TECHNOLOGY

Evidence-Based Policing Playing Catch-Up

In the second part of our book, we have provided numerous examples of evidence-based policing, expanding upon the evaluation research underpinning these efforts. These efforts have focused on interventions for micro places, communities, individuals, and groups. Thus, at least with regard to crime prevention, police have a relatively robust base of knowledge and examples to begin building and modifying strategies to reduce crime. More generally, we know that when police target high-risk places, people, and situations, and when they use proactive, tailored, and problem-oriented approaches, they can increase their chances of being effective. Of course, how they convert and use this research in practice, and how they carry out these activities matters. We will explore these issues in great depth in Part Three of this book.

However, we end Part Two of this book with a discussion of one area of policing that we know much less about but that is believed to be central to carrying out effective crime prevention strategies—technology. Unlike the research evidence for the various crime prevention strategies of Chapters 4, 5, and 6, the evidence for the impact of technology on the police and outcomes that the police care about is weaker. For example, while television may lead us to believe that technology is often used to successfully solve crimes, we actually know little about whether technologies help the police with solving or preventing crime. We also do not know how technology impacts citizen–police interactions and relationships or citizen satisfaction, trust, and confidence in the police. The realm of policing technology, therefore, provides a good example of an area in which police are playing catch-up with regard to evidence-based policing. In this chapter, we discuss the potential impacts of technology on policing, what we know about its actual impacts, and what more we need to understand to implement technology in evidence-based ways. Drawing heavily upon our own work on police technology, we highlight four technologies to make our point: information technologies, crime analysis, license plate readers, and body worn cameras.1

Technology and Its Impact on Policing

Technological advancements have shaped policing in many important ways over the years. One needs only consider that the primary police strategy for much of the twentieth century—motorized preventive patrol and rapid response to calls for service—was developed in response to the invention and use of the automobile, two-way radio communications, and computer-aided dispatch systems in policing. In recent decades, there have been many significant developments with respect to information technologies, analytic systems, video surveillance systems, license plate readers, DNA testing, body-worn cameras, and other technologies that have had far-reaching effects on police agencies. Technology acquisition and deployment decisions are high-priority topics for police (e.g., Koper, Taylor, and Kubu 2009), and law enforcement agencies at all levels of governments are spending vast sums of money on technology in the hopes of improving agency efficiency and effectiveness.

The current emphasis on police technology reflects a belief among both police and citizens in technology's potential to enhance policing. For example, technology is believed to strengthen crime control by improving the ability of police to identify and monitor offenders (particularly repeat, high-rate offenders); facilitating the identification of places and conditions that contribute disproportionately to crime; speeding the detection of and response to crimes; enhancing evidence collection; improving police deployment and strategies; creating organizational efficiencies that put more officers on the street and longer periods of time; enhancing communication between police and citizens; increasing perceptions of the certainty of punishment; and strengthening the ability of law enforcement to deal with technologically sophisticated forms of crime (e.g., identity theft and cybercrime) and terrorism. Technology advancements in automobiles, protective gear, weapons, and surveillance capabilities can reduce injuries and deaths to officers, suspects, and bystanders. Pressing operational needs exist in numerous areas to which technology is central, including crime analysis and information-led policing, information technology and database integration, and managing dispatch and calls for service.

1 This chapter draws upon many of our past efforts in the area of technology, including Koper, Taylor, and Woods (2013b); Koper, Lum, and Willis (2014); Koper, Lum, and Hibdon (2015b); Koper, Lum, Willis et al. (2015a); Lum, Meola, Willis (Hibdon) et al. 2010; Lum, Willis (Hibdon), Cave et al. 2011c; Lum, Koper, and Willis (2016b); and Lum, Koper, Meola et al. 2015.
Technology and Its Impact on Policing

(Koper et al. 2009). And to the extent that technology improves police effectiveness, strengthens communication between police and citizens, reduces negative outcomes from police actions, and increases police accountability, it may also have the added, indirect benefit of enhancing police legitimacy among citizens.

But these are only best guesses and hopes for technology. Because of the scarcity of evaluation research on technology, we do not know whether such outcomes are actually achieved. Much of the research we do have focuses on technology's efficiencies and outputs, rather than its connection to outcomes. Some research indicates that while recent technological advances have undoubtedly enhanced policing (e.g., see Ioimo and Aronson 2004; Danziger and Kraemer 1985; Roman, Reid, Reid et al. 2008; Roth, Ryan, Gaffigan et al. 2000), it is not clear that they have made police more effective (Byrne and Marx 2011; Chan 2001; Garicano and Heaton 2010; Harris 2007; Koper, Lum, Willis et al. 2015c; Lum 2015). Technology thus presents a paradox; it may operate correctly and speed up various policing activities, but it may not actually lead to outcomes sought by the police or the community.

Take, for example, forensics and surveillance technologies. It is fair to say that forensics technologies have significantly improved and become more available over the past thirty years; these changes include improvements in DNA and fingerprint collection and analysis, as well as the development of mobile devices to make the collection of forensic evidence easier and faster. Surveillance technologies have also improved, with greater use of closed circuit television (CCTVs), license plate readers (LPRs), and even technology that can detect gunshots. Police data systems that can be used to identify and locate suspects have also become more extensive and integrated. Yet, despite these improved detection capabilities, national averages of clearance rates for property and violent crimes have remained stubbornly low and stable for the past thirty years, and in the case of homicide, are declining (Braga, Flynn, Kelling et al. 2011; Lum, Welford, Scott et al. 2016d; Vovak 2016). Although there are likely many complex factors that influence clearance trends, it does not appear that advancements in police technology strongly correspond to obvious improvements in police performance.

