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Valuating Law Enforcement Data in the 21st Century: An Adaptive Mixed- Methods Approach

Final Report

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1. Purpose

The overarching goal of the Valuating Law Enforcement Data in the 21st Century study was to develop a guiding valuation methodology to assist law enforcement agencies in determining what comparative value different data sources have, whether to acquire new sources of information, and how to use that information effectively. These goals were substantially modified throughout the project because of unexpected findings during Phases I and II. After completing Phases I and II, RTI International changed the scope of Phase III to realign the project with the findings from the prior phases. The purpose of the project was refined to focus on body-worn cameras (BWCs) and the costs and benefits associated with them. RTI conducted a comprehensive literature review, and site visits with four law enforcement agencies (LEAs), to develop a cost-benefit analysis (CBA) tool that agencies can use to understand both the cost drivers and the potential benefits of BWC adoption.

2. Project Subjects

The project subjects were personnel (including sworn and civilian staff) at 13 law enforcement agencies, listed in Table 1. Efforts were made to diversify among municipal police and sheriffs, the variety of agency sizes and populations served, and geography.

Table 1: Participating Agencies

Agency	State	Type	Size
Phase I			
Wilmington Police Department	NC	Municipal police	Mid
Seattle Police Department	WA	Municipal police	Large
King County Sheriff's Office	WA	Sheriff	Large
Charleston Police Department	SC	Municipal police	Mid
Overland Park Police Department	KS	Municipal police	Mid
Yates County Sheriff's Office	NY	Sheriff	Small
Burlington Police Department	MA	Municipal police	Mid
St. Paul Police Department	MN	Municipal police	Large
Fort Collins Police Department	CO	Municipal police	Large
Phase II			
Greensboro Police Department	NC	Municipal police	Large
New Orleans Police Department	LA	Municipal police	Large
Indianapolis Police Department	IN	Municipal police	Large
Rochester Police Department	NY	Municipal police	Large

Note: Size definitions: small agencies had fewer than 100 sworn officers, mid-sized had 101–500 sworn, and large had 501 or more sworn.

Personnel included in each site visit varied by agency. In general, site visits were designed to include personnel from executive staff, information technology, patrol, investigations, and crime analysis.

3. Project Design and Methods

The project was conducted in four phases. Phase I was a literature scan and expert interviews. Phase II was an exploratory effort at understanding the dimensions and characteristics of valuation efforts focused on policing data. Phase III was focused on developing a CBA framework for BWCs. Finally, Phase IV turned the BWC CBA tool into a Web-based calculator that can be used by agencies to assess the likely impact of BWCs on their agency.

3.1 Phase I – Expert Interviews

Semi-structured interviews were conducted with the members of the advisory board between August 2016 and February 2017. Three were conducted in person and one was done via telephone. The interviews were conducted by two or three project team members, one of whom was designated to be the primary notetaker. Each interview started with an overview of the project. The goals of the interview were to (1) identify data that were perceived as most important, (2) explore how different kinds of agency personnel accessed and used data, (3) describe how data are translated into actionable information for policing operations, and (4) explore how these characteristics could be collected systematically. Interviews generally lasted about 1.5 hours. A summary of the expert interviews can be found in **Appendix A**.

3.2 Phase II – Valuation Site Visits

Nine in-person site visits were conducted with law enforcement agencies, each by two or three members of the project team. One person was generally designated as the primary notetaker, and the others led the discussion. Site visits were arranged by reaching out to a single point of contact in each agency. We provided an overview of the project and described the goals of the site visit. Each site visit was expected to take 1 day (although, when necessary, it was split into sessions over 2 days). During Phase I, we realized that valuation would vary considerably by different types of users. Therefore, during Phase II site visits, we attempted to meet with agency personnel in the following roles: (1) command staff, (2) patrol officers, (3) investigators, and (4) crime analysts. Except for command staff, the sessions were usually conducted by assignment type in small groups (three to five participants). Command staff was usually represented by a single senior sworn officer (typically at the rank of captain or higher). Site visit protocols for this phase can be found in **Appendix D**.

A subset of participants (patrol officers, investigators, and crime analysts) were asked to talk through the instrument described in **Appendix Table C-1**. The goal of this activity was to gather information on the utility of specific datasets, by user type.

Discussion topics varied by the role of the participants. For command staff, the discussion focused on agency-level issues such as policing strategy, data-driven policing, budgeting and funding technology infrastructure, and goals and methods to achieve agency transparency. Discussions with patrol officers, investigators, and crime analysts focused on practical issues with collecting and using data in law enforcement. A key focus was on understanding what data were used, how they were used, and what the impact of removing those data would be. Two other topics came up frequently: "How do users assess the quality of data/data systems?" and "How does informal data sharing affect the utility of agency data?"

3.3 Phase III – Cost-Benefit Analysis for Body-Worn Cameras

Phase III focused on developing a cost-benefit framework appropriate for BWCs. This technology was selected for three reasons. First, the rate of adoption by LEAs has been extremely fast and thorough. Large and small agencies have found BWCs to be a necessary component of law enforcement. Second, BWC adoption has received substantial attention from researchers. As such, there is a reasonable body of research that we initially believed could inform both the costs and benefits sides of the equation. Finally, BWC acquisition tends to be complex. It can trigger considerable infrastructure changes, creates policy and personnel issues that must be addressed, and may alter how other work at the agency (e.g., internal investigative practices) is conducted. Given the complexity of adoption and integration, we believed that a BWC CBA would be an ideal example of the process. Replication of the process with other technologies should be less complex.

We began by scanning the literature to identify both costs and benefits that had been documented in peer- and non-peer-reviewed research. A structured coding instrument was developed, and key information was extracted from each article. A subset of the project team reviewed any empirical articles with a focus on BWCs using the standardized instrument. The instrument prompted reviewers to collect information across multiple fields, including the research questions, methodology used and study type (e.g., randomized controlled trial), sample size, operationalization of complaints or use of force, effect sizes, and summary of results (see **Appendix E** for the full coding instrument). The literature search was conducted in multiple stages. Online searches of key words (e.g., body-worn cameras, BWC) were conducted on Google, Google Scholar, and EBSCOhost. References from the articles identified during this search were reviewed and any newly identified articles were sourced. We focused on peer-reviewed articles/manuscripts, but we also reviewed other materials to gather as much information as possible to outline the characteristics and parameters of the CBA. For example, we reviewed vendor marketing

materials to develop a broad understanding of the proposed benefits and costs associated with adopting BWCs. Some articles were excluded because they were about research conducted outside of the United States, presented results that were duplicated in another article, or did not provide sufficient information regarding effects of BWCs (e.g., one article presented only odds ratios, which cannot be converted to percent change pre- and post-intervention). Once key cost and benefits were identified, we conducted in-depth data collections with four jurisdictions that had implemented BWCs. The site visits were conducted with members of command staff, information technology/BWC management, and internal affairs.

A preliminary BWC costing tool, developed on the basis of existing published research, was completed by the participating agencies. This tool was disaggregated into a fillable PDF form that was sent to sites before the site visit. Agency representatives were asked to complete the site visit guide, which was reviewed by the project team before the in-person visit. The review was focused on identifying where data were located that were needed to answer the questions and to identify the questions that could not be answered. The site visits were then conducted in person. The project team was represented by two RTI staff. Representatives from the participating agencies included agency executive staff, technology director, staff responsible for footage storage or transfer, and users of BWC technology. The in-person session was organized around the pre-visit guide and attempted to determine answers for a number of issues, including the following:

1. The process to identify and select a BWC vendor. This included exploring any potential pilot programs that were implemented by the agency before widespread deployment
2. The cost associated with that identification process, camera acquisition, officer training, data transfer and storage, analysis or retrieval of footage, and other maintenance costs
3. The sources of funding for BWC adoption and implementation
4. What benefits were anticipated at the point of BWC adoption and what benefits have been realized since implementation, and, relatedly, what challenges have been experienced because of BWC adoption
5. The perceived impact of BWC adoption from the perspective of officers, agency leadership, city leadership, and the general public
6. Whether any data are collected about BWC equipment use and functionality (including equipment malfunctions), and any metrics related to the storage or use of BWC footage

After completing the first two site visits, project staff refined the pre-site visit instrumentation. Changes were made to clarify language, further disaggregate cost components, and add additional cost fields that had not previously been documented.

3.4 Phase IV – Developing the Calculator for the Cost-Benefit Analysis of Body-Worn Cameras

Information from the site visits was used to develop and refine the cost-benefit calculator. The CBA tool was produced in two formats: a Web-based tool and a corresponding Microsoft Excel file.

