot patrols to the most crime-prone micro areas in Newhallville. In effect, the SPI intervention honed in on the 20 percent of the neighborhood that generated the greatest risk. In all three agencies that employed SNA, the technique allowed the SPI teams to identify and target a small number of the most influential and prolific offenders among much larger criminal networks. For example, in Glendale (Foothills) the network of property and drug offenders associated with the apartment complex included more than 160 individuals, but since SNA provides metrics of importance to the group, the team was able to focus on the top 15 offenders. In Kansas City, the SPI team used SNA results to target offenders for varied interventions: some were immediately identified for arrest and prosecution, and others were offered social service interventions. In Cincinnati, the SPI team used the SNA results to explore the degree of overlap between robbery offenders and victims and then to devise and implement strategies that targeted both groups.

Enhanced Understanding of High-Crime Places and People

The technologies described above clearly provided SPI teams with a more complete understanding of crime in their jurisdictions. In New Haven, using RTM to identify crime-prone locations allowed the SPI team to draw on robust criminological theory to support their place-based intervention. According to Routine Activities Theory, in particular, crime is determined by the convergence in time and space (or place) of motivated offenders and suitable targets, in the absence of capable guardianship.[23] Situational crime prevention and crime prevention through environmental design (CPTED)[24] also recognize the importance of place, and a large body of empirical evidence supports the notion that crime is concentrated in certain narrowly defined locations (hot spots).[25] Hot spot policing is considered an evidence-based police practice.[26] RTM allows police to merge their knowledge of hot spots with a more sophisticated understanding of why certain places are crime prone. In New Haven, the crime analysis unit incorporated the findings from research on criminogenic facilities to create a model that, rather than relying solely upon past incidents, gave more formal recognition to the combined contributions of the built environment and transportation features in creating persistent "crime places":

> Hot spots tell you where crime is clustering, but not necessarily why. All too often people focus on hot spots without giving equal consideration to the spatial attributes that make these areas opportunistic in the first place. While there are social, situational, political, cultural, and other factors related to the variety of crime outcomes, there is also a spatial component. Hot spots are merely signs and symptoms of places that are highly suitable for crime. RTM advances this by providing the spatial diagnosis (http://www.riskterrainmodeling.com/overview.html.).

SNA also enhanced the SPI teams' understanding of crime in their respective jurisdictions. In Glendale (Foothills), the investigation of offenders in the network led to the identification of another high-risk crime location, a specific motel), where many of the offenders in the network committed crimes and sold drugs. In Kansas City, as the use of SNA evolved, hot spots of violent crime were identified. The incidents in the hot spots were then used as the starting point to build a network of offenders and identify the central offenders in the hot spot. In Cincinnati, the SPI team used SNA to explore the degree of overlap among robbery offender and victim populations, as well as the degree of specialization among robbery offenders. The results demonstrated little specialization among robbery offenders (they were crime-committing generalists), and little overlap among robbery victims and offenders. This had implications for the types of interventions CPD implemented to address robbery offending and victimization.

[23] L. E. Cohen and M. Felson, "Social Change and Crime Rate Trends: A Routine Activity Approach," *American Sociological Review* 44 (1979): 588–605.
[24] http://www.popcenter.org/tools/PDFs/cpted.pdf
[25] J. Eck, S. Chainey, J. G. Cameron, M. Leitner, and R.E. Wilson, *Mapping Crime: Understanding Hot Spots* (Washington, DC: U.S. Department of Justice, Office of Justice Programs, National Institute of Justice, 2005); L. W. Sherman, "Hot Spots of Crime and Criminal Careers of Places," in *Crime and Place*, ed. J. E. Eck and D. Weisburd (Washington, DC: Police Executive Research Forum, 1995), 35–52.
[26] http://www.crimesolutions.gov/PracticeDetails.aspx?ID=8.