Technology can also produce unintended consequences in police agencies. For instance, while manual report writing is tedious, agencies transitioning from paper reports to records management systems and automated report writing often go through significant growing pains. Officers have to adapt to new systems that may have added reporting requirements and require the use of the internet or wireless technology that is slow or unreliable. All of this may reduce expected gains in efficiency and have other unintended and undesirable consequences (see our discussion of information technology below). Another example of unintended consequences can be found in the adoption of computer-aided dispatch, or “999”/“911” systems. These systems were developed to improve officer response to calls for service not only to improve customer service and connectivity with citizens, but also to increase the possibility of apprehending offenders. However, the notion that 911/999 systems improve offender apprehension has been undermined by studies showing that response times have little effect on arrests due to delays in the reporting of crime (Sherman and Eck 2002; also see Chapter 5). Further, the burden of answering 911 calls, roughly half or more of which are not urgent (Mazerolle, Ragan, Frank et al. 2002, 98), leaves police with less time to engage in proactive or problem-oriented policing, which we now know from research can prevent and reduce crime. As we have argued elsewhere (see Lum 2010), 911 systems may have thereby reinforced a reactive, incident-based approach that marks the standard model of policing, which may have even hindered other innovations (e.g., see Sparrow, Moore, and Kennedy 1990).

In practice, the impact of technology on police effectiveness may be limited or distorted by several factors. These include engineering problems (i.e., whether the technologies work), difficulty in implementing and using a technology, legal or administrative limits on a technology’s use, lack of fit between a technology and the tasks for which it is used, interdependencies between different technologies (within and across agencies), ancillary costs associated with using a technology (e.g., costs related to training, technical assistance, and maintenance), and the failure of technologies to provide certain expected benefits like time savings or increased productivity. Studies have varied in terms of findings on these issues (see, e.g., Chan 2003; Chan, Breton, Legos et al. 2001; Colvin 2001; Frank, Brand, and Watkins 1997; Ioimo and Aronson 2004; Koper, Moore, and Roth 2002; Koper and Roth 2000; Kraemer and Danziger 1984; Manning 2008; Nunn 1994; Nunn and Quinter 2002; Roth et al. 2000; Zaworski 2004). In particular, organizational and cultural factors within an organization may mediate, either positive or negative ways, the potential of technology to improve police effectiveness and legitimacy.

For instance, from a crime prevention perspective, new information systems and analytic technologies like crime analysis can help police to more precisely identify the people, places, and problems that contribute most to crime. Yet these advances may have less impact if police managers fail to focus adequate resources on crime hot spots or if the results of crime analysis are not adequately disseminated (or accepted) throughout the agency, particularly among patrol officers and first-line supervisors. Consequently, the effects of these and other technologies may often depend on organizational culture and other organizational changes, such as the adoption of new management systems, the implementation of analytic processes, and changes in deployment. In order to achieve the many improvements to existing police operations that might be sought with new technology, changes may thus be needed in an agency’s organizational culture, practices, and infrastructures (e.g., Chan 2003; Chan et al. 2001; Garicano and Heaton 2010; Harris 2007; Koper et al. 2015c; Zaworski 2004).

The idea that organizational aspects can shape technology’s outcomes is not unique to policing. Technology scholars Ortúzar and Gash (1994) theorize
that "technological frames" mediate the impact of technology on outcomes in organizations more generally. Such frames reflect officer's expectations, knowledge, experiences, values, objectives, and roles within an organization, as well as the organization's history of technology use. In turn, these frames can shape technology uses and products in an organization and, therefore, the outcomes associated with those technologies (see also Boudreau and Robey 2005; Orlikowski 1992; Robey, Boudreau, and Rose 2000). Technological frames can also vary across members and units of a police service. Such "incongruence" (Orlikowski and Gash 1994, 180) can result in conflicts about the development, use, and meaning of technologies in a police organization, as well as different outcomes of technology (see Rocheleau 1993, for further discussion). For example, a police chief may view a new information system as increasing efficiency and accountability. However, patrol officers and detectives may see the same innovation as threatening their discretion or autonomy, or making their daily work more difficult and time-consuming (e.g., see Chan et al. 2001; Harris 2007; Manning 1992).

Frames are important to our discussion of evidence-based policing and technology. Manning (2008) argues that the dominant frame in policing is a reactive nature of policing, characterized and fostered by an incident-based, response-oriented, and procedures-dominated approach. Manning and others (see Harris 2007; Lum 2010; Sanders and Henderson 2013; Sanders, Weston, and Schott 2015) suggest that the technological and organizational frames that are nurtured by this reactive model filter technology adoption. This filtering process influences the way technology is used and the outcomes achieved with technology. In other words, adopting new technologies such as information and records management systems, body-worn cameras, license plate readers, analytic tools, or forensics technologies might produce benefits in administrative efficiency, accuracy and timeliness of crime data, response to calls, and detection capabilities. Yet these changes may not be sufficient to produce substantial improvements in police outcome effectiveness (crime prevention and control, improved relationships with citizens, stronger internal affairs and management, etc.) absent congruent technological frames and practices that promote technology use in these strategic ways.

