



**The author(s) shown below used Federal funding provided by the U.S. Department of Justice to prepare the following resource:**

**Document Title:**           **The Benefits of Body-Worn Cameras: New Findings from a Randomized Controlled Trial at the Las Vegas Metropolitan Police Department**

**Author(s):**               **Anthony Braga, Ph.D., James R. Coldren Jr., Ph.D., William Sousa, Ph.D., Denise Rodriguez, M.A., Omer Alper, Ph.D.**

**Document Number:**   **251416**

**Date Received:**       **December 2017**

**Award Number:**       **2013-IJ-CX-0016**

**This resource has not been published by the U.S. Department of Justice. This resource is being made publically available through the Office of Justice Programs' National Criminal Justice Reference Service.**

**Opinions or points of view expressed are those of the author(s) and do not necessarily reflect the official position or policies of the U.S. Department of Justice.**

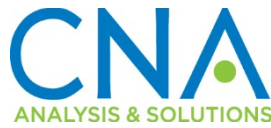
# The Benefits of Body-Worn Cameras: new findings from a randomized controlled trial at the Las Vegas Metropolitan Police Department

Anthony Braga, Ph.D., James R. Coldren, Jr., Ph.D., William Sousa, Ph.D., Denise Rodriguez, M.A., Omer Alper, Ph.D.

NIJ Award No.: 2013-IJ-CX-0016  
September 28, 2017



Cleared for public release.



This project was supported by Award No. 2013-IJ-CX-0016, awarded by the National Institute of Justice, Office of Justice Programs, U.S. Department of Justice. The opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect those of the Department of Justice.

Recommended citation: Anthony Braga, James R. Coldren, Jr., William Sousa, Denise Rodriguez, and Omer Alper. "The Benefits of Body-Worn Cameras: New Findings from a Randomized Controlled Trial at the Las Vegas Metropolitan Police Department." Final report to the National Institute of Justice, 2013-IJ-CX-0016, September 2017.

#### **Distribution**

Cleared for public release.





CNA is a not-for-profit research organization  
That serves the public interest by providing  
in-depth analysis and result-oriented solutions  
to help government leaders choose  
the best course of action  
in setting policy and managing operations.

*Nobody gets closer—  
to the people, to the data, to the problem.*



[www.cna.org](http://www.cna.org) • 703-824-2000

3003 Washington Boulevard, Arlington, VA 22201

## Abstract

Many community stakeholders and criminal justice leaders have suggested placing body-worn cameras (BWCs) on police officers improves the civility of police-citizen encounters and enhances citizen perceptions of police transparency and legitimacy. In response, many police departments have adopted this technology to improve the quality of policing in their communities. However, the existing evaluation evidence on the intended and unintended consequences of outfitting police officers with BWCs is still developing. This study reports the findings of a randomized controlled trial (RCT) involving more than 400 police officers in the Las Vegas Metropolitan Police Department (LVMPD). We find that BWC-wearing officers generated significantly fewer complaints and use of force reports relative to control officers without cameras. BWC-wearing officers also made more arrests and issued more citations than their non-BWC-wearing controls. In addition, our cost-benefit analysis revealed that savings from reduced complaints against officers, and the reduced time required to resolve such complaints, resulted in substantial cost savings for the police department. Considering that LVMPD had already introduced reforms regarding use of force through a Collaborative Reform Initiative prior to implementing body worn cameras, these findings suggest that body worn cameras can have compelling effects without increasing costs.

This page intentionally left blank.

# Table of Contents

<b>Executive Summary .....</b>	<b>1</b>
Introduction .....	1
Process Evaluation .....	2
Officer Surveys .....	2
Officer Interviews.....	2
BWC Video Review .....	3
Impact Evaluation Analytic Approach .....	4
Assessing experimental group balance and generalizability.....	5
Attrition and statistical power .....	6
Analysis of Outcome Measures .....	8
Citizen Complaints and Use of Force Outcomes.....	8
Officer Activity Outcomes.....	9
Cost-Benefit Analysis Analytic Approach .....	9
Cost-Benefit Analysis Results.....	10
Conclusions and Implications .....	10
 <b>I. Introduction .....</b>	 <b>13</b>
A. Statement of the problem.....	13
B. Literature citations and review .....	14
Influence on the Civility of Police-Citizen Encounters.....	14
Influence on Police Officer Work Activities.....	18
C. Statement of hypotheses .....	20
Study Hypotheses:.....	20
 <b>II. Methods.....</b>	 <b>22</b>
A. Research setting .....	22
B. Methods: Process evaluation .....	24
Research design.....	24
Challenges.....	25
Confronting the Challenges .....	28
Monitoring the BWC Implementation Process .....	30
C. Methods: Impact evaluation .....	38
Analytical Approach .....	38
D. Methods: Cost-Benefit Analysis.....	47
Analytical Approach.....	47



<b>III. Results.....</b>	<b>50</b>
A. Results: Impact Evaluation .....	50
Citizen Complaints and Use of Force Outcomes.....	50
Officer Activity Outcomes.....	51
B. Results: Cost-Benefit Analysis.....	52
<b>IV. Conclusions .....</b>	<b>56</b>
A. Discussion of the findings.....	56
B. Implications for policy and practice .....	57
C. Implications for further research.....	58
<b>V. References.....</b>	<b>60</b>
<b>VI. Dissemination of Research Findings .....</b>	<b>65</b>

# List of Figures

Figure 1.	Percentage of Contaminated Control Officer Responses to CAD Events .....	45
-----------	--	----

This page intentionally left blank.

## List of Tables

Table 1.	<b>Summary of BWC RCT Implementation Challenges and Resulting Concerns .....</b>	<b>27</b>
Table 2.	<b>Summary of Reasons for Officer Refusal to Wear BWCs .....</b>	<b>28</b>
Table 3.	<b>Experience / Comfort Levels with Technology, Pre and Post Survey Results.....</b>	<b>31</b>
Table 4.	<b>Percent stating that they “agree” or “strongly agree” with the following... ..</b>	<b>31</b>
Table 5.	<b>Percent stating that they “agree” or “strongly agree” with the following... ..</b>	<b>32</b>
Table 6.	<b>Summary of Interviews with BWC Officers (n = 50).....</b>	<b>35</b>
Table 7.	<b>Summary of Observations of BWC Interactions on Ride-Alongs (n = 72).....</b>	<b>36</b>
Table 8.	<b>Summary Characteristics .....</b>	<b>40</b>
Table 9.	<b>Percentage of Officers with at Least One Complaint and at Least One Use of Force Incident.....</b>	<b>50</b>
Table 10.	<b>Body-Worn Camera Impacts on Monthly Activity of LVMPD Officers Participating in the RCT (N=416 officers) .....</b>	<b>51</b>
Table 11.	<b>Labor Cost per Complaint Investigation, with and without BWCs (\$ dollars) .....</b>	<b>52</b>
Table 12.	<b>Complaint Investigation Costs Avoided because of BWCs .....</b>	<b>53</b>
Table 13.	<b>Itemized Costs of the LVMPD BWC Implementation.....</b>	<b>53</b>

This page intentionally left blank.