III. CHALLENGES AND LESSONS LEARNED

Unrealistic Expectations

Many assume that the latest technological innovation will solve all police problems or drastically reduce them. For example, the emergence of DNA evidence was supposed to allow police to identify and arrest the unknown offender in every single crime. The development of early intervention systems was supposed to put an end to police misconduct. And the advent of body-worn cameras was supposed to repair police relations with minority communities. Each of the aforementioned technologies has improved policing, but they are not "silver bullets" that single-handedly eliminate the targeted problems. These marketing claims and unsubstantiated assertions create unrealistic expectations. The actual impact of an innovation is shaped by myriad local issues that are specific to an agency, as well as the human and technology problems associated with implementation (such as delays in data entry to an early warning system or failure to collect and test DNA evidence from a crime scene).

The technologies reviewed here are no different. The use of SNA as part of a targeted offender strategy in three SPI sites led to crime reductions in the target areas, but those reductions dissipated over time. The reasons for the decaying crime effects in each jurisdiction are unclear, though it is likely that the cause lies with implementation difficulties associated with focused deterrence or the long-term sustainability of the model rather than with SNA. SNA is simply a tool that facilitates the identification of specific offenders and their position in the criminal world. Regardless, the consistent story from Glendale, Kansas City, and Cincinnati highlights the limitations of SNA as a crime reduction tool. In sum, software technologies such as RTM and social network analysis can provide benefits to policing, but users of the technology must be realistic about those benefits.

Human Problems

New technologies can present a host of human challenges for police departments, which are notoriously resistant to change—for example, Guyot equated change in a police department to "bending granite."[27] One of the biggest human challenges is buy-in among rank-and-file officers. In simple terms, technologies that are not well accepted will not be widely used. Officers in both Glendale and Kansas City were skeptical about delivering the "other" supportive message in focused deterrence: the offer of social services. Novak et al. note:

> Focused deterrence delivers a second, equally important message to offenders: if the offender wants help to stop engaging in crime, help will be provided. Help comes in the form of educational and vocational training, housing, employment, substance abuse treatment, medical care, and spiritual support. This message can be more difficult for line-level patrol officers to accept, especially when the message is delivered to known violent offenders. [28]

Moreover, the decaying crime reduction effects in each of the three SPI sites that used SNA may be explained by human problems, such as the high level of difficulty associated with implementation of focused deterrence, the overreliance on traditional enforcement responses, officer fatigue with the labor-intensiveness of such approaches, or even adaptation by offenders (changing behavior to avoid police detection).

Presenting technology in a format useful to the line officer can facilitate officer buy-in. In New Haven, the SPI team sought to overcome officer resistance by developing a field-level RTM product called the "flash sheet." Officers working in Newhallville received this document daily to guide their directed preventive patrol. The flash sheets distributed in Newhallville "included information about reported offenses, open warrants, and neighborhood events occurring within the target areas and the neighborhoods in general. The flash sheets also included directory information on command-level staff and key contacts from outside agencies (e.g., referral agencies)."[29] During the training session for newly promoted sergeants that occurred as part of the New Haven SPI project, the 19 sergeants provided critiques of the existing flash sheet as well as suggestions for making the product more useful to the officer in the field.[30] This exercise helped both to improve the product and to give the officers a stake in its use. Over the 13-week intervention period, officers received flash sheets at the beginning of each shift. In the post-shift activity logs, roughly 50 percent of officers indicated that they used or referenced the flash sheet during their shift; this percentage was slightly higher for officers who worked four or more shifts on the project.[31] This was a considerable change from past practice, as prior to this project, crime analysis products were distributed primarily to command-level staff and reserved for use at Compstat meetings.[32]

[27] D. Guyot, "Bending Granite: Attempts to Change the Rank Structure of American Police Departments," *Journal of Police Science and Administration* 7 (1979): 253–284.
[28] K. J. Novak, A. M. Fox, and C. N. Carr, *From Foot Patrol to Focused Deterrence: Kansas City's Smart Policing Initiative* (Kansas City, MO: Department of Criminal Justice and Criminology, University of Missouri-Kansas City, 2015), 16.
[29] C. Sedelmaier and N. Kroovand Hipple, *New Haven, CT, Smart Policing Initiative: Employing Evidence-Based Policing Strategies to Engage the Community and Reduce Crime,* Smart Policing Initiative Spotlight Report (Washington, DC: Bureau of Justice Assistance, 2016), 9.
[30] C. Sedelmaier and N. Kroovand Hipple, *New Haven, CT, Smart Policing Initiative: Employing Evidence-Based Policing Strategies to Engage the Community and Reduce Crime,* Smart Policing Initiative Spotlight Report (Washington, DC: Bureau of Justice Assistance, 2016), 15.
[31] C. Sedelmaier, *New Haven, CT, Smart Policing Initiative – Final Report to Bureau of Justice Assistance* (unpublished document, 2014), 16–17.
[32] C. Sedelmaier and N. Kroovand Hipple, *New Haven, CT, Smart Policing Initiative: Employing Evidence-Based Policing Strategies to Engage the Community and Reduce Crime,* Smart Policing Initiative Spotlight Report (Washington, DC: Bureau of Justice Assistance, 2016), 9.