Similarly, police leaders, scholars, and reformers may see technology as a means to facilitate innovations (e.g., problem solving; community policing; "hot spots" policing; third-party policing; evidence-based policing) that can reduce crime or improve citizen trust, rather than just as a means to react to crime or increase arrests and detections. However, these expectations might be overly optimistic if these objectives are not incorporated into daily policing tasks and expectations that ultimately can create the technological frames of officers, detectives, or supervisors. Hence, technology will not be used in evidence-based ways if an agency's approach to policing more generally does not involve evidence-based policing.

Examining the Evidence Base for Selected Technologies

The mediating effects of organizational frames and culture on technology's impacts provide a strong justification for improving the evidence base on technology application in policing. Not only do we need to identify how organizational frames and other factors shape technological outcomes, but we also need more evaluation research to discern which outcomes are and whether they are aligned with broader policing goals. Four examples illustrate our point—information technologies, crime analysis (as a technology), license plate readers, and body-worn cameras.

Information technologies

Information technology (IT) is arguably the technology category with the most potential to impact activities related to evidence-based policing, as it has become well developed and affects almost all aspects of police work and management. IT within police agencies includes a wide array of databases and data systems (and their supporting hardware and software) for storing, managing, retrieving, sharing, and analyzing information both within and across agencies. Common components include records management systems (RMS) that capture criminal incident records, computer-aided dispatch systems that record and assign calls for service, and various other databases that may contain information and/or intelligence on persons, groups, personnel, and other matters. IT systems can also include those fostered by data collection over the internet (such as tiplines or other social media sites), as well as mobile computers and data terminals that give officers wireless access to information in the field and that allow them to file reports remotely.

By improving the ability of police to collect, manage, and analyze data, IT has enhanced the administrative efficiency of police organizations, improved their apprehension capabilities, and given them the ability to more precisely and proactively target the people, places, and problems that contribute most to crime and disorder in their communities (e.g., see Groff and McEwen 2006). Many police researchers have recognized the centrality of IT to police work and organizational change more generally (e.g., Boudreau and Robey 2005; Chan 2001; 2003; Ericson and Haggerty 1997; Harris 2007; Manning 1992; Mastrofski and Willis 2010). Accordingly, IT has been studied more extensively than other forms of police technology. Yet, this evidence base has produced complex and often contradictory findings on IT's impacts.

For example, in a national study of U.S. police agencies over the period of 1987–2003, Garicano and Heaton (2010) found that increases in the use of IT by police were not associated with improvements in case clearance rates or crime rates. Brown (2015) reported similar findings in a national study focusing on more recent changes (2003–2007) in police IT capabilities and clearance
The Evidence Base for Selected Technologies

rates. However, Garicano and Heaton also found evidence that IT is linked to improved performance (i.e., higher clearance rates and/or lower crime rates) when complemented with other organizational changes, including greater use of specialized units, higher educational and training requirements for staff, and managerial practices indicative of Compstat. Other studies of IT in policing have also produced a somewhat clouded picture: while officers generally have positive attitudes towards IT improvements (though exceptions are noted below), the effects of IT have been mixed with respect to improving productivity, case clearances, proactive policing, community policing, problem solving, and other outcomes (e.g., Agrawal, Rao, and Sanders 2003; Brown 2001; Brown and Budney 2003; Chan et al. 2001; Colvin 2001; Donziger and Kraemer 1985; Groff and McLurken 2008; Ialom and Aronson 2003; 2004; Koper et al. 2015b, 2015c; Nunn 1994; Nunn and Quinet 2002; Palys, Boyanowski, and Dutton 1984; Rocheleau 1993; Zaworski 2004).

In general, these studies highlight a number of factors that can offset the potential benefits of IT for officers. For example, officers may be hampered by technical difficulties and the complexities of using IT systems, particularly when the systems are new. Further, the adoption of new IT systems often leads to more extensive reporting requirements for officers. These factors may negate expected time savings, lessen (or fail to improve) time for interacting with citizens and engaging in proactive work, and create frustration and dissatisfaction for officers. Surveys and interviews in police agencies illustrate that negative implementation experiences and functionality problems with new technology have important ramifications for the acceptance, uses, and impacts of that technology and can produce negative effects on officers' attitudes and performance (i.e., job satisfaction and productivity) that last for long periods (Koper et al. 2015c; see Koper, Lum, and Willis 2014). It may have other unintended consequences that also have negative implications for organizational functioning and performance (e.g., see Chan et al. 2001; Koper et al. 2015c). Examples include reducing time that supervisors spend mentoring officers; worsening perceptions of inequality for line-level staff, particularly patrol officers who may feel heavily burdened and scrutinized by the reporting demands and monitoring that often come with new information and surveillance technologies; and encouraging an overemphasis on technical skills and computer literacy at the expense of skills in dealing with people in the community (on the latter point, see Palys et al. 1984).

Perhaps more importantly, police may also fail to use IT in the most strategically optimal ways for reducing crime. Although research shows that police are most effective in reducing crime when they focus their efforts on high-risk places and groups and use problem-solving strategies tailored to specific issues, police may not regularly employ technology towards these ends in practice. This is because perceptions and uses of technology are highly dependent on the norms and culture of an agency and how officers view their function (i.e., technological "frames," as discussed above). And because officers continue to

Evidence-Based Policing Playing Catch-Up

frame policing in terms of reactive response to calls for service, reactive arrest to crimes, and adherence to standard operating procedures, they use and are influenced by technology to achieve these goals. In our own research with officers from four agencies, we found that patrol officers were much more likely to use IT to guide and assist them with traditional enforcement-oriented reactive activities than for more strategic, proactive tasks (Koper et al. 2015c; also see Koper et al. 2014; Koper et al. 2015b; Lum et al. 2016b).