RTI had originally proposed to produce only the Web-based tool. However, the project team was concerned about the transparency and sustainability of a Web tool. To ensure that the product would be available after the project was completed, we also produced an Excel version of the calculator. The Excel version of the CBA tool provides redundancy and has the added benefit of being easy for external reviewers to use to review model assumptions and revise calculations if necessary.

4. Data Analysis

Data analysis for Phases I, II, and III was done through qualitative assessment of site visit interview notes. After each site visit, the project team (including the members that attended the site visit and those that did not) met to discuss the interviews and focus groups. Patterns and themes, both consistent and inconsistent with previous site visit data, were discussed. Content analysis was performed to identify emergent themes. During Phase II, this process was done on an ongoing basis. Themes would be identified and site visits that came after would be assessed for consistency with findings from earlier site visits.

Only a limited analysis was needed for the BWC CBA parameters. Key research was identified and coded as described in **Appendix E**. Parameters were standardized, and high, low, and median values were identified. The values identified from this work were used to provide recommendations if no agency data are available from prospective BWC CBA users.

5. Findings

We present findings from Phases I and II together because of the close relationship between the expert input and the resulting instrumentation used in the Phase II site visits.

5.1 Phases I and II – Expert Interviews and Site Visits

Phase I completion allowed for the development of Phase II interview formats and guides. All nine of the site visits scheduled for Phase II were completed. Key takeaways from completed site visits include the following:

1. Data are more valuable when they are delivered in real time, immediate, and up to date. The longer the time gap between when data are generated/analyzed and their delivery to relevant personnel, the less value they are perceived to have.

2. Informal information and data sharing can be valuable both within and across agencies. Many participants said that a considerable amount of information is shared via informal channels despite the advance of structured information sharing systems.
3. There are political, legal, and organizational barriers to interagency information sharing. Executive staff varied in their perceptions of the utility of structured and formalized information sharing technology platforms. Several users reported that peer-to-peer conversations between personnel in different agencies were a more efficient way of learning necessary information.
4. The most valuable information when responding to calls for service is that which could affect officer safety. This includes details about the current call for service and premise/person history of involved parties. Officers are obviously interested in the current call characteristics, but they also expressed interest in what has happened in that location in the past.
5. Data are valuable when they are accessible and convenient. Barriers to access (e.g., multiple login procedures, rapidly expiring passwords) discourage use, and reduce the value, of data. Users expressed relatively low thresholds for discontinuing use, especially if the system was noncritical to their primary duties.
6. For crime reports, longer narratives are valued, with more information perceived as better. However, this longer narrative comes at the price of increased burden on reporting officers.
7. The value of data is dependent on the person recording the data. The quality and utility of dispatch data vary by dispatcher. Similarly, the quality and value of report narratives vary by report taker. Investigators were finely tuned in to which patrol officers tended to provide better information through more carefully documented report narratives.
8. Users are skeptical of data entered by others and are cautious about taking data at face value. For example, crime analysts often review the crime classification of events for accuracy, even though the officer has submitted the information and records staff have verified it. Data cleaning and transformation are often viewed as necessary to maximize utility.
9. Several types of agency participants questioned the utility of crime analysis products. There is a pervasive belief that officers already “know” where crime is occurring. Analytics can be useful but are not essential. There was often an emphasis on self-experience over analytics or data products.
10. Many sworn officers reported that crime analysis information should still be pushed to them; they did not want to have to source it themselves, even from easy-to-use online platforms. This belief suggests that certain technologies (e.g., decentralized crime mapping and analysis tools) are unlikely to reach their full potential. It is also clear that making data analytics easier to use will not resolve the challenge with turning data into actionable information.
11. Data consumers (e.g., detectives, crime analysts) often find discrepancies in auto-populated fields frequently used in records management systems. People will often click through fields without verifying their accuracy. Users reported a lack of accountability and leadership necessary to resolve this problem. At the same time, they recognized that the issue was likely not going to be resolved by the personnel entering the data unless more direct accountability was made.

12. The thoroughness or completeness of the investigative process is difficult to document systematically. Participants reported that it is difficult to provide objective evaluations about the quality of an investigation. Related to CBA methodologies, this difficulty makes it problematic to understand how much technology contributed to the quality of an investigation.
13. The budgetary process is often procedural in nature. A majority of the budget is nondiscretionary funds (e.g., salary and benefits) that have predictable changes from year to year. Although much smaller in scale, methods of budgeting discretionary funds appear to be poorly defined. Justifications for technology and equipment that support data use, access, storage, or retrieval were not easy to identify, even among agencies that had well-defined budgetary processes.

5.2 Phase III – Cost-Benefit Analysis for Body-Worn Cameras

Phase III had two components: conduct a literature review to identify the costs and benefits of BWCs in law enforcement and conduct a BWC CBA in four agencies. The literature review was conducted in mid-2018.

5.2.1 Establishing Costs and Benefits

The purposes of the literature review were to (1) identify cost and benefits that have been studied in existing research and (2) develop guidelines for agencies that could be used if agency-specific data were unavailable. Table 2 presents the characteristics and parameters developed from the existing BWC literature. Despite the seemingly large body of literature around BWC use and adoption, we found relatively little research to inform estimates of several key dimensions. Most research was focused on understanding how BWCs changed citizen complaints and officer use of force.

In fact, only one study attempted to understand the financial costs associated with the changes in complaints. Braga and colleagues (2017)* established the cost of investigating citizen-initiated complaints by counting the number of hours spent by investigators and supervisors on each investigation. Before BWC implementation, investigators and supervisors spent an estimated 91 person-hours on each complaint. After BWC implementation, this estimate dropped to less than 8 hours. We could find no other studies that assessed the reasonableness of this reduction.†

It should be noted that we also considered the impact of BWCs on lawsuits. If BWCs reduce use of force, it is plausible that they may also reduce events that result in lawsuits associated with allegations of improper use of force. There were four issues with

*Braga, A., Coldren, J. R., Jr., Sousa, W., Rodriguez, D., & Alper, O. (2017, September). *The benefits of body-worn cameras: New findings from a randomized controlled trial at the Las Vegas Metropolitan Police Department* (NCJ Report No. 251-416). Washington, DC: U.S. Department of Justice, Office of Justice Programs, National Institute of Justice. Available from <https://nij.ojp.gov/library/publications/benefits-body-worn-cameras-new-findings-randomized-controlled-trial-las-vegas>

†We discussed these values during the four site visits. More information can be found in **Section 5.2.2**.

incorporating this dimension. First, there was limited research linking BWCs and lawsuits. Second, the monetary costs associated with lawsuits are highly variable and prone to being overly influenced by outliers. Third, although lawsuits are common across law enforcement, they are relatively rare at any individual agency. Fourth, it is not clear how lawsuit costs or settlements affect agency budgets. Costs may be absorbed by the city/government and insurance and not directly impact the LEA's operating budget.

Table 2. Parameters in the Cost-Benefit Analysis for Body-Worn Cameras

Input	Type	External Source	Value		
			Mid	Low	High
Total sworn officers	Required input	N/A ¹			
Total complaints last year	Required input	N/A ¹			
Total use of force (last fiscal year)	Required input	N/A ¹			
BWC initial equipment cost	User input	N/A ¹			
BWC annual recurring cost	User input	N/A ¹			
Cost per complaint/UoF investigation	User input or external source	N/A ¹			
Detective hourly wage	User input or external source	Bureau of Labor Statistics (BLS) ^a	\$30.47	Unavailable ²	
Detective hours per complaint (pre-BWC)	User input or external source	Braga et al., 2017	80 hours	Unavailable ³	
Detective hours per complaint (post-BWC)	User input or external source	Braga et al., 2017	6 hours	Unavailable ³	
Sergeant hourly wage	User input or external source	BLS & Braga et al., 2017	\$55.04	Unavailable ²	
Sergeant hours per complaint (pre-BWC)	User input or external source	Braga et al., 2017	7 hours	Unavailable ³	
Sergeant hours per complaint (post-BWC)	User input or external source	Braga et al., 2017	1 hour	Unavailable ³	
Lieutenant hourly wage	User input or external source	BLS & Braga et al., 2017	\$66.05	Unavailable ²	
Lieutenant hours per complaint (pre-BWC)	User input or external source	Braga et al., 2017	4 hours	Unavailable ³	
Lieutenant hours per complaint (post-BWC)	User input or external source	Braga et al., 2017	0.33 hours	Unavailable ³	
Change in complaints (BWC)	User input or external source	4 studies ⁴	-44%	0%	-65%
Change in UoF (BWC)	User input or external source	6 studies ⁴	-28%	0%	-50%
% of complaints due to UoF ⁵	User input or external source		Unavailable ⁶		