Technology Problems

The deployment of new technology may bring its own set of challenges. Both RTM and SNA require up-to-date, accurate, computerized databases that can be searched, cross-referenced, extracted, and analyzed in near-real time. Both also require specialized training to carry out the analysis. Finally, both RTM and SNA place an extra labor burden on crime analysts beyond the typical analysis conducted in most departments. For departments with limited staff and budget dedicated to crime analysis, this burden may be significant.

Evaluation Difficulty

The implementation of new technologies often does not lend itself to rigorous evaluation, and researchers may face numerous challenges in their efforts to effectively assess outcomes. SPI emphasizes employing randomized controlled trials, but in the case of technology evaluation, alternative approaches may be necessary. Moreover, comprehensive process evaluations that fully capture the planning and deployment of the technology are necessary. For example, in New Haven, the use of RTM naturally complicated the identification of comparable, nonintervention areas because the technique includes infrastructure and environmental features that may be less prevalent outside the identified target areas (such as liquor stores, bars, and convenience stores). In effect, a comparison area must be similar not only in terms of crime, but also in the distribution of risky places and people (e.g., parolees and probationers). Similarly, the use of SNA as part of a targeted offender strategy creates a methodological problem in that a randomized design would require that some number of high-risk offenders be randomly assigned to not receive the intervention. In 2016 KCPD received additional SPI funding to evaluate SNA using a randomized design. As part of the project, hot spots will be randomly assigned to control, traditional, and social network interventions. The challenges of dealing with both geography and networks in a randomized controlled trial can be considerable. These are difficult questions that must be resolved collaboratively among the researchers and department leadership, and in many cases, there are no easy answers.

Sustainability

Sustainability also presents a significant challenge for technological innovation. A number of factors could inhibit the integration of technology into a police department's day-to-day operations—from cost/resource burdens and a lack of line-level buy-in to competing technologies. Another major concern is turnover in the agency, especially at the leadership level. New chiefs bring new priorities, which can often result in the initiatives of the prior administration being left behind. A number of the sites described in this report devoted considerable effort to sustaining the use of their software technologies. In Glendale, the department sought to facilitate the use of SNA through modifications to their newly purchased CAD/RMS system. In New Haven, training for new sergeants and line officers added units on data-driven decision making for the front line in an effort to create a stronger culture of data use outside the upper command staff. In Kansas City, a number of efforts were used to encourage sustainability. First, a year-long effort of presenting at the department's in-service training ensured that all officers on the department were exposed to the foundations of focused deterrence and SNA. This allowed officers to ask questions and for rumors about the effort to be addressed. Second, the research partner engaged in three rounds of SNA training with KCPD crime analysts over the course of three years. To institutionalize the use of the technology, it was important that internal crime analysts had the capability to create and analyze networks. This allowed the department to test the analysis in different contexts with different commanders.

IV. LOOKING AHEAD

The SPI projects in New Haven, Kansas City, Glendale, and Cincinnati have all been completed, but new SPI sites funded also have embraced software technology as a core feature of their projects.