In addition, we found through these studies that officers judged technology against the value (or technological frame) of efficiency, not necessarily outcome effectiveness. Officers often verbalized these outputs as gaining information "faster" or with "greater ease" when they discussed IT, and they emphasized how technology helped them to accomplish tasks quickly. When these efficiency gains were not achieved, technology was seen more negatively, sometimes leading officers to avoid using it. This mindset affects not only discretionary uses of technology (which in turn impacts outcomes) but also definitions and expectations about outcomes themselves. For example, the term "effectiveness" was most often defined by officers (and used interchangeably) to mean "efficiency," or the ability to respond to crime and to quickly identify suspects, victims, witnesses, and other aspects of crimes to resolve cases. Less often did officers define effectiveness in terms of their ability to achieve specific outcomes of interest to the police department, such as preventing crimes or improving relationships with citizens or community groups.

These tendencies are also extended to managers, as we found that supervisors were less likely to use IT to form crime prevention initiatives with their subordinates and more likely to use IT to check reports and assess performance measures of officers and squads. Supervisors typically provided little in the way of consistent training or direction to officers on ways to optimize technology use in their daily work and deployment habits. Our observations suggest that while technology has fostered strategic innovation and accountability at higher managerial levels in policing (e.g., through Compstat-type management processes), the innovative use of technology as a tool by middle- and lower-level supervisors to manage the performance of line-level officers is still neither institutionalized nor clearly understood in many agencies.

All of this suggests that police may not fully capitalize on the aspects of technology that enable them to do things that could optimize their effectiveness. Hence, while basic application of IT might have marginal effects in improving police efficiency, detection capabilities in the field, and officer safety in responding to calls, these improvements may not alone be enough to enhance police performance as measured by crime reduction or even case clearances. This is where we need to strengthen the evidence base in this area.

2 This tendency is likely reinforced by the limitations of police IT systems, in terms of available data and functionality, for facilitating problem-solving tasks (e.g., Brown 2001; Brown and Budney 2003; Nunn and Quinet 2002).
Crime analysis

The development and application of analytic technology in policing (i.e., crime analysis) also has a high potential for enhancing police effectiveness and has been strongly linked to that of IT. Despite the mixed findings of prior technology research, innovations like hot spots policing and Compstat have been linked to advances in IT. Strategic use of IT capabilities by police is thus likely central to realizing IT’s full potential. One strategic use with demonstrated promise for improving the effectiveness of police is IT’s application to crime analysis. As described by Taylor and Boba (2011, 6), “crime analysis involves the use of large amounts of data and modern technology—along with a set of systematic methods and techniques that identify patterns and relationships between crime data and other relevant information sources—to assist police in criminal apprehension, crime and disorder reduction, crime prevention, and evaluation.” Common duties for crime analysts involve assisting detectives, mapping crime, identifying crime patterns, conducting network analysis, and compiling data for uniform crime reporting and managerial meetings (Taylor and Boba 2011).

The development and adoption of crime analysis have been significant trends in policing over the past few decades, as the use of crime analysis has become very common in law enforcement agencies (Burch 2012; Reaves 2010; Taylor and Boba 2011). Crime analysis is believed to hold great potential for improving the effectiveness of police, as we discuss in more depth in Chapter 13. While it has perhaps been linked most prominently to hot spots policing and Compstat, crime analysis is also used heavily for investigative work and can be a valuable component of problem-oriented policing (see Taylor et al. 2011a).

However, with the exception of its role in supporting hot spots policing (see, e.g., Kennedy, Caplan, and Piza 2015), we are not aware of much evidence demonstrating a clear link between the use of crime analysis and lower rates of crime (Lum 2013; Santos 2014). Although this may reflect a lack of study (e.g., we have seen no before-and-after assessments evaluating the impact of establishing crime analysis units on crime reduction), it is also likely that, as with other technological and analytical innovations, the potential impact of crime analysis is also limited by organizational factors. While agencies are obviously constrained by the sophistication of their crime analysis capabilities (see O’Shea and Nicholls 2003), other obstacles can also impede effectiveness, such as a police culture that doesn’t value analytical work, the reactive nature of policing, and a disregard for crime analysis that is done largely by civilians (Lum 2013; Taylor and Boba 2011). In practice, officers may not use products like maps and may find them of little value in their work (Cope 2004; Cordner and Biebel 2005; Koper et al. 2015c; Paulson 2004). Indeed, crime analysis is largely produced for police managers. Additionally, while managers tend to be the heaviest users of crime analysis, they often focus largely on criminal apprehension and short-term tactical planning rather than long-term strategic planning (Harris 2007; O’Shea and Nicholls 2003; Taylor and Boba 2011).