(continued)

Table 3. Parameters in the Cost-Benefit Analysis for Body-Worn Cameras (continued)

Input	Type	External Source	Value		
			Mid	Low	High
% of UoF ending in officer injury	User input or external source	Smith et al., 2010 ^b	15%	Unavailable ⁷	
Cost per officer injury	User input or external source	Holloway-Beth, 2018 ^c		\$2,500	\$12,000

Notes: BWC, body-worn camera use; UoF, use of force. 1. An agency must supply this information using its own characteristics and cost information from BWC vendors. 2. Hourly wages provided by the Bureau of Labor Statistics. No salary range was provided. 3. At the time of writing, only one study provided information on the impact of BWCs on internal investigations. We were unable to confirm these estimates during any of the four site visits conducted during Phase III. 4. For a list of studies used to characterize this change, see **Appendix B**. 5. The percentage of UoF events that end in officer injury is needed to avoid double-counting the benefits of BWC adoption. It is assumed that if BWCs reduce the UoF, the number of officer injuries will likely be reduced as well. 6. We could not identify any published sources that disaggregated complaints by reason for complaint. 7. We could only identify one source that discussed the percentage of UoF cases that resulted in officer injuries.

a. BLS data for officer salary costs are available at: <https://www.bls.gov/ooh/protective-service/police-and-detectives.htm>

b. Smith, M. R., Kaminski, R. J., Alpert, G. P., Fridell, L. A., MacDonald, J., & Kubu, B. (2010, July). *A multi-method evaluation of police use of force outcomes, executive summary* (Report No. 231177). Washington, DC: U.S. Department of Justice. Available from <https://www.ncjrs.gov/pdffiles1/nij/grants/231177.pdf>

c. Holloway-Beth A., Forst L., Freels S., Brandt-Rauf S., & Friedman L. (2016). Occupational injury surveillance among law enforcement officers using workers' compensation data, Illinois 1980 to 2008. *Journal of Occupational Environmental Medicine*, 58, 594–600. <https://doi.org/10.1097/JOM.0000000000000708>

This literature review was used to develop a pre-site visit form that was completed by four agencies. Beyond capturing the data relevant to CBA, we also attempted to better understand how agencies arrived at answers for these questions.

5.2.2 Conducting a Cost-Benefit Analysis for Body-Worn Cameras in Four Agencies

The site visits were conducted in person by two members of the research team. The research team reviewed the pre-site visit form during interviews with key personnel (**Appendix F** summarizes the data provided by each agency before the site visit). In three of the four sites, the meetings were organized around job position and role in the agency. Separate interviews or small group meetings were held for command staff, BWC technology managers, and internal affairs investigators.

This work identified considerable challenges in attempting to build a robust CBA for BWC implementation by law enforcement. The limitations we encountered were both practical and conceptual. From a practical perspective, agencies were unable to provide sufficient information to complete several components of the pre-site visit guide. The most

problematic variables were the time taken for investigating complaints and use-of-force activity. Agencies reported that they did not collect information that would allow them to track labor hours expended on these efforts. Respondents were generally unwilling to speculate on how BWC adoption affected internal investigative efforts. Various respondents told us that BWCs increase, decrease, or sometimes increase and sometimes decrease the amount of time it takes to conduct an investigation. Most respondents were skeptical of the large reduction in investigation time identified by Braga et al. (2017) but were unable to suggest a more plausible impact of BWC on investigations. None of the agencies that participated in our site visits tracked staff time in a manner that would be conducive to answering this question.

Some research has established that the adoption of BWCs should reduce officer injuries. This is a result of improved officer and citizen behavior during police contact, and thus a lower likelihood that police-public interactions end in use of force, when BWCs are in use. Our discussions with agency personnel suggested that they were not able to accurately report the cost of officer injuries in their agencies. Some reported that this number should be available, but that it would require access to data from another city agency and review of hard-copy documents.

Other challenges were more conceptual and sometimes reflected a lack of necessary research. For example, it is unclear how to value an arrest in the context of a CBA. Considered from a short-term, agency-focused perspective, if BWCs increase arrests, it may be appropriate to consider the efforts on the cost side of the equation. A broader view may consider an arrest a net benefit if it reduces future crime and therefore police workload. We note, however, that despite the seemingly logical connection, research linking arrests with crime prevention is limited.

Research is also limited in understanding the value of BWCs in supporting police-community relations. There is a limited, but growing, body of research that suggests BWCs are helpful in facilitating positive police-community relations.[‡] However, even this research is limited in facilitating a CBA because these studies often do not report on costs. At this time, it is unclear how improved police-community relations could be translated into a cost parameter for a CBA. Research has also suggested that police-community relationships are multifaceted.

Other concerns about BWC adoption were discussed during some site visits. For example, we heard that BWC adoption may negatively affect officer morale or informal peer-to-peer information sharing. In particular, respondents believed that because BWCs are always recording, officers have virtually no privacy even when talking among themselves. This

[‡]Maskaly, J., Donner, C., Jennings, W. G., Ariel, B., & Sutherland, A. (2017). The Effects of Body-Worn Cameras (BWCs) on Police and Citizen Outcomes: A State-of-the-Art Review. *Policing*, 40(4), 672-688.

could result in less interpersonal information sharing, which could negatively affect morale. We could not find research that would allow us to quantify this effect.

More broadly, agencies expressed a number of concerns that would make a CBA on BWCs less useful. Contrary to information we gathered during earlier phases of the project, some respondents were not convinced that it was necessary to conduct a CBA before purchasing or implementing BWCs. Numerous participants stated that the adoption of BWC was necessary, and that this necessity was based on generating goodwill among community members. For this reason, BWC acquisition could be seen as fulfilling a symbolic need. These participants did not think that conducting a CBA would have led them to change their decision with regard to adoption. One participant suggested that a BWC CBA was attempting to fit an emotional decision into an overly rational framework.

Respondents did not, in general, appear to connect BWC costs to tradeoffs in spending in other areas. In other words, agencies were not making decisions between funding another sworn officer or purchasing BWCs for the department. Instead, money to implement BWCs was available only for BWCs. This was either because the money was part of grant funding, because BWCs were needed to comply with legal mandates, or because the funding was allocated to the agency specifically for BWC adoption.

Despite the widespread belief that BWCs were useful and good for the agency, most respondents could not identify measurable goals or objectives for BWCs that were developed before their adoption. For example, there was broad concurrence that BWCs should improve police-community relations. There was no discussion, or consensus, on how agencies would measure or assess changes in police-community relations. Even measurable goals, such as reducing complaints, were not regularly tracked as a technology performance measure.

5.3 Phase IV – Tool for Cost-Benefit Analysis of Body-Worn Cameras

We used existing research and Phase III site visits to create and refine a CBA tool for LEAs to use. The literature review helped to identify both costs and benefits that had been established in previous research. The site visits with agencies were helpful in identifying additional costs and in ensuring that the language used in the tool was clear and would be consistently interpreted by agencies. A preliminary CBA tool was developed for the site visits with the first two agencies. On the basis of the feedback those agencies provided, several changes were made to the site visit protocol to address issues with how people interpreted and responded to questions and to add additional important data.

Two versions of the tool were created: a Web-based tool, hosted on a commercial cloud provider, and an Excel workbook version. Both versions are available at costofpolicing.org. A demonstration of the CBA tool (Excel version) can be found in **Appendix G**.

The Excel version was created to ensure that the tool would be available if RTI were unable to maintain the Web server hosting. It has additional benefits in that it allows users to review how costs and benefits are being calculated in the final model. Transparency in cost calculations allows users to understand how agency-level characteristics are being treated by the model and facilitates customization by users, if necessary, to match the conditions in their agencies.

5.4 Limitations

Throughout this project, we talked and met with dozens of representatives of 13 agencies. These agencies were diverse in size, type, and location. Nevertheless, it is possible that our findings are not representative of all LEAs everywhere. We attempted to counter this limited sample size by conducting literature reviews of key technologies. In general, existing research tended to support our findings that the adoption of technology by LEAs is not a highly structured or logical process.

During the BWC costing efforts conducted with agencies, we heard several times that some information may be available if given enough time. However, they were not willing to make the effort for the site visits that were conducted. This limits the precision of our BWC CBA efforts but also points to a larger issue with data availability. If agencies could not complete this process without extensive research, it is unclear whether they would ever have sufficient motivation to do so.