# Executive Summary

## Introduction

The past several years have witnessed significant growth in the number of police agencies using body-worn cameras (BWCs). It has been reported that over one-third of the 18,000 or so law enforcement agencies in the United States have begun using this technology.<sup>1</sup> Implemented in response to increased community criticism after several controversial police use of force incidents, BWCs were seen as a remedy for resolving issues of community trust and a way to increase police accountability. However, BWCs are just one tool to address these issues, and the new technology has limitations. As more law enforcement agencies implement BWCs, it has become clear that the technology's potential impacts are far-reaching and not widely understood. Successful implementation often requires substantial changes to a police organization and its partners (for example, the prosecutor's office, defense attorneys, the judiciary) in policy, training, staffing, investigations, and technology. Although research on the impacts of BWCs on use of force, citizen complaints, and community perceptions has grown in recent years<sup>2</sup>, more research is needed to fully understand the breadth of BWCs' impact on policing and the criminal justice system.

This paper reports on a randomized controlled trial with BWCs in the Las Vegas Metropolitan Police Department (LVMPD). The study sample included over 400 officers concentrated in four area commands (districts) in the LVMPD Patrol Division. The research questions addressed the impact of BWCs on police officer use of force incidents, on the number of complaints filed against police officers, and police officer citations and arrests. The study also included a cost-benefit analysis. Below we describe the process and impact evaluation methods and findings and the implications of this research.

---

<sup>1</sup> Katie Delong and *CNN Wire Service*. "One-Third of United States Police Departments Using Body Cameras: They're Expensive, so Are They Worth It?" <http://fox6now.com/2015/03/02/one-third-of-united-states-police-departments-using-body-cameras-theyre-expensive-so-are-they-worth-it/>, July 10, 2017.

<sup>2</sup> See, for example, White, 2014; and Lum et al., 2015.

## Process Evaluation

This research project included process and impact evaluations. The process evaluation included interviews and surveys with officers in the study sample, focus groups with patrol officers and supervisors (sergeants), ride-alongs with camera-wearing officers, and a review of BWC video footage. The primary purpose of the process evaluation was to document the challenges LVMPD experienced with implementing BWCs and to learn about experiences and adaptations made by officers, and the organization, working with the new technology.

### Officer Surveys

Officer surveys before and after BWC implementation revealed that, in general, officer comfort with technology improved over the course of the study, and officers wearing BWCs indicated slightly higher comfort levels compared to controls.

We found few differences between the pretest and the posttest—or between the treatment and control officers during the posttest on a series of survey questions pertaining to police discretion and ethics. Several results, however, were somewhat unexpected. For example, on some items, a higher percentage of officers reported greater formal standards (such as arresting a fellow officer for DUI, issuing a fellow officer a speeding ticket, or reporting a fellow officer who used unnecessary force) during the posttest. However, in these instances treatment officers and control officers were relatively consistent (or a higher percentage of control group officers actually reported greater formal standards than treatment group officers).

### Officer Interviews

Throughout the research project, we interviewed a random sample of officers from the treatment group to assess several phenomena, such as their level of comfort with technology, their perceptions of civilians, their perceptions of self, their perceptions of how other officers related to BWCs, and other positive or negative thoughts they had regarding BWCs. They reported some minor problems regarding their level of comfort with BWC technology, such as the need for time to develop the muscle memory required for consistent activation and de-activation of BWCs in accordance with policy.<sup>3</sup> Several officers commented on the cumbersome nature of the equipment (primarily the wiring). Officers reported few problems regarding civilian reactions to

---

<sup>3</sup> LVMPD personnel overseeing BWC implementation told us that, initially, activation compliance with policy was at about 50 percent, and it gradually increased to 75 percent or higher during the course of the study.

BWCs, little change in their own behavior while wearing BWCs, and few issues regarding how non-camera-wearing officers reacted to BWCs. On balance, officers mentioned more positives than negatives regarding BWCs, noting their satisfaction with how BWCs protected them when civilians filed complaints and allowed them to introduce their own narratives as they approached a call for service or a potentially serious incident. Still, they had reservations about whether the BWC videos would be used against them by supervisors, who could review the videos and more easily catch officer policy infractions than they could for non-camera-wearing officers.

## BWC Video Review

We reviewed a random sample of 53 BWC videos during the study, with the primary purpose of monitoring the audio and video quality of the BWCs. The following summarizes the analysis from these 53 activations.

### *Description of Events*

Just over half of the 53 activations (54 percent) were officer self-initiated activities, including vehicle stops (29 percent) and person stops (25 percent). The remaining activations (46 percent) were responses to calls for service. Most of the self-initiated vehicle stops were for minor traffic violations (broken taillights, expired license plates, etc.), while most of the self-initiated person stops were for minor disorders (public intoxication, loitering, etc.). The calls for service were for a range of emergencies, including domestic violence; burglary; larceny; threats of suicide; welfare checks; and numerous other types of disorders, disturbances, and suspicious activities (noise complaints, prostitution, destruction of property, etc.).

In terms of subject demeanor during the encounters, we observed a small percentage of cases in which subjects offered some verbal (8 percent) or physical (4 percent) resistance, but for the most part the subjects presented little or no verbal or physical protest. Most of the encounters in the sample (74 percent) involved no use of force by the BWC officer or other officers at the scene. Some (23 percent), however, involved a physical search of a subject, and in two cases the BWC officer physically restrained a subject. Half of the encounters ended with no action taken by the BWC officer, whereas others ended with verbal warnings (14 percent), citations issued (15 percent), or arrests made (17 percent).

With only a few exceptions, officers did not noticeably announce the presence of the BWC at any point during the encounter, nor did subjects clearly appear to take notice of the BWC on the officer. However, the subjects' knowledge of the presence of the BWC was not always clear from the BWC video and audio. Of the four cases where the subject clearly had knowledge of the BWC, only once did the BWC appear to alter the subject's demeanor (the subject became more compliant).