In our technology fieldwork referenced above, we examined crime analysis in tandem with IT, and our conclusions about its uses and impacts were much the same as those for IT. Although officers were sometimes asked to conduct directed patrol in particular areas based on crime analysis (particularly in one agency that had a very advanced crime analysis unit and a strong managerial commitment to its use), they often did not take their own initiative in using crime analysis for self-directed proactive work and problem solving. Nor did they necessarily understand the value of crime analysis for facilitating such work. Even detectives, who often worked closely with crime analysts, most heavily used and valued crime analysis for tracking leads for cases they were investigating reactively. The use of crime analysis by detectives to anticipate future events using pattern analysis or for other types of proactive decision making that might help to prevent crime was rare. Again, these tendencies varied notably across agencies, but they were apparent among many officers and detectives even in an agency that placed a heavy managerial emphasis on crime analysis and data-driven policing.

These technological frames of officers thereby mediate the relationship between the adoption, implementation, and use of crime analysis and outcomes sought. Our work and that of others suggest that crime analysis can be leveraged to greater effect if police can learn to use this technology more systematically throughout their organizations to identify crime patterns, respond to crime problems, guide proactive patrol, and facilitate other innovations that are networked to evidence-based policing. We hold this discussion for deeper analysis in Chapter 13.

License plate readers (LPRs)

One technology that has been rapidly adopted by law enforcement to achieve crime control outcomes is license plate reader (LPR) technology. The story of LPR with regard to evidence-based policing is also one of the rapid adoption of technology in a low-information environment in which little outcome research was available at the time of adoption—but adoption moved forward nonetheless. LPRs are both a sensory and information technology which can be placed on mobile patrol units or in fixed locations to detect stolen automobiles, help with investigations, assist in finding missing people, or for general crime prevention purposes. Using a high-speed camera and database system, LPRs scan and read the alpha-numeric characters of license plates within view of the camera and then automatically (and instantaneously) compare the scanned plates against existing databases of license plates that are of interest to law enforcement. Plates “of interest” might include those associated with vehicles that have been recently stolen, are of interest to a police investigation, or linked to registered owners that have open warrants or are being sought by
The Evidence Base for Selected Technologies

Evidence-Based Policing: Playing Catch-Up

of LPRs with patrol units. One study that spanned two suburban jurisdictions
in Virginia found that thirty-minute LPR patrols conducted once every few days
(on average) in randomly selected crime hot spots for a period of two to three
months did not reduce auto-related or other forms of crime in the targeted
locations (Lum et al. 2010; Lum et al. 2011c). Although the experimental dosage
was relatively low and the LPR databases were limited to information on
stolen vehicles, Lum et al. argued that these conditions reflected the current state
of LPR use, providing a realistic understanding of outcome effectiveness.
The other study testing LPR was a randomized experiment in Mesa, Arizona (Koper,
Taylor, and Woods 2013b; Taylor et al. 2011b, 2012). In that study, a small
auto theft squad conducted short operations to detect stolen and other vehi-
\cles of interest at high-risk road segments that were identified as likely travel
routes for auto thieves based on analysis of auto theft and recovery locations
(see Lu 2003) and the input of detectives. As expected, the officers were more
likely to detect and recover stolen vehicles and apprehend auto thieves
when using the LPR devices, though the numbers of hits and arrests were small.
Further analyses revealed that the patrols produced short-term reductions in
crime at the hot spots in both the LPR and non-LPR modes (Koper et al. 2013b),
but the study could not definitively isolate the effects of the LPRs from the
deterrent effects of the extra patrols more generally, due in part to the low
number of LPR arrests (and to the fact that the LPR cameras were mounted on
the cars even when not in use, thus potentially creating deterrent effects).

While informative, both the Mesa and Virginia studies were limited by the
short duration or low dosage of the interventions, the small numbers of LPRs
available, and the limited data fed into the LPR devices (the data consisted
largely or entirely of manually downloaded information on stolen vehicles
and license plates). Updated studies are thus needed to examine large-scale LPR
deployments and LPR operations conducted with access to more extensive data
systems.4

LPR has also raised questions about citizen privacy that have also not been
fully evaluated. In their study of LPR use in Virginia, Lum et al. (2010) surveyed
community residents in one of the study jurisdictions and found that while
there was strong support for LPR use in general, this support can vary depend-
ing on the types of LPR applications under consideration (see also Merola,
Lum, Cave et al. 2014). For example, using the devices to detect stolen autos
or criminal behavior received much more community support than
using them to detect parking violations. Additionally, the survey revealed that
members of the public do not regard all uses as equivalent, but rather make
significant distinctions in their concerns based upon the way in which systems
are deployed. Several factors corresponded with increased support for the tech-
ology, including using LPR in ways unrelated to vehicle crimes or prolonged

---

1 These sources also provide information on some of the technical limitations of LPR with
regard to issues like misreads, false alarms, and difficulties with reading particular types of license
plates or reading plates under particular types of conditions.

4 The authors are currently carrying out such evaluations of the use of LPR for patrol and
investigations, the results of which will be available by the end of 2017.
storage. Merola and Lum (2013) also found that support for an agency’s use of technology depended on how much legitimacy and trust a person affords to the police. Those with more trust tend to support the use of LPRs more than those with less.

Improving apprehensions and deterrence with LPRs will also depend on many other operational decisions about how and where to deploy them. Police currently deploy more than half of their LPRs on patrol vehicles, and deploy most of the remainder in fixed locations (Lum et al. 2016c). However, the relative pros and cons of mobile versus fixed LPR deployments have yet to be studied. Decisions about where to deploy LPRs are especially critical from an evidence-based perspective, especially given our discussion about place-based policing in Chapter 4. Our sense is that many agencies deploy their LPRs with no particular strategy. LPR technology is often treated as a resource that has to be divided equally among administrative units (e.g., districts or divisions) within the agency, rather than allocated based on needs assessment. Assignment of LPRs to officers might similarly be made with no particular strategy, nor any guidance for the officers. Further, it seems that most agencies using LPRs do not collect performance measures associated with LPR use (Lum et al. 2016c). All of this is consistent with the technological frames (discussed above) that arise from a reactive and procedures-oriented mindset towards policing.