Our cost-benefit tool for BWCs is limited in several ways. We attempted to provide plausible ranges for values that users may not be able to specify. For example, an agency considering the implementation of BWCs would not know how BWCs might reduce use-of-force events in their agency. We developed the plausible range values from existing BWC literature. However, despite the increasing body of BWC literature, many of the parameters needed have limited support. For example, we could only identify only one article that considers the impact of BWC on internal affairs investigations, so we do not know whether those results would translate to other agencies. Caution must be used when adopting values derived from limited research.

6. Implications for Criminal Justice Policy and Practice

Our work identified a number of substantial challenges to implementing cost-effectiveness analyses in LEAs. This section describes our observations about the barriers to CBA for law enforcement technology and our recommendations of ways to overcome the barriers.

6.1 Barriers

Lack of articulation of technology goals. Agencies found it difficult to explain the logic behind technology, systems, and data adoption. As part of the site visits, we asked command staff

to discuss why technology, systems, or data were purchased. In many cases, answers to this question were incomplete. Answers mostly resolved around transparency, crime control, or agency efficiency, but only in a general sense. These very broad goals lacked the specificity needed to conduct an effective evaluation. There was little discussion about how technology or data linked to policing strategy or crime control philosophy or about how technology could support key missions of the department.

Lack of performance metrics. Beyond not describing appropriate goals of technology, many agencies did not have the capacity to capture performance metrics. There was little interest in expending limited funds or resources in establishing performance metrics. Agencies reported that technology that stores or facilitates the use of data often does not capture relevant metrics that could be used to evaluate the technology's effectiveness. Objective measures about access, use, or queries—or other metrics that may provide insight into the value of data systems—were generally not available. Agencies have generally not tracked this information, and most were unaware whether this kind of information was available from their software vendors. Most agency representatives stated they would not be able to provide such information if requested.

Agencies' reliance on case studies. Discussions with agency representatives revealed considerable belief that some technologies were effective even there was no systematic evidence of their effectiveness. Instead, perceptions of effectiveness appear to be driven by knowledge of situational effectiveness or case studies. For example, when asked whether license plate readers were effective, officers would often point to cases where such data were used to help identify a suspect. Reliance on case studies is understandable given the lack of, or confusing nature of, empirical evidence on technology effectiveness. Nevertheless, agencies' overreliance on case studies makes it difficult to accurately assess the impact of technology and data.

Lack of demonstrated effectiveness or demands to demonstrate effectiveness. Agencies are not routinely asked to report on technology effectiveness or efficiency with a high degree of scientific certainty. The role of the community, city managers, or city councils in pushing for better performance metrics appears underdeveloped. It is no surprise, then, that agencies are unprepared to answer questions about how they assess effectiveness. Our discussions with them suggest that even basic usage metrics were either unavailable or difficult enough to obtain that they were not reviewed. When evaluation was mentioned, it was often focused narrowly on the metrics that were mandated by state or federal grant reporting requirements. Broad and undefined technology goals do not lend themselves to robust evaluations and often fail to explain how specific implementation decisions were made (e.g., why cameras were placed in a certain location or why certain data systems were purchased for only a subset of users).

Lack of knowledge about costs. Most users in a department know relatively little about the monetary costs of technology or data. This is compounded by the fact that most people do not consider the total costs associated with acquisition and maintenance. Costs associated with acquiring hardware or licensing software are relatively easy to quantify, but costs associated with personnel are often not well recognized or documented. This information is not easily available and generally does not matter to typical users. Limited access to this kind of information means that most personnel do not conceptualize the acquisition of technology or data as a tradeoff with other things that the agency may spend money on.

Inconsistencies between user types. The perceived value of data varied considerably between different types of users. Unsurprisingly, the information that detectives found useful in investigating a case, for example, was not the same information that patrol needed to efficiently and safely respond to calls for service. However, there was consistency in the characteristics of data (e.g., timely and accurate) that were perceived as valuable. We also found that most users were reluctant even to speculate in valuation exercises. For example, when asked, many users were unwilling to make ranking decisions on the most important data for their job. Instead, we would often hear about how the decision of value was contingent upon very specific issues with the task at hand.

Inconsistencies between individuals. There were considerable differences in data valuation within user groups which was unexpected at the start of this project. Even within a single agency and within a single user group (e.g., detectives), there were inconsistencies in what users reported as most valuable. For example, in a site visit at a single agency, three detectives told us that they used three different public record aggregators. None of them knew that the other systems were available for their use or how they would go about getting access to the other systems. The inconsistency in knowledge about the existence of resources would significantly complicate attempts to develop valuation frameworks.

Lack of agency performance metrics. Consistent with other research, agencies we spoke with struggle to provide information about their own effects on crime, fear of crime, and community sentiment. Agencies do an excellent job tracking the outputs of their efforts. They can tell how many reports were taken and how many arrests were made. Unfortunately, they capture much less information that systematically characterizes other important aspects of policing, such as fear of crime or community sentiment toward the police. To a large extent, then, it would not be possible to understand how data affect these key metrics of police performance. One of the key goals of BWCs, for example, was to provide increased transparency of police operations and increase community trust in the police. However, agencies do not routinely gather evidence on police-community trust, thereby limiting the ability to provide a full accounting of benefits attached to technology and data.

Insufficient research on BWC effectiveness. We note two areas where research on BWC effectiveness is extremely limited. First, there is limited research documenting the value of BWCs for police-community relations. Agencies were almost universal in suggesting that a key driver of BWC adoption was improved police-community relations (often through promoting more transparent police operations). Nevertheless, we could find no research that empirically demonstrated how BWCs were linked to police-community relations in a manner that would be conducive to CBA. Second, the link between BWC and agency performance measures is similarly limited. For example, only one study has explored how BWC adoption affects the process of complaint investigations. During Phase IV site visits, we were unable to find any agency that could provide these numbers with a high degree of accuracy. Most agencies simply do not track employee time in sufficient detail. Given the potential importance of this characteristic in the CBA, the lack of additional research on this topic is unfortunate.

These factors suggest that considerably more work is needed on foundational issues before CBA can be effectively carried out for police technology and data. Agencies do not routinely place data and technology in a framework that is amenable to CBA. Questions about effectiveness, utility, and value are often based on opinion, not fact. Agencies also rely heavily on the case study, or perfect example, in justifying technology utility. Although these examples are useful, they do not provide enough information to systematically measure the impact of technology. More importantly, they cannot be used to describe the comparative value of technology or to answer the critical question of how funds should be allocated between competing priorities.

6.2 Recommendations for Facilitating Cost-Benefit Analysis in Law Enforcement

On the basis of our experience conducting the BWC CBA, we developed a series of recommendations for researchers and LEAs (and the governments that operate them).

Recommendations for researchers:

1. *Conduct more in-depth costing exercises.* There were many studies on the effects of BWCs in LEAs, but most of them consisted of looking at a narrow component of BWC impacts. The limited scope of studies is also apparent in other technologies. More comprehensive case studies are needed to fully identify the costs and benefits associated with the technology.
2. *Carry out replication studies.* Policing varies greatly from agency to agency, and it is reasonable to expect that the motivations and benefits of technology adoption will also vary. If agencies are to be encouraged to conduct costing exercises, more research is needed to develop a robust research base that is sensitive to local context.
3. *Engage with LEA partners.* Researchers need to develop closer ties to agencies to understand the considerations of technology adoption. For example, we found that agencies explained BWC acquisition in terms of its symbolic relevance to the

community. However, the value of BWCs for community relations is not well studied in existing research.

Recommendations for government and LEAs:

1. *Develop a sound and strategic framework before acquiring a technology.* Agencies should have a strategic framework for acquiring technology that will help to guide the identification, vetting, and acquisition of new technologies.
2. *Identify performance metrics and evaluation plans.* Throughout this project, agencies struggled with describing the motivations and expectations for their data and technology. Agencies should articulate expected costs and benefits of technology before acquisition. Doing so will allow them to better understand what is, or is not, effective.
3. *Push technology companies to capture performance metrics.* Some types of performance measures could be captured automatically by hardware or software platforms. Basic measures, such as number of users or uses, could easily be tracked with minimal user intervention. Agencies should require companies to provide these kinds of metrics.
4. *Partner with researchers.* Partnerships between agencies and researchers would ensure that research questions and projects are more directly applicable to the day-to-day operations of LEAs. Strong partnerships would facilitate more complete and robust evaluations of law enforcement technology.
5. *City managers and elected officials must create a system of accountability.* During site visits, we heard numerous times that agencies had never been asked to justify the adoption or maintenance of technologies. Agencies may need external pressures to track the impact of data and technology. Evidence-based decisions about hardware or software acquisition and support costs can be used to encourage agencies to track performance measures and to make more accurate assessments about technology's impact on operations.
6. *The availability of state and federal funding for technology and data systems should be tied to better, and more comprehensive, performance measures.* Many funding programs require reporting outputs of technology such as the number of BWCs purchased or the number of LPRs active in the field. Our work here suggests that these kinds of metrics are insufficient to judge the use or impact of technology and systems. Additional information and data are needed to understand how these systems have been integrated and affected operations. These more critical measures should be required of grantees in order to ensure that public money is being spent wisely.