Toledo

The goal of the Toledo Police Department's SPI project is to reduce the amount of serious crime in Toledo by identifying prolific offenders for focused attention and targeted enforcement. To help accomplish this goal, Toledo's research partner developed an evidence-based scoring matrix designed to identify the most prolific street felony offenders within the city. The researcher gathered data from the Northwest Ohio Regional Information Management System (NORIS) records management system on all individuals arrested by TPD from 2010 through 2013. Using all individuals arrested during 2010 as a sample, the research partner examined what offender characteristics were most correlated with whether each offender committed a new prolific offender offense (burglary, robbery, or non-domestic violence felony assault) during 2011 through 2013. Using this analysis, the researcher identified what offender characteristics best predicted new offending for these specific offense categories, and the weight each predictor carried. This resulted in a prolific offender scoring matrix based primarily on such characteristics as the offender's past prolific offending, past incarceration record, weapons use, and offender gender. To effectuate the scoring matrix, NORIS programmers created a Priority and Prolific Offender (PPO) module that applies the scoring matrix to data contained in the RMS to create a ranked list of prolific offenders.

> *Being able to accurately and efficiently identify prolific offenders is a key component to the success and sustainability of our prolific offender program. The PPO module allows us to quickly apply the scoring matrix to the entire RMS, producing a ranked list of offenders in a matter of seconds", noted Lt. Scott Sterling, Commander of the Toledo Police Department's Special Investigations Section, which oversees the prolific offender program. "In addition to allowing us to identify prolific offenders, the PPO module allows us to track any additional contacts a designated prolific offender has with the criminal justice system. If a PPO is stopped, arrested or cited, the Toledo PD is notified.*

The use of technology is a key component to Project Green Light Detroit's success. Twenty-four hours a day, the Real Time Crime Center is tuned in to the camera feeds of participating businesses and communicating with officers in the field. At the same time, experienced analysts are using tools like risk terrain modeling, which identifies variables that contribute to crime. This type of analysis enables DPD to make decisions about where to allocate resources or even to recruit new PGLD participants.

Detroit Police Department crime analysts.

Detroit

Beginning in early 2016 the Detroit Police Department (DPD) started what may very well be the first public-private crime-fighting partnership of its kind, DPD's Project Green Light Detroit. The goal of the partnership is to not only improve neighborhood safety but to revitalize the community and hopefully bring growth to local businesses. To do this, the Detroit Police Department built on research conducted in other urban cities in an effort to reduce violent crime in its neighborhoods. The project focused on better understanding the correlation of violent crime hotspots and their connection to certain features of the city, identified through COMPSTAT data analysis. In the fall of 2016 the Detroit Police Department saw an opportunity to expand the number of participating businesses, as well as evaluate the program's impact by becoming a SPI project. As part of the SPI project DPD has partnered with the School of Criminal Justice at Michigan State University (MSU). Using Risk Terrain Modeling (RTM) analyses, their research partner, Dr. Edmund McGarrell, and his team of graduate students is playing a crucial role in problem identification and analysis along with evaluating the impact. Currently the project has over 500 participating community "partner" businesses. The partners have each installed and agreed to maintain high-definition cameras and adequate security lighting at their businesses. The cameras are connected by high-speed network connections that allow a dedicated staff at DPD to monitor and respond to incidents quickly both enhancing the safety at participating businesses and helping create a customer friendly atmosphere. Additional work is also being done with Project Green Light Detroit Partners to strengthen the local ties between participating businesses, DPD Precinct Captains, DPD Neighborhood Police Officers, and surrounding community leaders and organizations.

V. FINAL THOUGHTS

The range of technologies that have emerged on the law enforcement landscape over the last few decades is extraordinary—from forensics and advanced crime analysis to license plate readers and body-worn cameras. The case studies of SPI projects in this report demonstrate two important points about the effective use of technology, a core pillar of SPI. First, software technologies such as RTM and SNA come with challenges. The adoption of technology does not occur in a vacuum, and agency leaders must consider the consequences and costs (financial and otherwise) of deploying a technology. As with any innovation, implementation should be defined by a deliberate, collaborative, and informed planning process. Second, the technologies described here have benefited the SPI agencies in several ways—from more efficient deployment of resources and enhanced understanding of crime-prone people and places to reductions in crime and disorder.[33] The experiences of SPI sites with RTM and SNA offer important insights for other agencies on the limitations and benefits that can be expected when deploying such technologies.

[33] In some cases, the reductions were temporary.

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