## Audio / Video Quality

Each of the 53 BWC activations was rated on a three-point scale (low, medium, high) in terms of audio clarity, video quality, and camera positioning. In almost all cases, the BWC audio clarity and video quality were high. In a small number of cases, outside interference (e.g., noise from the street) or the physical distance between the officer and the subject lessened the sound quality, and in two cases the video quality was less than ideal (generally due to poor lighting). For the most part, however, the BWC officer, the subject, and others at the scene could be clearly heard, and the visual recording was generally clear in the direction that the BWC was pointing.

BWC positioning, however, was occasionally problematic. For most of the cases in the sample (85 percent), the BWC was pointed in the proper direction where the subject and event were clearly (or at least adequately) framed. For the remaining cases, however, the BWC was pointed in a direction where the subject could not be observed. In some cases, this was because the officer was addressing someone who was not directly in front of him. More frequently, though, it appeared that the BWC lapel or collar mount had adjusted out of position, resulting in the BWC pointing at the ground or at the sky rather than at the subject. In these cases, the audio was clear but the video did not capture the officer's interaction with the subject.

Overall, the audio and video qualities of the BWC videos were high, although some changes could be made to ensure appropriate camera positioning to properly capture the interactions between officers and subjects. These could include technological enhancements (BWCs with wider angle lenses, sturdier mounts for lapels and collars, etc.), or implementation suggestions for officers (such as asking officers to periodically check on the direction of the BWC).

## Impact Evaluation Analytic Approach

This RCT tested the impact of BWCs on citizen complaint reports, police use of force incidents, and police activity measures for treatment officers compared with control officers over pre-intervention and intervention periods. Treatment officers were requested to wear the BWCs for at least 12 months. We recruited a sample of 416 volunteer patrol officers and randomized them into treatment and control groups from February 2014 through September 2015. This extended period was needed to recruit eligible patrol officers on a rolling basis through informational sessions held in each of the area commands, randomize volunteer officers from each area command into treatment and control groups, equip the treatment officers, and train them on BWC operations and policy. In anticipation of higher levels of attrition in the treatment group, the randomization procedure was weighted so that 10 percent more officers would be allocated to wear BWCs. The randomization process resulted in the

assignment of N=218 officers to the treatment group and N=198 officers in the control group.

LVMPD provided the evaluation team with detailed information on the patrol officers who participated (N=416) in the RCT as well as the remaining patrol officers (N=955) who did not participate. This information included age, race, sex, rank, time on the job, current assignment, complaints filed, use of force incidents, and unique identification number. All officers in the RCT were monitored by review of administrative data over the course of the March 1, 2014 to September 30, 2015 intervention period. The data on the officers not participating in the randomized controlled trial represented a “snapshot” of nonexperimental officers as of the start of the experiment on March 1, 2014.

## Assessing experimental group balance and generalizability

Randomization provides a simple and convincing method for achieving comparability in treatment and control groups<sup>4</sup>. If randomization is done correctly, the only systematic difference between treatment and control groups should be the presence or absence of the treatment. To test the balance between the treatment and control groups on key officer variables, we used independent samples *t*-tests and standardized mean differences, known as Cohen's *d*.<sup>5</sup> Our analysis confirmed equality of variances for all variables. This reveals that the randomization created balanced treatment and control groups. We also tested for any systematic differences between patrol officers who participated in the experiment (N=416) and patrol officers who did not participate in the experiment (N=955) using the same approach. There were no statistically significant differences in sex, race, age, years on the job, and mean yearly complaints noted between the patrol officers who volunteered to participate in the RCT and those who did not. These data suggest that officers with higher numbers of complaints did not avoid participating in the BWC pilot program. Indeed, on most observable characteristics, the volunteer officers seemed no different from the officers who chose not to volunteer for the program.

Volunteer officers were somewhat more likely than their non-volunteer counterparts to be sergeants and to be assigned to the Enterprise, Northeast, and Northwest area

---

<sup>4</sup> William Shadish, Thomas Cook, and Donald Campbell, *Experimental and Quasi-Experimental Designs for Generalized Causal Inference* (Boston: Houghton Mifflin, 2002).

<sup>5</sup> Jacob Cohen, *Statistical Power Analysis for the Behavioral Sciences*, 2nd ed., (Hillsdale, NJ: Lawrence Earlbaum Associates, 1988).

commands and somewhat less likely to be patrol officers and to be assigned to the Convention Center, Southeast, and South Central area commands.<sup>6</sup> These observed differences were driven largely by implementation decisions. During the pre-implementation recruitment period, LVMPD commanders highly encouraged sergeants to “lead by example” by volunteering for the BWC program. These data suggest that many sergeants responded to this call. LVMPD located the BWC docking stations in four of the eight LVMPD area commands: Bolden, Enterprise, Northeast, and Northwest. Participating officers were required to place their cameras in the docking stations at the end of their shift in these area commands so that acquired videos could be uploaded to cloud memory storage. Patrol officers not assigned to an area command with a docking station could still participate through an alternative mechanism that LVMPD established for uploading videos. However, the lack of docking station infrastructure at those area commands limited the number of officers who volunteered from them.

The equivalence observed between the treatment and control groups supports the internal validity of the design and suggests that the randomized controlled trial was well positioned to isolate the impact of BWCs on the study outcome measures.

## Attrition and statistical power

Attrition represents a threat to the internal validity of randomized experiments, as it introduces bias into the analysis of experimental data.<sup>7</sup> Attrition from this randomized controlled trial was low; only 10.1 percent (42 of 416) of the officers left their assignments during their 12-month intervention periods. However, we observed differential attrition for the treatment officers (N=26, 11.9 percent of 218) when compared with the control officers (N=16, 8.1 percent of 198). In the treatment group, 14 officers changed assignments from the Patrol Division and did not continue wearing BWCs, seven officers withdrew from the program but stayed in their current assignment, two officers retired, two officers resigned from LVMPD, and one person took a medical leave for a surgical procedure. In the control group, 13 officers changed assignments from the Patrol Division, two officers resigned from LVMPD, and one officer retired.

---

<sup>6</sup> Although the *t*-tests revealed that the observed differences were statistically significant at the  $\alpha=.05$  level, the Cohen’s *d* standardized mean difference metric suggested that these differences were small ( $ES<.20$ , see Cohen).