Appendix A: Expert Interview Summary

Expert Interview Participants

Jason Schiess, Durham, NC, Police Department

Damien Williams, Rock Hill, SC, Police Department

Dr. Eleazar (Lee) Hunt, Greensboro, NC, Police Department

Chris Bruce, independent consultant and law enforcement agency (LEA) data subject matter expert

Overview

The purpose of the expert interviews was to aid in the development of a framework that helps law enforcement agencies determine what comparative value different data sources have, whether they should incorporate new sources of data, and how to use data more effectively. We interviewed subject matter experts who are knowledgeable about law enforcement operations, technology, and data, as well as about how each of those broad categories intersects the others. Another key purpose for the expert interviews was to help determine that were asking the right types of questions to the right types of people during subsequent phases of the project.

Format

Individual expert interviews were conducted with the participants. Three were conducted in person and one via telephone. The interviews were generally unstructured but followed a general process in which the project team members outlined the purpose of the study and the goals of the interview. The experts were then asked about their experiences (both within their agency and with other agencies). Discussions lasted from 1.5 to 2 hours.

Overarching Themes

LEAs' valuations of specific types of data varies based on the strategy and philosophy of each agency. Participants emphasized that, especially in the age of community-oriented policing, LEAs are more open to nontraditional data sources (e.g., data from computer aided dispatch [CAD]/records management system [RMS], criminal histories, information from public record aggregators) that may help them gauge community trust and perception. Participants uniformly noted, however, that LEAs may need to be prompted to think about nontraditional data sources and their comparative value. Respondents suggested that more reactive LEAs, and certain units within most LEAs—like patrol—will focus mostly on internally generated data, which participants described as information that is generated through the course of operational activity. For example, when a call is dispatched and an officer is assigned, that action generates a record in the CAD system. Similarly, when an officer writes a report, it is stored in the RMS. Reactive LEAs, and staff in the patrol

function, are both the generators and consumers of these internally generated data and may have less familiarity with the universe of datasets that may be available to them.

We asked the experts to assess the site visit protocol for the next phase. They suggested that site visit participants will be much more familiar with and able to discuss information that the agency generates and consumes, like CAD and RMS data. This familiarity may result in bias toward information that the LEA generates itself because those data are created as a function of the core law enforcement responsibility: responding to calls for service, documenting incidents, and conducting investigations.

The experts noted that the value that specific types of data have within a LEA is not uniform. The value of data varies based on the role that an individual has within the agency. Defining typologies of data users within an LEA could be accomplished by grouping individuals with similar responsibilities. Four broad data user groups were identified by the experts: field operations and patrol, investigations, crime analysis and administrative, and command and executive staff. The experts noted that these broad groups value data differently because of the substantial variability in their responsibilities and activities. Participants suggested that staff in LEAs may be prompted to think comprehensively about which types of data they use regularly if they are prompted to respond by activity type. Several key activity types were confirmed as being common across LEAs, including responding to calls for service, conducting follow-up investigations, being proactive in high-risk areas, analyzing information, engaging the community, and tracking internal performance.

In addition to being prompted to think of data types on the basis of activities and responsibilities, participants suggested that many of the staff in LEAs will think in terms of specific technologies. They noted that agency representatives may think in terms of what technology enables them to do, rather than of how much they value the data that those technologies contain, manage, or generate.

Most Important Law Enforcement Agency Data Types

Respondents suggested that internally generated data would be the most valuable. Information in the RMS and CAD is essential to law enforcement operations and analysis. CAD is required to effectively place LEA resources in areas of need identified both by citizens through citizen-initiated calls and by officers through proactive activity. One respondent emphasized the critical importance of CAD by stating, "The only information and technology that are essential to LEA operations is a CAD system and radio." Respondents noted that because CAD systems are so essential, they are both ubiquitous and generally uniform in functionality across agencies regardless of agency size or sophistication.

Respondents emphasized the importance of the RMS as a vital technology and data source. They also noted that, relative to CAD systems, RMSs have greater variance in functionality

across agencies, which could in turn lead to more variation in the value of the data that RMSs contain. Respondents noted that an RMS can become a catchall for many different data types besides criminal incident reports, including citizen contact information, vehicle crash information, arrest data, and investigative case management. They also suggested that the project team consider each of these data sets separately, rather than categorizing them monolithically within an RMS.

There was less consensus among the experts regarding critical datasets outside of CAD systems and RMSs. Important LEA data types confirmed by the respondents included license plate reader data, public record aggregators, regional information sharing platforms, data generated by other first responders, and municipal and utility services.

The experts had global observations about what makes data valuable to LEAs. Dimensions that were cited as making information valuable were timeliness, accuracy/quality, connectivity, and relevance to a person's specific role in the LEA.

Facilitating Data Collection with Law Enforcement Agencies

Participants were asked whether the level of effort or monetary expense that agencies dedicate to a specific dataset could be used as a proxy for how much they value that information. One respondent suggested that recurring costs and data quality processes, like subscriptions or crime incident report reviews, could be an indicator of value regardless of a participant's role in the LEA, noting that it may be difficult to determine whether data quality processes exist only nominally and what budgetary mechanisms are used to make determinations about recurring costs.

Participants noted that the ease of connectivity for external data to existing technologies/datasets in the LEA environment will have a substantial impact on the perceived value. They suggested asking participants scenario-based questions about the utility of relevant but disparate datasets, like court or corrections information, to provide an example for the types of information that could be valuable, even if the LEA was not currently using it.

Two experts independently reported that it would be helpful to organize datasets into three general categories: information about people, information about places, and information about events or criminal incidents. They noted that LEAs are accustomed to thinking about data in this way and that doing so would provide a way to discuss the value of data independent of technologies or activities. An alternative was also suggested by one expert: organizing datasets by people, places, and events and then further by activity.

Participants were asked about approaches that could be successfully employed to solicit feedback from law enforcement staff. Several approaches were noted as being helpful. They believed that presenting participants with scenarios and then asking whether they would be

able to complete an activity without a specific dataset would demonstrate what information is most critical to certain law enforcement functions. Another approach that was acknowledged by the experts was asking participants to build their own LEA and see what technologies and datasets were needed, and when, in the process of creating a new agency. Similarly, the experts were asked to respond about how they would work in their current capacity, but in another agency. They suggested that participants could be asked questions about how they would orient themselves to their organization, their responsibilities, and the new environment.

Appendix B: References

Articles Used to Establish Likely Impact of Body-Worn Cameras on Use of Force

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Articles Used to Establish Likely Impact of Body-Worn Cameras on Complaints

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- Braga, A., Coldren, J. R., Jr., Sousa, W., Rodriguez, D., & Alper, O. (2017, September). *The benefits of body-worn cameras: New findings from a randomized controlled trial at the Las Vegas Metropolitan Police Department* (NCJ Report No. 251-416). Washington, DC: U.S. Department of Justice, Office of Justice Programs, National Institute of Justice. Available from <https://nij.ojp.gov/library/publications/benefits-body-worn-cameras-new-findings-randomized-controlled-trial-las-vegas>

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<https://doi.org/10.1080/07418825.2016.1198825>

Jennings, W. G., Lynch, M. D., & Fridell, L. A. (2015). Evaluating the impact of police officer body-worn cameras (BWCs) on response-to-resistance and serious external complaints: Evidence from the Orlando police department (OPD) experience utilizing a randomized controlled experiment. *Journal of Criminal Justice*, *43*, 480–486.
<https://doi.org/10.1016/j.jcrimjus.2015.10.003>

Appendix C: Phase II Site Visit Protocol

1. Datasets to be discussed
 - a. Public Data Aggregators: TLO/ACCURINT/CLEAR
 - b. CAD/RMS/CFS
 - c. Multimedia
 - d. Federal Repositories
 - e. Mapping products
 - f. Social media
 - g. Informal information
2. User groups
 - a. Patrols
 - b. Crime analysts
 - c. Investigations
 - d. Command staff

The questions below were asked for each technology listed above.