In contrast, a more strategic, evidence-based approach to using LPRs is to deploy them to crime hot spots and other locations (like highly traveled roads) where the risk of detecting stolen vehicles and other vehicles of interest will be higher (e.g., see the Mesa and Virginia studies discussed above). Agencies might also conduct their own pilot tests to determine optimal places and methods for LPR deployment based on sound analysis. For example, police in Surrey, British Columbia (Canada) conducted pilot tests with LPRs by assessing the number, rate, and types of LPR hits they could obtain on various roadways in the jurisdiction at different times of day (Cohen et al. 2007). This established baseline data for the agency that could guide LPR deployment and be used to evaluate trends over time. Another example comes from the Ohio State Highway Patrol (2005), which tested three modes of LPR deployment: fixed use at tollbooths on a major turnpike; mobile deployment on marked police cars on the same turnpike; and mobile deployment on an unmarked police vehicle in a high-crime area. They compared these modes of deployment with respect to technical performance (number and accuracy of reads), hits (including an assessment of the validity of these hits), arrests, and stolen vehicle recoveries (results were most promising for the mobile deployment in the high-crime area).

In sum, LPR technology has been rapidly embraced by police because it fits well into the domino-effect technical frame of efficiency and rapid reaction to crimes. However, a much stronger evidence-base for LPRs needs to be generated about their crime control, legitimacy, and privacy impacts so to better inform law enforcement leaders who acquire them. In the case of this and many other technologies, adoption came before outcome evaluation and relied almost exclusively on technical tests of the technology. An evidence-based approach to LPRs requires not only increasing this knowledge of this technology, but also using it to maximize the potential for LPRs to increase both criminal apprehension and deterrence while minimizing negative impacts on the community. In-depth program evaluation of LPRs can assist with this goal.

Body-worn cameras (BWCs)

Body-worn cameras (BWCs) provide another very contemporary example of the intersection between technology and evidence-based policing. As of this writing, recently publicized and controversial use-of-force events in Ferguson (Missouri), New York City, South Carolina, Baltimore, and elsewhere have led law enforcement agencies, citizens, civil rights groups, and city councils to push for the rapid adoption of BWC technology. The U.S. Department of Justice has dedicated $20 million to fund the purchase of and technical assistance for BWCs in the United States. Proponents of BWCs believe that these devices will deter problem conduct in police-citizen contacts (on the part of both police and citizens) and provide better evidence on police-citizen encounters that will foster police transparency and accountability in the handling of cases that do result in citizen complaints and/or use of police force. If achieved, these benefits could increase citizens’ trust and confidence in the police.

As with LPRs, this rapid adoption of BWCs has occurred within a low evidence-based environment; researchers are only beginning to develop knowledge about the effects, both intentional and unintentional, of this technology. But in contrast to developments surrounding LPRs, there has been a rapid push in generating research evidence on BWCs, primarily spearheaded by the Laura and John Arnold Foundation, as well as the National Institute of Justice. In a recent study led by the authors (Lum, Koper, Merola et al. 2015), we examined both the existing and ongoing BWC research to identify existing gaps in the knowledge necessary to build the evidence base of this rapidly diffusing technology.

At the time of our review, we found over a dozen completed empirical studies of BWCs and thirty ongoing research projects, many of which were randomized controlled experiments and high-quality quasi-experimental studies. This level of evidence generation for a law enforcement technology is unprecedented in the history of police technology adoption. In many ways, it reflects greater recognition of the importance of the evidence-based policing paradigm than with other technologies like crime analysis or LPR. The evidence building for BWCs also illustrates that evidence-based policing is not merely about crime control research, as some of its critics have inaccurately portrayed. Our survey of existing and ongoing research on BWCs highlighted issues that are

---

5 To view all of these studies in this report, go to http://cebcp.org/wp-content/technology/BodyWornCameraResearch.pdf.
receiving significant research attention as well as knowledge gaps in need of more attention.

We found that the most common research that has been or is being conducted explores questions related to the impact of BWCs on the quality of officer-citizen interactions (including, e.g., the nature of the interaction/communication, displays of procedural justice and professionalism, and misconduct or corruption), as often measured by complaints and/or surveys. Also highly researched is the related issue of the impact of BWCs on officer use of force during these interactions. Other relatively common research topics include officer attitudes about cameras, the impact of BWCs on citizen satisfaction with police encounters, the broader impacts of BWCs on community attitudes and perceptions of the police and their legitimacy, the effects of BWCs on officer discretion (especially to arrest or cite individuals), and the impact of BWCs on suspect compliance to commands (and relatedly, assaults on officers). While findings are not definitive, they illustrate the complexity of questions that research needs to address given the rapid adoption of this technology.