<sup>7</sup> Donald Campbell and Julian Stanley, *Experimental and Quasi-Experimental Designs for Research* (Chicago: Rand McNally, 1963).

## Contamination of Control Conditions

Another threat to the internal validity of any randomized experiment is the diffusion of the treatment into the control group.<sup>8</sup> Put simply, contaminated control conditions undermine the counterfactual contrast between subjects that receive the treatment and subjects that do not. In the context of the LVMPD experiment, this could include effects of treatment officers responding to the same dispatched calls for service as control officers. The well-known Rialto, California, BWC randomized experiment experienced possible diffusion of treatment effects, but this was due to the randomization of BWCs by shift rather than by individual officer.<sup>9</sup> In the Rialto experiment, the same officers participated in treatment (BWC on during shift) and control conditions (no BWC during shift). Therefore, it was possible that participating officers “carried over” the treatment effect into control shifts. Although the evaluation found significant reductions in citizen complaints and use of force incidents during treatment shifts relative to control shifts, Ariel et al. also observed reductions in these outcome measures during the control shifts, which suggest possible contamination.<sup>10</sup>

The LVMPD RCT attempted to minimize these kinds of contamination effects by using different officers in control and treatment groups. Because LVMPD normally operates with one-officer patrol units, interaction between officers—and thus the potential for contamination—is infrequent during a typical shift but does occur when one officer backs up another on particular calls. Ideally, our randomized controlled trial would have also separated treatment and control officers into different policing areas to minimize interactions further. Unfortunately, this was not possible because of our reliance on volunteer officers to form treatment and control groups.

Our analysis found modest contamination between treatment and control officers each month (from March 2014 to September 2015); contamination ranged from a low of 15.3 percent in March 2014 to a high of 20.9 percent in August 2014, with an average of 19.1 percent per month. Generally, high contamination can lessen the likelihood of finding significant differences in outcome variables between treatment and control groups. Given that our study found significant differences between the treatment and control groups on all outcome variables of interest (see below), we feel confident that

---

<sup>8</sup> Donald Campbell and Julian Stanley, *Experimental and Quasi-Experimental Designs for Research* (Chicago: Rand McNally, 1963); and William Shadish, Thomas Cook, and Donald Campbell, *Experimental and Quasi-Experimental Designs for Generalized Causal Inference* (Boston: Houghton Mifflin, 2002).

<sup>9</sup> Barak Ariel, Tony Farrar, and Alex Sutherland, “The Effect of Police Body-Worn Cameras on Use of Force and Citizens’ Complaints Against the Police: A Randomized Controlled Trial,” *Journal of Quantitative Criminology* 31(2015): 1–27.

<sup>10</sup> Ibid.

the modest contamination experienced in this experiment did not interfere with our impact analysis.

## Analysis of Outcome Measures

Civilian complaints against officers and use of force reports were rare events for LVMPD officers. Indeed, during the one-year period preceding inclusion in the randomized controlled trial, 45.4 percent of treatment officers (99 of 218) and 52.0 percent of control officers (103 of 198) did not experience a single citizen complaint, and 68.8 percent of treatment officers (150 of 218) and 73.7 percent of control officers (146 of 198) did not generate a single use of force report. Given these rare event distributions, we collapsed the observed counts into binary outcomes (0 = no event, 1 = one or more events) for both citizen complaint events and use of force events outcomes during 12-month pre-intervention and 12-month intervention time periods. We used differences-in-differences of proportions *Z* tests<sup>11</sup> to determine whether treatment officers were less likely to experience complaints and generate use of force reports relative to control officers between the pre-intervention and intervention periods.

## Citizen Complaints and Use of Force Outcomes

Between the pre-intervention and intervention periods, the percentage of treatment officers that generated at least one complaint decreased by 16.5 percentage points, from 54.6 percent to 38.1 percent. By comparison, the percentage of control officers that generated at least one complaint decreased by only 2.5 percentage points, from 48.0 percent to 45.5 percent. The absolute differences in the share of officers with at least one complaint between the treatment and control groups over the pre-intervention and intervention periods represented a 14.0 percent difference in favor of the treatment group ( $Z = 2.035$ ,  $p < .05$ ). The proportional difference between the two groups over time represented a larger 25.0 percent reduction in the percentage of treatment officers relative to control officers who generated at least one complaint

Similar significant reductions were noted in the likelihood that a treatment officer generated at least one use of force report during the intervention period. Between the pre-intervention and intervention periods, the percentage of treatment officers that generated at least one use of force report decreased by 11.5 percentage points from 31.2 percent to 19.7 percent (table 9). By comparison, the percentage of control officers that generated at least one use of force report increased by 1.0 percentage points from 26.3 percent to 27.3 percent. The absolute differences in the share of officers with at

---

<sup>11</sup> Hubert Blalock, *Social Statistics*, 2nd ed. (New York: McGraw-Hill, 1979).

least one use of force report between the treatment and control groups over the pre-intervention and intervention periods represented a 12.5 percent difference in favor of the treatment group ( $Z = 2.057$ ,  $p < .05$ ). The proportional difference between the two groups over time represented a larger 40.7 percent difference in the percentage of treatment officers relative to control officers who generated at least one use of force report. The complete results of the complaint and use of force analyses can be found in Section III.

## Officer Activity Outcomes

We calculated difference in difference (DID) estimator results of the panel regression models comparing pre-intervention and post-intervention monthly work activity levels for treatment officers with monthly work activity levels for control officers. We also compared the pre-intervention and intervention means and their percent differences for the various activity outcomes for the treatment and control officers. Holding group and period constant, the BWC intervention was not associated with any statistically significant changes in the monthly count of responses to dispatched call events, officer-initiated call events, and call events involving crime reports. However, controlling for group and period, the BWC intervention was associated with a statistically significant 6.8 percent increase ( $p < .01$ ) in the monthly count of call events with citations issued and a statistically significant 5.2 percent increase ( $p < .01$ ) in the monthly count of call events with arrests by the treatment officers relative to the control officers.

## Cost-Benefit Analysis Analytic Approach

To better understand the costs and benefits of implementing the BWCs, we measured the annual costs and benefits per user (officer wearing a BWC for a year). The benefits derive from the estimated decrease of 25 complaints per 100 users, as well as the reduced cost to investigate each complaint (because of the available BWC video evidence), and the reduced amount of time it takes to resolve a complaint when video evidence is available. LVMPD provided the average processing and investigation cost for a typical complaint (with and without BWCs).