1. What do you use it for?
 - a. Probes: Investigations? Responding to CFS? Tactical analysis?
2. How often are you using it?
 - b. Probes: If you are not using it often, why not? What would have to happen for you to use it more?
3. What makes it a good resource?
 - a. *Probes:*
 - i. Accessible? What makes accessibility so important?
 - ii. Exhaustive/comprehensive?
 - iii. Accurate?
 - iv. Immediate?
 - v. Up to date?
 - vi. User friendly?
 - vii. Connects to other data sources?
4. What are its major limitations?
 - b. *Probes:*
 - i. Inaccessible?
 - ii. Non-exhaustive?

- iii. Inaccurate?
 - iv. Lack of immediacy?
 - v. Out of date information?
 - vi. Difficult to use?
 - vii. Not connected to other data?
5. How could these limitations be resolved?
 6. From your perspective, what are your agency's biggest data-needs?

COMMAND STAFF

1. What are the most important decisions you make in your position, and what types of data or information are you using to inform those decisions?
2. How do you make decisions about the tools or data sources that will be incorporated into the agency's operations?
3. What are the biggest challenges your agency faces?
 - a. Probes: Are there any types of data or information that could help resolve these challenges in an ideal world?
4. How do you think the size of your agency affects your orientation towards data?

Focus group participants were asked to consider and rank the value of data for their jobs. The goal of this exercise was to explore differential importance as a function of job assignment. The information was used to facilitate discussion within the groups, especially when there were large differences between ranked importance.

Appendix Table C-1: Phase II Site Visit Exercise

Data List	Rate Data Value (1 lowest – 5 highest)
Multimedia	
Video Recordings (Any Source)	
Audio Recordings (Any Source)	
Images & Photos (Any Source)	
911 Call Recordings / Radio Traffic Recordings	
Physical Evidence	
Fingerprints	
Biometrics (DNA)	
Firearm-Related Evidence	
Personal Property	
Event/Incident Data	
Criminal History	
Address History	
CAD/RMS Person Alerts/Cautions	
Incident Aggregators (E.g. CopLink, Linked RMSs)	
Internal RMS Information (From Narrative)	
Internal RMS Information (From Fields)	
RMS Suspect/Victim Information	
RMS Property Values	
Weapon/Firearm Information	
Premise/Property Information	
Vehicle Information	
Crime Analysis Bulletins/Docs	
Intelligence/Offender Bulletins	
CAD Dispatch Information	
CAD Notes	
Field Interview Forms/Field Contact Report	
Spatial Data	
Crime Location Data	
CFS Location Data	
Land-Use Data	
Outside Agency CFS Location Data	
Traffic Collision Location Data	
GPS Tracking of Offenders	

(continued)

Appendix Table C-1: Phase II Site Visit Exercise

Data List	Rate Data Value (1 lowest – 5 highest)
Automatic Vehicle Location Data	
Probation/Parolee Location Data	
Sex Offender Location Data	
Crime Analysis Mapping Products	
Agency-Identified Hot Spots/Targeted Patrols	
Internal/Management Metrics	
Early Warning System Metrics	
Officer Performance Metrics	
Performance Metrics for Grants / Programs	
Agency cost/budget	
Personnel/HR Records	
Training Information	
Internal Affair Investigations	
Staffing / Unit Assignment Information	
Social Media	
Social Media Posts	
Social Media Networks	
Social Media Pictures/Videos/Recordings	
Geographically Tagged Social Media	
Public Data Aggregators	
Online Records Database (TLO, CLEAR, Accurint)	
Internet Search Tools (Pipl, Spock)	
Nontraditional Data Sources	
Emergency Room Data	
Code Enforcement Data	
Other Public Health Data	
Mental Health Data	
Utility/Billing Information	
Employment/Benefit Information	
Agency Performance	
Complaint Data	
Use of Force Data	
Criminal Rates	

(continued)

Appendix Table C-1: Phase II Site Visit Exercise

Data List	Rate Data Value (1 lowest – 5 highest)
Arrest Rates	
Drug/Contraband Seizure Rates	
Traffic Accident Rates	
Citizen Survey Responses	
CFS Metrics (Response Time/Close Codes)	

Appendix D: Phase III Site Visit Protocol

Valuating Law Enforcement Data in the 21st Century: Pre-Site Visit Questionnaire

Thank you for participating in Phase III of the Valuating Law Enforcement Data in the 21st Century Study, funded by the National Institute of Justice. Please fill out this questionnaire to the best of your ability at least one week prior to our site visit with your agency, which is currently scheduled for _____.

The purpose of these questions is for our project team to learn information about your agency that will ultimately help us to assess the relationship between the costs and benefits of body-worn cameras for your agency. In some cases, you may need assistance from some of your peers to enter in the correct answer. If you do not know the answer to a question, please leave it blank and we will discuss during the site visit. When you have completed the form, please email it to Brian Aagaard at baagaard@rti.org.

*RTI International on behalf of the National Institute of Justice
NIJ Award Number 2015-IJ-CX-K005
Travis Taniguchi, PhD, Principal Investigator*



RESPONDENT BACKGROUND INFORMATION

1. What is the name of your agency? _____
2. What is your name and your rank/duty/assignment? _____
3. How many years have you been employed in your current position? _____
4. What is your email address? _____

Full-time Sworn Officers

5. How many full-time sworn officers are employed at your agency? *This figure should reflect the actual number of full-duty officers, **not** the number of authorized officers.*

Citizen-Initiated Complaints

6. What is the total number of citizen-initiated complaints formally filed with your agency for calendar year 2018? *Your answer should reflect all types of complaints, including those involving officer use of force.*

7. A key component of this project is determining how agencies record, manage, and access information related to the items in this questionnaire. We are interested in knowing how you were able to answer the previous question? *(For example: how did you retrieve this information? What databases, if any, were accessed to answer this question? If you had to seek assistance to answer this question, please describe the rank/duty/assignment of the person who assisted)*

Incidents Involving Use of Force

8. How many incidents involving the use of officer force occurred in your agency in calendar year 2018? *Your answer should include any incident involving force beyond a hands-on-custodial arrest.*

9. What percentage of complaints resulted from use of force incidents in calendar year 2018? *This information is necessary to avoid double counting staff time used to conduct complaints that resulted from incidents involving use of force:*

_____ %

10a. Please provide a brief description of when a use of force report is required.

10b. If you were able to answer the previous questions, how did you retrieve this information? What databases, if any, were accessed to answer this question? If you had to seek assistance to answer this question, please describe the rank/duty/assignment of the person who assisted.

Officer Injuries Occurring During Use of Force Events

11. What percentage of incidents involving officer use of force resulted in an officer being injured in calendar year 2018?

_____ %

12. What was the average cost per officer injury per calendar year 2018?

\$ _____

13. If you were able to answer the previous questions, how did you retrieve this information? What databases, if any, were accessed to answer this question? If you had to seek assistance to answer this question, please describe the rank/duty/assignment of the person who assisted.

Initial Equipment and Recurring Costs for Body-worn Cameras

14. What was the monetary cost associated with your agency's initial acquisition of body worn camera equipment?

\$ _____

15. What was the unique startup costs associated with BWC acquisition? *For example, if you needed to upgrade any network infrastructure to support the use of BWC, enter the costs here.*

\$ _____

16. What is the recurring annual cost associated with your agency's use of body-worn cameras?

\$ _____

17. If you were able to answer the previous questions, how did you retrieve this information? What databases, if any, were accessed to answer this question? If you had to seek assistance to answer this question, please describe the rank/duty/assignment of the person who assisted.

Cost Associated with Video Redaction

18. Is your agency responsible for redacting BWC videos prior to public release?

___ Yes ___ No

Please answer question 19a or 19b

19a. In total, how much time (in hours) is spent redacting videos, per year?

19b. How many full-time equivalent personnel are assigned entirely to video redaction?

20. What is the average hourly rate for personnel responsible for redacting video?

\$ _____

21. If you were able to answer the previous questions, how did you retrieve this information? What databases, if any, were accessed to answer this question? If you had to seek assistance to answer this question, please describe the rank/duty/assignment of the person who assisted.

Cost Per Complaint / Use of Force Investigation

The following questions are used to determine the financial cost of each complaint or use of force investigations. Please provide the following average hourly rate for each type of staff (including fringe costs associated with the employee, such as retirement, healthcare, paid time off, etc.):

22. Average hourly rate for detective/investigator:

\$ _____

23. Average hourly rate for detective sergeant/investigator or similar first-line supervisor:

\$ _____

24. Average hourly rate for detective lieutenant/investigator or similar grade supervisor:

\$ _____

25. If you were able to answer the previous questions, how did you retrieve this information? What databases, if any, were accessed to answer this question? If you had to seek assistance to answer this question, please describe the rank/duty/assignment of the person who assisted.