For example, early results suggest that BWCs may reduce complaints against the police (see Ariel, Farrar, and Sutherland 2015; Farrar and Ariel 2013; Goodall 2007; Katz, Choate, Ready et al. 2014) or result in quicker resolution of complaints (see Katz et al. 2014; ODS Consulting 2011). However, whether or not that signals increased accountability, improved citizen satisfaction, and/or improved police or citizen behavior is still uncertain. There are signs that BWCs also reduce use of force by police, but with caveats. For instance, Ariel et al. (2015) find that BWCs reduce the use of force incidents, but Katz et al. (2015) find that arrest activity increases for officers wearing BWCs (Owens, Mann, and McKenna 2014, also seem to find similar impacts on individuals being charged). Interestingly, Ready and Young (2015) find that officers wearing cameras, while less likely to perform stop-and-frisks or make arrests, are more likely to give citations. In a recent review of ten experiments in the United States and the United Kingdom, Ariel, Sutherland, Henstock et al. (2016) found that BWCs may only reduce use of force if officers do not have much discretion on when to turn cameras on and off. These initial findings suggest that BWCs can at least discourage negative behaviors by officers; however, deeper research will be needed to determine if BWCs prompt more fundamental changes in officers’ attitudes and behaviors the more police use this technology for training, supervision, accountability systems, and self-learning (e.g., see Koen 2016).

Some questions at the time of writing remain unanswered. For instance, will BWCs change discretionary officer behaviors by affecting officers’ propensity to engage in proactive activities, issue citations, or make arrests? To the extent that officers frame BWCs as a tool for monitoring them, it might conceivably make them less likely to engage in proactive contacts out of fear that their actions will result in greater scrutiny, particularly if encounters go badly. This same concern might also prompt them to take a more legalistic approach in situations where they have discretion over issuing citations or making arrests (thus resulting in more minor citations and arrests). Substantial changes in officer behavior could then have ramifications, both good and bad, for police crime control efforts as well as police-citizen interactions and relationships. Studies are underway on this issue, but it is an area that arguably needs further research emphasis (Lum et al. 2015).

There is then the question of how BWCs affect citizens’ views and behaviors. The decline in citizen complaints found in BWC studies to date is encouraging, but it may not mean that citizens are more satisfied with police contacts in general. Citizens’ views of police more generally may also not change if the adoption of BWCs doesn’t seem to bring changes in police accountability and actions. BWCs could also have unintended effects on citizens’ actions. For example, might fear of being recorded on a police BWC discourage some people from contacting the police or cooperating with police as victims, witnesses, or informants? Also, might police adoption of BWCs worsen citizens’ perceptions of the police due to privacy concerns? Some of these issues are currently under study, while others need attention.

Other significant research gaps also remain. While much of the existing and ongoing research focuses on officer behavior, this research tends to focus on police professionalism, use of force, and misconduct. However, BWC adoption has also been spurred by more critical and hard-to-measure concerns, including whether BWCs can reduce implicit or explicit bias among police and differential police treatment based on race, sex, age, ethnicity, or other extralegal characteristics. Additional questions of misconduct or professionalism concern the potential impact of BWCs on officer compliance with Fourth Amendment standards (and analogous legal standards outside the United States) during stop-question-and-arrest—an area not yet examined. In a similar vein, while ongoing research is examining officer attitudes about BWCs, other measures of these attitudes, such as job satisfaction and retention, have not been investigated. Finally, several organizational issues warrant attention, including whether BWCs can: facilitate the investigation of critical incidents such as officer-involved shootings; improve training and affect policy changes; or impact the accountability, supervision, management, and disciplinary systems of an organization, including those related to internal investigations.

Thus, like LPRs, BWCs were adopted with relatively little understanding of their effects. In a period of only a few years, tens of millions of dollars (and perhaps more) have been spent on their acquisition. Of course, law enforcement cannot always wait for research before making a policy or technology decision. In the current environment, police agencies felt they needed to do something to improve their legitimacy with citizens as well as to protect themselves against unjustified complaints. And in fairness, unlike LPRs, the push to create an evidence base for this technology is stronger, due to a greater level of commitment and funding for research on BWCs by both the U.S. Department of Justice and private funders such as the Laura and John Arnold Foundation. Nonetheless, BWCs provide another example of how police can sometimes
move quickly to adopt an innovation despite a lack of knowledge about the consequences of that innovation. This stands in contrast to experience with other innovations, such as problem-solving, community-oriented, hot spots, or targeted policing. The uptake on these innovations has been much slower even though we have lots of research knowledge to guide these practices. Politics, a belief that an innovation is “common sense” or straightforward, and the ease with which an innovation fits into policing’s tasks, function, and existing technological frames all contribute to this state of affairs.

**Integrating Technology and Evidence-Based Policing**

We recognize that technology adoption is sometimes viewed outside of the realm of evidence-based policing; in some cases, adoption of technology is a reflection of modernizing the police force, increasing job satisfaction, and just making certain processes easier. But to optimize the use of technology requires viewing technology from an evidence-based perspective. Agencies may already have acquired LPRs and BWCs and want to know how to use them in ways that lead to outcomes that they seek, including not angering the communities in which they operate. Technologies such as crime analysis or information technologies have already been well-integrated into many police agencies, but thinking about how they are currently used and how organizational factors shape those uses is essential when agencies consider how to optimize technology use. Research knowledge on police strategies and tactics, technological frames, and outcome research on technology are all important parts of the evidence base for technology that can contribute to optimizing its use.