LVMPD covered the BWC installation, training, operation, and maintenance costs incurred during the study period. These costs included both one-time (e.g., facilities and infrastructure upgrades) and recurring costs (e.g., licenses and storage). Our analysis assumed an average call activity level similar to that observed during the period of analysis (approximately 30 call events per officer per month between March 1, 2011, and September 30, 2015). Assuming a higher call activity (together with a constant rate of complaints per call) would result in greater benefits because a larger number of complaints would be avoided.

## Cost-Benefit Analysis Results

We estimated the cost of labor required to investigate an average complaint, with and without BWC evidence. According to data provided by LVMPD, BWCs save over \$6,200 in officer time spent investigating an average complaint, compared to complaint investigations for officers without BWCs.

We estimated the annual monetary benefits per BWC user, using the results of the impact evaluation. Based on the difference-in-difference estimate from the impact evaluation, the BWC user group would have had an average of 0.25 (25 complaints per 100 users) more complaints (0.84) without the BWCs. We estimate that LVMPD realizes benefits of \$4,006 per BWC user per year. These benefits are driven primarily by the reduced cost of investigating complaints.

We estimated the costs incurred by LVMPD during FY14 to implement the BWC program. Many of the costs were up-front investments in assets that have useful lives exceeding one year and/or that can support BWC users beyond the initial 200. In consultation with LVMPD personnel, we estimated the useful life of these assets and apportioned the cost equally over the useful life. To calculate a standard cost per user per year we also indicate the number of BWC users to which each cost applies.

We estimate that BWCs cost between \$828 and \$1,097 per user per year, and generate net annual savings of between \$2,909 and \$3,178 per user. BWCs generate savings mainly through significantly faster investigation of complaints. We assume that there would be 0.84 complaints per officer each year in the absence of BWCs (the average during the pre-implementation period of the BWC study). The “break-even” level of complaints occurs between 0.23 and 0.27 complaints per officer per year. At the break-even level, the costs avoided by BWCs would just offset the costs to implement BWCs.

Most notably, further applying the cost-benefit estimates to all 1,400 patrol officers (again assuming there would be 0.84 complaints per officer each year in the absence of BWCs) suggests BWC net annual savings of \$4.1 million to \$4.4 million department-wide.

## Conclusions and Implications

The results of this RCT suggest that the placement of BWCs on LVMPD officers reduced complaints<sup>12</sup> and use of force reports for treatment officers relative to non-BWC wearing control officers. These results support the position that BWCs may de-escalate

---

<sup>12</sup> We also observed a two-week reduction in the time required to resolve complaints for officers wearing BWCs.



aggression or have a “civilizing” effect on the nature of police-citizen encounters. The complaint and use of force reductions associated with placing BWCs on police officers may be particularly important for improving police-community relations in impoverished minority neighborhoods. We found that BWC-wearing officers generated moderately more arrests and issued more citations than their control counterparts. Extrapolating BWC costs and benefits to a department-wide implementation, we estimated that BWCs could produce a net annual savings of \$4.1 million to \$4.4 million.

The findings of this study suggest that BWCs have strong potential to benefit police agencies and communities alike. Not only do they reduce complaints against officers and use of force incidents in large measure (and the corresponding costs of resolving those complaints and use of force incidents), they seem to increase police productivity, evidenced by the modest but significant increases in police citations and arrests. Further research is needed on this count to determine whether bias exists in the increased stops and arrests, and whether this increase in productivity has negative effects on community perceptions of police. Our study also suggests that the benefits of cameras (at least in terms of cost savings due to the reduction in complaints) far outweigh the costs of the BWC program. This too requires additional research —the benefits might not be so great in a community characterized by positive police-community relations prior to the introduction of BWCs. As the policing profession moves towards further implementation of BWCs, jurisdictions implementing BWCs will hopefully be open to rigorous research regarding outcomes and cost-benefit analyses, as well as the unintended benefits or consequences of their implementation.

Further research is needed to determine whether the increases in enforcement activity were driven by enhanced officer confidence that the video evidence would be used to hold offenders accountable for their transgressions, officers’ concerns that supervisors who view videos of the interactions would hold them accountable for their discretionary actions, or both. Further research would help determine whether increased arrest and citation activity affected communities of color or other communities of concern disproportionately. It is also unknown how the observed increased enforcement activity of BWC officers might influence police legitimacy. It is possible that increased enforcement activity associated with BWCs might enhance legitimacy by improving police effectiveness in controlling crime, the departments’ capacity to hold offenders accountable, or both.

Alternatively, increased enforcement activity could undermine police legitimacy if citizens view increased arrests and citations as harmful to their communities. Citizens’ appraisals of the police are largely influenced by the style of policing in their communities. Policing strategies that emphasize increased investigative stops, criminal summonses, and misdemeanor arrests across jurisdictions have been shown



to generate concern about racial disparities<sup>13</sup> and are suggested to contribute to the increased incarceration of young minority males.<sup>14</sup> The findings of this RCT raise the possibility that, in our most vulnerable neighborhoods, increased enforcement activity associated with the placement of BWCs on officers could possibly undermine the improvement in citizen perceptions of the police generated by reductions in complaints and use of force incidents.

---

<sup>13</sup> Jeffrey Fagan, Amanda Geller, Garth Davies, and Valerie West, “Street Stops and BrokenWindows Revisited: The Demography and Logic of Proactive Policing in a Safe and Changing City,” in *Race, Ethnicity, and Policing*, ed. S. Rice and M. White (New York: New York University Press, 2010).

<sup>14</sup> Charles Epp, Steven Maynard-Moody, and Donald Haider-Markel, *Pulled Over: How Police Stops Define Race and Citizenship* (Chicago: University of Chicago Press, 2014); James Jacobs, *The Eternal Criminal Record* (Cambridge, MA: Harvard University Press, 2015); and Kathryn Young, and Joan Petersilia, “Keeping Track: Surveillance, Control, and the Expansion of the Carceral State,” *Harvard Law Review* 129, (2016): 1318–1360.