Time Per Complaint / Use of Force Investigation

Some research indicates that body-worn cameras allow agencies to more efficiently resolve complaints and investigations. Much of efficiency gains are from reducing burden on staff to conduct investigations focused on complaints and use of force. The following information is required to determine the amount of time staff spend on this activity, which can be used to calculate the cost of this activity.

26. Average amount of time spent on a complaint investigation per detective/investigator:

_____ hours

27. Average amount of time spent on a complaint investigation per detective sergeant/investigator or similar first-line supervisor:

_____ hours

28. Average amount of time spent on a complaint investigation per detective lieutenant/investigator or similar grade supervisor:

_____ hours

29. If you were able to answer the previous questions, how did you retrieve this information? What databases, if any, were accessed to answer this question? If you had to seek assistance to answer this question, please describe the rank/duty/assignment of the person who assisted.

30. Average amount of time spent on a use of force investigation per detective/investigator:

_____ hours

31. Average amount of time spent on a use of force investigation per detective sergeant/investigator or similar first-line supervisor:

_____ hours

32. Average amount of time spent on a use of force investigation per detective lieutenant/investigator or similar grade supervisor:

_____ hours

33. If you were able to answer the previous questions, how did you retrieve this information? What databases, if any, were accessed to answer this question? If you had to seek assistance to answer this question, please describe the rank/duty/assignment of the person who assisted.

Appendix E: Structured Coding for Literature Review

Identification and coding of the body-worn camera (BWC) literature was done in several stages. First the research team conducted Web searches through Google, Google Scholar, and EBSCO. The citations from articles identified from this stage were reviewed; additional articles identified in the references were also retrieved and reviewed. Articles were then reviewed to identify their main outcomes. Articles were grouped by two main outcomes: BWC effect on use of force and BWC effect on citizen complaints.

Outcomes were reviewed for potential reasons to exclude. Nine studies were identified for complaints. Two studies were excluded because they were conducted in the United Kingdom. Three articles reported on the same study; two were excluded and one was retained. One article was excluded because results were reported only as odds ratios and we were unable to convert these impacts to percent change.

For use of force, 10 studies were identified. Two studies were excluded because they were conducted outside the United States.

The following characteristics were coded for each article:

- Agency
- BWC equipment
- Measurement or design issues that may impact utility for cost-benefit analysis (CBA)
- Definition of complaint or use of force
- Study type (i.e., randomized controlled trial or other)
- Sample size
- Length of pre-BWC intervention period
- Length of BWC intervention
- Implementation start date
- Outcome baseline (i.e., number of complaints, number of use of force events, number/percentage of officers with complaints, or number/percentage of officers a use of force event)
- Effect of BWC implementation
- Percent change
- Variance
- Significance of change
- Modeling approach

Additional research was done to better inform plausible values for other parameters of the CBA tool. For example, we conducted a literature search to identify values for officer hourly salary that can be used as defaults if that information is unavailable.

Appendix F: Pre-Site Visit Responses

Data were provided by agencies participating in Phase III site visits.

Appendix Table F-1: Pre-Site Visit Guide Responses

Question	Agency 1	Agency 2	Agency 3	Agency 4
How many full-time sworn officers are employed at your agency?	674	1168	1675	739
What is the total number of citizen-initiated complaints formally filed with your agency for calendar year 2018?	325	441	84	23
How you were able to answer the previous questions?	I had to seek assistance from the Administrative Assistant of the Professional Standards Division. The information was pulled from IA Pro/Blue Team which is the database used to process administrative reports.	We utilize IAPro as a database. Ran a report for all 2018 investigations filed by a member of the public.	2018 IMPD Annual Report	This is the official statistic of Professional Standards Section (PSS) and represents the total number of citizen-initiated formal complaints of misconduct. PSS produces an annual report which is publicly available on the city's website in .pdf form. The individual case processing and documentation occurs within the department's standalone internal affairs records management system. The RPD utilizes IAPro software and is in the process of implementing a new end-user interface. The new interface, Blue Team, will include all

Question	Agency 1	Agency 2	Agency 3	Agency 4
How many incidents involving the use of officer force occurred in	179	468	1430	<p>digital forms for data collection on uses of force, fleet vehicle accidents, pursuits, firearm discharges, and internal investigations of misconduct.</p> <p>The Chief's Office also tracks less formal complaints generated by citizens, city officials, and officers using a basic excel spreadsheet. This process was instituted in mid 2018 so full year estimates are based on a combination of 2018-2019 data. The Chief of Staff (Lt-level) logged roughly 350 complaints that were distributed throughout the department for follow-up.</p> <p>Additionally, 911/311 will dispatch supervisors to follow-up on quality of service complaints from callers. These are coded as QSIA (Quality Service Inquires) in the CAD system. For 2018, RPD responded to 2,612 QSIA calls for service.</p> <p>776</p>

Question	Agency 1	Agency 2	Agency 3	Agency 4
your agency in calendar year 2018?				
What percentage of complaints resulted from use of force incidents in calendar year 2018?	0.05%	Could not answer	About 10%	73.9
Please provide a brief description of when a use of force report is required.	Question added in v2		<p>Force applied that exceeds unresisted handcuffing including: any strike, pressure point manipulation, forcible takedown.</p> <p>Force applied through non-deadly/less lethal weapons.</p> <p>Any force resulting / or alleged to have resulted in Serious Bodily Injury, Injury, complaint of pain.</p> <p>Any force a supervisor determines should be documented.</p>	<p>RPD personnel are required to complete a Subject Resistance Report (SRR) for any force used, with the exception of mere handcuffing, blanketing, escorting or application of a hobble or spit sock as defined in General Order (GO) 335. All RPD GO's are available on the department's Open Data Portal.</p> <p>The percentage would be 4.8% (17/350) if the denominator used Chief's complaints or 0.6% (17/2,612) if QSIA complaints were used. If all complaint categories were combined the percentage of complaints resulting from Use of Force (UOF) incidents in 2018 would be 0.5% (17/2,985).</p>
How you were able to answer the previous questions?	Question added in v2		<p>Policy and Planning Sergeant Policy and Planning Lieutenant</p>	<p>The PSS office is responsible for maintaining the SRR documentation and</p>

Question	Agency 1	Agency 2	Agency 3	Agency 4
			2018 Annual Use of Force Report and Analysis 2018 Blueteam	subsequent reviews. The data for 2018 was pulled from the annual report.
What percentage of incidents involving officer use of force resulted in an officer being injured in calendar year 2018?	20	N=54 officers. Could not answer the percentage of events	17%	14.21
What was the average cost per officer injury per calendar year 2018?	Could not answer	Could not answer	Could not answer	\$1,291.40
How you were able to answer the previous questions?	The percentages for 25 and 26 were gathered from the Administrative Assistant of PSD.	N/A	Blue team Policy and Planning Sergeant	The data was retrieved in two places for this section: 1) the number of officers injured (28) in UOF events was obtained from PSS; 2) the average cost per officer injury in 2018 was obtained from RPD's 3rd party claims assistant. The percentage of use of force based injuries was calculated by dividing the number of officers injured in UOF events by the total of officer claims for 2018 (28/197). The average cost per injury was calculated by dividing the total injury payout for 2018 by the

Question	Agency 1	Agency 2	Agency 3	Agency 4
What was the monetary cost associated with your agency's initial acquisition of body worn camera equipment?	\$1,108,630	\$369,463	Could not answer	total of officer claims in 2018 (\$254,407.29/197) \$420,000
What was the unique startup costs associated with BWC acquisition?	Question added in v2		Could not answer	\$100,000
What is the recurring annual cost associated with your agency's use of body-worn cameras?	2017: \$324,486; 2018: \$328,236; 2019: \$335,736; 2020: \$343,236	\$1,290,094	Could not answer	\$85,000 - \$145,000
How you were able to answer the previous questions?	The information was taken from equipment contracts from Axon.	Contracts - Invoices	Could not answer	This responses for this section were provided by our Technology Applications Coordinator. This position acts as the technical lead for the department on this project. The initial acquisition of the Body Worn Camera (BWC) equipment was partially funded with a US Department of Justice grant. The annual reoccurring costs associated with our BWC program for years 0-5 is roughly \$85,000 and moves to about \$145,000 from year six on. These costs include equipment upgrades, web migration, etc.