Based on our fieldwork in this area with James Willis as discussed in Koper et al. (2014; 2015c), we suggest several recommendations for agencies to optimize their adoption and use of technology within an evidence-based policing framework. For starters, there are a number of ways that police can potentially smooth the process of technological change and increase receptivity to new technology. For one, police managers should allow for a broad base of participation in the technology implementation process by various personnel who will be affected by the technology. This process should provide ample opportunities for pilot testing early versions of a technology for both technical assessment and outcome effectiveness, and soliciting input that can be incorporated into its final design. This process can be helpful in identifying and correcting technical problems with a technology and for determining its most effective applications. Staff at various levels should also have opportunities to offer insights on how technologies like IT, crime analysis, LPRs, and BWCs might be best integrated into assessments of performance. Allowing those who are being assessed to participate rather than simply imposing new requirements upon them will likely increase levels of understanding and acceptance of the technology being used in this way (Mastrofski and Widman 1991).

Proper levels of training are also essential, especially for the most difficult technological changes. For example, learning how to use an IT system properly, in terms of both input and use of output, requires extensive training, follow-up, and consistent adjustment. Moreover, once basic training is done, agencies should prepare a systematic and continuous approach to follow-up, in-service training, reinforcement, ongoing technical support, and adaptation to new lessons. This should include dissemination of information about effective practices, success stories, and tips for easier or faster use of technology (such techniques are often discovered by individuals but not shared widely or systematically).

However, to reap the full potential benefits of technology in an evidence-based framework, police must also arguably address traditional and long-standing philosophical and cultural norms about the role of law enforcement. For example, research indicates that from a policy and practice perspective, adjusting organizational factors and frames may be just as useful as adjusting the use of the technologies themselves. Technological adoption is not only a long and continuous process of its own, but one that is highly connected to many other aspects of policing, including daily routines and deployments, job satisfaction, interaction with the community, internal relationships, and crime control outcomes. Thus, managing technological change in policing is challenging and closely connected to managing other organizational reforms (such as improving professionalism, reducing misconduct, and adopting community problem solving, or evidence-based policing). Accordingly, strategizing about technology application is essential and should involve careful consideration of the specific ways in which new and existing technologies can be deployed and used at all levels of the organization to meet goals for improving efficiency, effectiveness, and agency management. Research evidence can provide knowledge to assist agencies with this task.

Most fundamentally, training about proactive and evidence-based strategies—and how technology can be used in support of those strategies—is needed. As we have discussed throughout this book, police are most effective in reducing crime when their strategies are proactive, focused (both on high-risk places and groups), and oriented towards problem solving and prevention. In our experience, however, officers often seem to have a limited understanding of how technology might help them in these regards, and their agencies typically lack reward systems to encourage innovative responses to crime. As discussed earlier, officers generally focus on using technology in support of answering calls and other traditional enforcement and surveillance activities. Given that an agency is trying to reduce, prevent, and control crime (rather than just react and respond to it), training regarding technology or other tools needs to incorporate how technology might be used more comprehensively for these goals. How, for example, can officers use their agency’s information systems and
crime analysis to guide their patrol activities between calls for service, identify and address problems at hot spot locations, and monitor high-risk people in their areas of responsibility? At the same time, how can managers use these technologies to encourage such work by their subordinates?

Training on the use of technology for evidence-based practices should also extend to the enhancement of police legitimacy in the community; for example, to include the application of procedural justice (e.g., Mazerolle, Bennett, Manning et al. 2013). Officers working with video and audio recorders in their car or on their person might benefit from training on how these technologies can reduce the chances of conflict in citizen encounters and maximize citizens' sense that they have been treated respectfully and fairly. Training might also emphasize issues such as how officers can use their technologies (such as information systems) to be more helpful to citizens in their encounters and how they might explain the purpose and uses of surveillance technologies (like LPR) that may arouse privacy concerns.

Finally, there is a need for both police and researchers to make a greater commitment to a strong research and development agenda regarding technology. This is currently lacking, as police often adopt new forms of technology like LPRs and BWCs before their impacts and effectiveness have been demonstrated and understood. Practitioners should review existing research about the uses, consequences, and effectiveness of technologies and also consider conducting their own pilot testing and evaluation of these technologies before making substantial investments in them (e.g., Cohen et al. 2007; Ohio State Highway Patrol 2005).

A related point is that police managers should do more to systematically track the ways that new technologies are used and the outcomes of those uses. This is particularly applicable to technologies like LPRs which, based on the authors' familiarity with several agencies, are typically deployed with no systematic tracking of how they are being used and with what results. Earlier, we noted some of the ways that police could better track LPR use and results. One could envision similar forms of tracking and evaluation for other technologies like in-car and body cameras and new forensics technologies, to name a few. This would help police to evaluate the benefits of new technologies relative to their costs—an important consideration given the costs of many new technologies and the general fiscal pressures faced by police agencies—and inform their assessments of which technologies are most beneficial.

Researchers can assist practitioners in these endeavors by collaborating on evaluation studies that carefully assess the theories behind technology adoption (i.e., how and why a particular technology is expected to improve police effectiveness), the ways in which technology is used in police agencies, the variety of organizational and community impacts that technology may produce (both intended and unintended), and the cost efficiency of technology. Additionally, research is needed to clarify what organizational strategies—with respect to training, implementation, management, and evaluation—are most effective for achieving desired outcomes with technology and avoiding potentially negative unintended consequences. In all of these ways, greater attention to technology implementation and evaluation can help police agencies optimize technology decisions and fully realize the potential benefits of technology for policing within an evidence-based framework.