# I. Introduction

## A. Statement of the problem

In the past several years we have seen a dramatic growth in the number of agencies using body-worn cameras. Although not formally documented, it has been reported that over one-third of the 18,000 or so law enforcement agencies in the United States have begun using this technology.<sup>15</sup> Implemented in response to increased community uproar after several controversial police use of force incidents, body-worn cameras were seen as a panacea for resolving issues of community trust and increasing police accountability. However, it was quickly realized that body-worn cameras were just one tool to address these issues and that the new technology had limitations. As more law enforcement agencies and criminal justice stakeholders implement BWCs, it has become clear that the technology's potential implications and impacts are far reaching and not widely understood. Successful implementation often requires substantial changes to a police organization and its partners (for example, the prosecutor's office, defense attorneys, and judiciary) in policy, training, staffing, and technology. Although research on the impacts of BWCs on use of force, citizen complaints, and community perceptions has steadily grown, more research is needed to fully understand the breadth of BWCs' impact on policing and the criminal justice system.

The following report outlines the analytical approach and findings from our randomized controlled trial (RCT) on the impact of BWCs on officer behavior in the Las Vegas Metropolitan Police Department (LVMPD). We begin by providing an overview of the research setting, then we continue with a discussion of the research design, implementation challenges, and process evaluation. Next we review the analytical approach from our impact and cost-benefit analysis. We conclude with a summary of our findings from the impact and cost-benefit analysis and review the implications of this study for the larger research and policing communities.

---

<sup>15</sup> Katie DeLong and *CNN Wire Service*. "One-Third of United States Police Departments Using Body Cameras: They're Expensive, so Are They Worth It?" <http://fox6now.com/2015/03/02/one-third-of-united-states-police-departments-using-body-cameras-theyre-expensive-so-are-they-worth-it/>, July 10, 2017.

## B. Literature citations and review

### Influence on the Civility of Police-Citizen Encounters

Two theoretical perspectives, deterrence and self-awareness, are commonly applied to support the position that placing BWCs on officers will improve the civility of police-citizen interactions by deterring undesirable behaviors (e.g., not wanting to be recorded on video doing something inappropriate or illegal) and stimulating desirable behaviors (e.g., remembering to treat others with respect). Deterrence theory suggests that crimes can be prevented when the costs of committing the crime are perceived by the offender to outweigh the benefits.<sup>16</sup> Much of the literature evaluating deterrence focuses on the effect of changing certainty, swiftness, and severity of punishment associated with certain acts on the prevalence of those crimes.<sup>17</sup> The available research suggests that deterrent effects are ultimately determined by offender perceptions of sanction risk and certainty.<sup>18</sup>

BWCs have been suggested as a deterrent to noncompliance with the rules of proper behavioral conduct in police-citizen encounters.<sup>19</sup> In his discussion of the influence of cameras on behavior, Tilley argues that deterrence is one prominent prevention mechanism triggered by the technology: the presence of a camera “reduces...

---

<sup>16</sup> Franklin Zimring and Gordon Hawkins, *Deterrence: The Legal Threat in Crime Control* (Chicago: University of Chicago Press, 1973); and Jack Gibbs, *Crime, Punishment, and Deterrence*, (New York: Elsevier, 1975).

<sup>17</sup> Alfred Blumstein, Jacqueline Cohen, and Daniel Nagin, eds., *Deterrence and Incapacitation: Estimating the Effects of Criminal Sanctions on Crime Rates* (Washington, DC: National Academy of Sciences, 1978); Philip Cook, “Research in Criminal Deterrence: Laying the Groundwork for the Second Decade,” *Crime and Justice* 2 (1980): 211-268; and Raymond Paternoster, “The Deterrent Effect of the Perceived Certainty and Severity of Punishment: A Review of the Evidence and Issues,” *Justice Quarterly* 4 (1987): 173-217.

<sup>18</sup> Daniel Nagin, “Deterrence in the Twenty-First Century,” *Crime and Justice* 42 (2013): 199-263.

<sup>19</sup> Barak Ariel, Tony Farrar, and Alex Sutherland, “The Effect of Police Body-Worn Cameras on Use of Force and Citizens’ Complaints Against the Police: A Randomized Controlled Trial,” *Journal of Quantitative Criminology* 31 (2015): 1-27.

[noncompliance] by deterring potential offenders who will not wish to risk apprehension and conviction by the evidence captured on videotape or observed by an operator on a screen on which their behavior is shown.”<sup>20</sup> For officers and citizens alike, the presence of a camera during encounters increases the likelihood that any misconduct and illegal behaviors will be captured on video and, as such, generates a deterrent effect by increasing their perceptions of the likelihood of apprehension and celerity of punishment.

Self-awareness theory states that when we focus our attention on ourselves, we evaluate and compare our current behavior to our internal standards and values.<sup>21</sup> This theory further suggests that when human beings are under observation, they modify their behavior, exhibit more socially acceptable behavior, adhere to social norms, and cooperate more fully with the rules. People are more likely to align their behavior with personal standards when made self-aware and believe that they will be negatively affected if they do not live up to these standards.<sup>22</sup> Various environmental cues and situations induce awareness of the self, such as mirrors, an audience, or being videotaped or recorded.<sup>23</sup> A well-developed line of research suggests that people do alter their behavior once they know that they are being observed.<sup>24</sup>

The presence of BWCs during police-citizen encounters is suggested to stimulate self-awareness by making these individuals conscious that they are being watched and their actions are being recorded.<sup>25</sup> As a result, police and citizens alike become self-aware and compare their behavior in the encounters with objective standards, which are

---

<sup>20</sup> Nick Tilley, *Understanding Car Parks, Crime, and CCTV: Evaluation Lessons from Safer Cities*, London: Home Office, 1993, 5.

<sup>21</sup> T. Shelley Duval and Robert Wicklund, *A Theory of Objective Self-Awareness* (New York: Academic, 1972).

<sup>22</sup> Ibid.

<sup>23</sup> Ibid.

<sup>24</sup> Tanya L. Chartrand and John A. Bargh, “The Chameleon Effect: The Perception-Behavior Link and Social Interaction,” *Journal of Personality and Social Psychology* 76 (1999): 893-910; Kristen Munger, and Shelby Harris, “Effects of an Observer on Hand Washing in a Public Restroom,” *Perceptual and Motor Skills* 69 (1989): 733-734; and Delroy Paulhus, “Two-Component Models of Socially Desirable Responding,” *Journal of Personality and Social Psychology* 46 (1984): 598-609.