Question	Agency 1	Agency 2	Agency 3	Agency 4
Is your agency responsible for redacting BWC videos prior to public release?	Question added in v2		Could not answer	Yes
In total, how much time (in hours) is spent redacting videos, per year?	Question added in v2		Could not answer	650
How many full-time equivalent personnel are assigned entirely to video redaction?	Question added in v2		Could not answer	1
What is the average hourly rate for personnel responsible for redacting video?	Question added in v2		\$34.37	\$30.00
How you were able to answer the previous questions?	Question added in v2		2018 IMPD Annual Report	This responses for this section were provided by our Technology Applications Coordinator. This position acts as the technical lead for the department on this project. The redaction hourly estimates are based on an average of 25 hour per week but obviously would vary based on the complexity (or volume) of the request.
Average hourly rate for detective/investigator	\$31.93	\$38.41	\$34.37	\$83.38
Average hourly rate for detective sergeant/investigator or	\$44.74	\$46.95	\$38.79	\$83.84

Question	Agency 1	Agency 2	Agency 3	Agency 4
similar first-line supervisor				
Average hourly rate for detective lieutenant/investigator or similar grade supervisor	\$51.45	\$52.40	\$43.67	\$99.53
How you were able to answer the previous questions?	The Police Budget Manager receives actual payroll & salary information. Officers' salaries by rank were collected & 30% benefits estimate applied. Annual work hours used was 2080 hours.	Average Hourly Pay rate for each class of employee, Millage est of \$2500.00, State pay of \$600.00, City contribution average from City Health plan contribution sheet, 30% contribution from City to State pension plan	IMPD Annual Report 2018	The average hourly rate was calculated by using the midpoint of the 2019-2020 budgeted salary schedules for each rank and applying the 2019-2020 sworn officer fringe rate of 64.8% to generate a total (without overtime) annual salary average. The annual salary average was divided by 1,815 hours, which represents the total hours scheduled annually for a typical 4x2 work wheel in RPD. The data was access from the City of Rochester's fiscal year budget proposal. 2019-2020 Sworn Hourly Rates by Rank: Captain - \$106.98 Lieutenant - \$99.53 Sergeant - \$83.84 Investigator - \$83.38 Officer - \$59.26
Average amount of time spent on a complaint investigation per detective/investigator	Could not answer	Could not answer	Could not answer	N/A

Question	Agency 1	Agency 2	Agency 3	Agency 4
Average amount of time spent on a complaint investigation per detective sergeant/investigator or similar first-line supervisor	Could not answer	Could not answer	Could not answer	40
Average amount of time spent on a complaint investigation per detective lieutenant/investigator or similar grade supervisor	Could not answer	Could not answer	Could not answer	8
How you were able to answer the previous questions?	N/A	N/A	N/A	<p>This responses for this section were provided by our PSS Lieutenant. This position acts as the commanding officer of our internal affairs unit. PSS Sergeants are responsible for the primary investigative duties for complaints of police misconduct. There is no line-level investigative component to PSS cases.</p> <p>Estimates were based on professional experience since we do not officially record hours spent as a metric. Our time-bound measurable is calculated on progress, in calendar days, at various stages of the investigation.</p>

Appendix G: Cost-Benefit Analysis Tool (Excel Version)

Field Values				
Input	Value	Type	Definition	Why is this information necessary?
BWC Acquisition, Maintenance, & Depreciation Costs				
Pilot Program Cost	[user input]	Optional input	These costs may include trials or pilot programs designed to identify the best vendor or hardware. Enter 0 if this category of costs is not applicable.	Large scale adoption of BWCs are often preceded by smaller pilot programs. These costs are part of BWC adoption but may not be included in the total acquisition costs for all agency personnel
1st Year Up Front Establishing BWC Cost	[user input]	Optional input or external source	This input requires the cost associated with your agency's initial body-worn camera equipment acquisition or quoted price. If you do not have this information, use a value within the range identified in the cited link.	Many contracts for body-worn cameras include different costs for the initial acquisition and implementation in the first year than in subsequent years. This input provides users with the flexibility to consider the cost of the equipment acquisition along with recurring costs.
BWC Infrastructure Cost	[user input]	Optional input or external source	Infrastructure costs should include any major upgrades to facilities or supporting technologies that are needed to support BWC adoption. One common example is needing to upgrade bandwidth speed to support upload of large video files in a reasonable amount of time. Expected life span is the estimated useful life of the upgrade (in years).	Infrastructure costs can be a considerable barrier to BWC adoption. This information is used to estimate a one-year (amortized) cost of these infrastructure upgrades.
Expected BWC Hardware Life (in years)	[user input]	Optional input or external source		
Cost Per Officer Per Month	[user input]	Optional input or external source	Enter any subscription or per officer, per month costs associated with BWCs.	Some BWC vendors have maintenance or video storage plans that operate on a per month per officer cost plan. Enter 0 if there are no cost per officer per month during the first year.

(continued)

Appendix G: Cost-Benefit Analysis Tool (Excel Version)(continued)

Field Values				
Input	Value	Type	Definition	Why is this information necessary?
Effect of BWC on Complaints				
			This input represents the expected change in the	
Cost to Investigate Complaints				
Detective Hourly Wage	\$44.03	Optional input or external source	To understand the cost to investigate complaints we need both the average salary and the average time spent on the investigation. Hourly wage should include all fringe costs associated with the employee (total employment cost including retirement, healthcare, PTO, etc., rather than just salary). The time per complaint investigation requires knowing the amount of time spent on each investigation prior to, and after, adopting BWC. Many agencies do not track this type of information. Research has shown that: Detective (pre/post): 80/6 Sergeant (pre/post): 7/1 Lieutenant (pre/post): 4/.33	Research indicates that one of the main benefits of body-worn cameras is a reduction in the amount of time spent reviewing complaints. In many agencies, investigative staff are tasked with part of the complaint review process, which is why their time is included as an input.
Detective Hours per Complaint (Pre-BWC)	20	Optional input or external source		
Detective Hours per Complaint (Post-BWC)	10	External source		
Sergeant Hourly Wage	\$55.00	Optional input or external source		
Sergeant Hours per Complaint (Pre-BWC)	7	Optional input or external source		
Sergeant Hours per Complaint (Post-BWC)	6	External source		

(continued)

Appendix G: Cost-Benefit Analysis Tool (Excel Version)(continued)

Field Values				
Input	Value	Type	Definition	Why is this information necessary?
Cost to Investigate Complaints (continued)				
Lieutenant Hourly Wage	\$66.05	Optional input or external source		
Lieutenant Hours per Complaint (Post-BWC)	4	Optional input or external source		
Lieutenant Hours per Complaint (Pre-BWC)	2	External source		
Effects of BWC on Use of Force				
Total Use of Force Events (Last Calendar Year)	[user input]	Required input	The input requires the number of use of force incidents that occurred in your agency in the last full year. For the purposes of this tool, a use of force incident is defined as any force beyond a hands-on-custodial arrest.	Research indicates that body-worn cameras can reduce use of force incidents and the costs associated with those incidents. This input is used to calculate the plausible impact of BWC on reducing officer use of force.
Expected % reduction in UoF (Pre- to Post-BWC) - Low	28%	External source	This input represents the change in the number of use of force incidents after an agency implements body-worn cameras. Research indicates agencies can expect the impact on use of force to vary from a low of no reduction, to a high of 50% with a median effect of 28% reduction.	Research indicates that BWCs may reduce use of force incidents, and the costs associated with those incidents. This information is used to estimate the potential cost savings to your agency if use of force is reduced after implementing BWCs.
Expected % reduction in UoF (Pre- to Post-BWC) - High	50%	External source		
% of complaints that are due allegations of excessive force	25%	Optional input or external source	This input requires the percent of complaints that originated from a use of force incident. If you do not have this information, research indicates that 25% of complaints originate from use of force incidents.	Use of force incidents represent a subset of police actions that can result in a complaint. The percent of complaints associated with use of force events is needed to prevent double counting the overlap of use of force events that result in a complaint.

(continued)

Appendix G: Cost-Benefit Analysis Tool (Excel Version)(continued)

Field Values				
Input	Value	Type	Definition	Why is this information necessary?
Effects of BWC on Use of Force (continued)				
			This is input requires the cost associated with costs to the department, wages of the officer while	
BWC Generated Video Redaction Cost				
Number of Hours Spent Redacting BWC Video	[user input]	Optional input	Estimate the amount of time required to redact videos before released publicly. Hourly wage should include all fringe costs associated with the employee (total employment cost including retirement, healthcare, PTO, etc.).	In many places BWC footage is subject to open records laws and agency personnel may be required to review and redact sensitive information. This will add costs to the implementation of BWCs.
Hourly rate for Video Redaction Staff	[user input]	Optional input		