<sup>25</sup> Tony Farrar and Barak Ariel, *Self-Awareness to Being Watched and Socially Desirable Behavior: A Field Experiment on the Effect of Body-Worn Cameras and Police Use of Force*, Washington, DC: Police Foundation, 2013.

socially-desirable behaviors. If encounter participants notice a discrepancy between their behavior and what is socially desirable, then they will alter their behavior. As will be discussed further below, these socially-desirable behaviors include procedurally-just treatment of citizens by police officers. In summary, there is solid theoretical support for the use of BWCs as a prevention mechanism to influence the behaviors of those who are under observation. BWCs are suggested to have both an intrinsic effect (self-awareness theory) and an extrinsic effect (deterrence theory) on those being watched and, as a result, police and citizens will exhibit socially-desirable behavior in their interactions.<sup>26</sup>

While it remains unclear whether deterrence, self-awareness, or both are generating the observed effects, several recently completed RCTs and quasi-experiments suggest that BWCs improve the civility of police-citizen encounters by reducing complaints against officers and officer use of force incidents (both excessive and non-excessive). In a randomized controlled study conducted in Spokane, WA, researchers found the percentage of officers with a complaint declined by 50 percent in the control group and 78 percent in the treatment group.<sup>27</sup> Researchers also found that use of force declined by 39 percent in the treatment group.<sup>28</sup> In the Rialto, California, randomized experiment, officers wearing BWCs during treatment shifts generated a 90% reduction in complaints and a 50 percent reduction in use of force reports relative to officers not wearing cameras during comparison shifts.<sup>29</sup> The Mesa, Arizona Police Department's quasi-experimental evaluation of BWCs revealed a 48 percent reduction in citizen complaints against treatment officers for misconduct during the study period, and a 75 percent decline in use of force complaints.<sup>30</sup> In the Orlando, Florida

---

<sup>26</sup> Ibid; Michael D. White, "Police Officer Body-Worn Cameras: Assessing the Evidence," Washington, DC: Office of Community Oriented Policing Services, 2014; and Cynthia Lum, Christopher Koper, Linda Merola, Amber Scherer, and Amanda Reiou, *Existing and Ongoing Body Worn Camera Research: Knowledge Gaps and Opportunities*, New York: The Laura and John Arnold Foundation, 2015.

<sup>27</sup> Michael D. White, Janne Guab, Natalie E., Todak, "Exploring the Potential for Body-Worn Cameras to Reduce Violence in Police-Citizen Encounters." *Policing* (2017): pp 1-11.

<sup>28</sup> Ibid.

<sup>29</sup> Barak Ariel, Tony Farrar, and Alex Sutherland, "The Effect of Police Body-Worn Cameras on Use of Force and Citizens' Complaints Against the Police: A Randomized Controlled Trial," *Journal of Quantitative Criminology* 31 (2015): 1-27.

<sup>30</sup> Mesa Police Department, *On-Officer Body Camera System: Program Evaluation and Recommendations*, Mesa, AZ: Mesa Police Department, 2013.

randomized experiment, BWC officers had a significantly lower prevalence of response-to-resistance incidents (involving electronic control devices, chemical agents, impact weapons, and other non-lethal implements) and lower prevalence of serious external complaints relative to control officers without BWCs.<sup>31</sup> A quasi-experimental evaluation in Phoenix Arizona reported a 62 percent reduction in complaints lodged against treatment officers relative to control officers.<sup>32</sup> In the Mesa, Phoenix, and Rialto studies, many complaints were resolved quickly due to the accessibility of video evidence.<sup>33</sup>

While there is some promising evidence that BWCs de-escalate confrontation and aggression in police-citizen encounters, not all evaluations support this position. A randomized experimental design was used to evaluate the effects of BWCs on complaints against officers in the London Metropolitan Police Service (UK). The study did not reveal any statistically-significant differences in overall complaints made against officers with BWCs relative to officers not wearing BWCs. There were also no statistically-significant differences in self-reported assaults on officers or injuries for BWC officers relative to control officers.<sup>34</sup>

A multisite randomized experiment involving 2,122 officers in eight police departments reported no overall reduction in officer use of force and an increase in

---

<sup>31</sup> Wesley G. Jennings, Mathew Lynch, and Lorie Fridell, "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 (2015): 480-486.

<sup>32</sup> E.C. Hedberg, Charles Katz, and David Choate, "Body-Worn Cameras and Citizen Interactions with Police Officers: Estimating Plausible Effects Given Varying Compliance Levels," *Justice Quarterly*. Vol. 34 , Iss. 4,2017.

<sup>33</sup> Ian Lovett, "In California, a Champion for Police Cameras," *The New York Times*, August 21, 2013; and Charles Katz, David Choate, Justin Ready, and Lidia Nuno, *Evaluating the Impact of Officer Worn Body Cameras in the Phoenix Police Department*, Phoenix, AZ: Center for Violence Prevention & Community Safety, Arizona State University, 2014.

<sup>34</sup> Lynne Grossmith, Catherine Owens, Will Finn, David Mann, Tom Davies, and Laura Baika,

Police, Camera, Evidence: London's Cluster Randomised Controlled Trial of Body Worn Video. London: College of Policing and the Mayor's Office for Policing and Crime, 2015.

assaults on officers wearing BWCs during treatment shifts relative to officers not wearing BWCs during control shifts.<sup>35</sup> In a re-analysis of the multisite randomized experiment data, Ariel et al. show that use of force by treatment officers decreased by 37 percent in three sites with high compliance to a BWC policy that required officers to notify citizens that they were being recorded at the beginning of the encounter. Ariel et al. also reported a 71 percent increase in officer use of force in sites with low compliance to the BWC policy. Based on these findings, the authors hypothesized that unchecked BWC discretion may increase use of force as camera activation during situations with escalating aggression may further increase aggression during these volatile situations. The authors also suggested that verbal notification of video recording by officers at the commencement of encounters may be helpful in deterring aggressive behavior and stimulating civil behavior before police-citizen interactions escalate.<sup>36</sup>

## Influence on Police Officer Work Activities

A small number of studies examined the effects of BWCs on police officer work activities such as their willingness to be proactive and problem solve, and their discretion in making arrests and citations in discretionary incidents.<sup>37</sup> Survey research suggests that police officers generally view the technology as facilitating the arrest and prosecution of criminal offenders by improving the quality of evidence via the creation

---

<sup>35</sup> Barak Ariel, Alex Sutherland, Darren Henstock, Josh Young, Paul Drover, Jayne Sykes, Simon Magicks, and Ryan Henderson, "Wearing Body-Cameras Increases Assaults Against Officers and Do Not Reduce Police-Use of Force: Results from a Global Multisite Experiment," *European Journal of Criminology* 13a (2016): 744-755.

<sup>36</sup> Barak Ariel, Alex Sutherland, Darren Henstock, Josh Young, Paul Drover, Jayne Sykes, Simon Magicks, and Ryan Henderson, "Increases in Police Use of Force in the Presence of Body-Worn Cameras are Driven by Officer Discretion: A Protocol-Based Subgroup Analysis of Ten Randomized Experiments," *Journal of Experimental Criminology* 12b (2016): 453-463.

<sup>37</sup> Cynthia Lum, Christopher Koper, Linda Merola, Amber Scherer, and Amanda Reioux, *Existing and Ongoing Body Worn Camera Research: Knowledge Gaps and Opportunities*, New York: The Laura and John Arnold Foundation, 2015; and Michael D. White, "Police Officer Body-Worn Cameras: Assessing the Evidence," Washington, DC: Office of Community Oriented Policing Services, 2014.

of a permanent record of the events that transpired.<sup>38</sup> In agencies considering the adoption of BWCs, police officers have been noted to express concern over how camera footage will be used to monitor officer performance.<sup>39</sup> Indeed, officers may fear being reprimanded for not issuing a citation or making an arrest when a video clearly shows that a citizen has violated the law.<sup>40</sup> Both orientations towards the placement of BWCs on officers – that is, the belief that offenders are more likely to be held accountable for their transgressions via the availability of video evidence and the a priori knowledge that supervisors may scrutinize officer discretion in resolving incidents – seem likely to influence officer work activities.

Two controlled studies suggest that officers do increase their law enforcement activities when outfitted with BWCs. In the Phoenix, Arizona quasi-experimental evaluation, Katz et al. concluded that BWCs increased officer productivity as measured by the number of arrests. They reported that the number of arrests increased by about 17 percent among officers in the BWC treatment group compared to 9 percent among officers in the comparison group.<sup>41,42</sup> In the Essex (UK) randomized controlled trial,

---

<sup>38</sup> Martin Goodall, *Guidance for the Police Use of Body-Worn Video Devices*, London: Home Office, 2007; and ODS Consulting, *Body Worn Video Projects in Paisley and Aberdeen, Self Evaluation*, Glasgow, UK: ODS Consulting, 2011.

<sup>39</sup> Police Executive Research Forum, *Implementing a Body-Worn Camera Program: Recommendations and Lessons Learned*, Washington, DC: Office of Community Oriented Policing Services, 2014.

<sup>40</sup> Mesa Police Department, *On-Officer Body Camera System: Program Evaluation and Recommendations*, Mesa, AZ: Mesa Police Department, 2013.

<sup>41</sup> Charles Katz, David Choate, Justin Ready, and Lidia Nuno, *Evaluating the Impact of Officer Worn Body Cameras in the Phoenix Police Department*, Phoenix, AZ: Center for Violence Prevention & Community Safety, Arizona State University, 2014.

<sup>42</sup> The study conducted in Phoenix, Arizona focused on domestic violence incidents, and it may be that in those cases officers would feel more confident in making arrests compared to when video evidence was not present.



Owens et al. found that incidents attended by BWC officers more likely to result in criminal charges as compared to incidents attended by control officers.<sup>43</sup>

Ready and Young used a quasi-experimental analysis of field contact reports to examine whether BWCs influenced Mesa, Arizona Police Department officer behavior during police-citizen encounters over a 10-month period. The analysis suggested that BWC officers were less likely to perform stop-and-frisks and make arrests, but were more likely to give citations and initiate encounters. Ready and Young suggested that Mesa police officers were more proactive with the BWC technology without increasing their use of invasive strategies that may threaten the legitimacy of the organization. However, the authors did not assess how initiating additional encounters with citizens and issuing more citations might impact police relationships with the communities they serve.<sup>44</sup>

## C. Statement of hypotheses

This research project involved process and impact evaluation components, with the primary focus on the impact evaluation. It was important to observe and document the formative aspects of this implementation of BWCs in LVMPD, for this was a formidable undertaking with significant adjustments along the way, and important lessons to be learned for the benefit of other departments implementing BWCs. The primary goal, however, was to evaluate the impact of BWCs on LVMPD police (patrol) officer behavior. We learned other important lessons along the way, but our primary interest was in hypotheses and outcome measures pertaining to LVMPD patrol officer behavior, given the introduction of BWCs. Below we list the primary hypotheses for this study.

### Study Hypotheses:

Hypothesis 1: Officers with BWCs will make fewer self-initiated citizen contacts compared to officers without BWCs.

---

<sup>43</sup> Catherine Owens, David Mann, and Rory McKenna, *The Essex BWV Trial: The Impact of BWV on Criminal Justice Outcomes of Domestic Abuse Incidents*, London: College of Policing, 2014.

<sup>44</sup> Mesa Police Department, *On-Officer Body Camera System: Program Evaluation and Recommendations*, Mesa, AZ: Mesa Police Department, 2013.

We hypothesized that officers wearing BWCs would be less likely to make self-initiated contacts with civilians because the fact that the contacts would be recorded might reflect negatively on their behavior towards civilians, and that they would tend to initiate fewer contacts to avoid possible negative review of the outcome of the contacts.

Hypothesis 2: Officers with BWCs will take fewer official police actions compared to officers without BWCs.

Similar to the hypothesis above, we hypothesized that LVMPD officers would take fewer formal actions (e.g., arrests) as a result of wearing BWCs, because the existence of BWC recordings would make them more vulnerable to review and criticisms, perhaps even discipline.

Hypothesis 3: Officers with BWCs will engage in use of force less frequently than officers without BWCs.

We hypothesized that the ‘civilizing effect’ of BWCs (Ariel, et al., 2015) – the likelihood that police officers wearing cameras would temper their behavior and use less force (or lower levels of force options) as a result of wearing BWCs – was real, and that officers wearing BWCs would engage in use of force less often (compared to controls).

Hypothesis 4: Officers with BWCs will receive fewer citizen complaints of officer misconduct compared to officers without BWCs.

Similar to hypotheses number 3 above, we hypothesized that officers wearing BWCs would receive fewer citizen complaints against them, compared to officers not wearing BWCs, primarily because officers would temper their behavior knowing that recordings of their interactions with civilians would exist.

We also had several working hypotheses about the cost impact of BWCs at LVMPD. We hypothesized that:

- Costs incurred due to officers spending time in court responding to civilian complaints, or on suspension due to complaints, would lessen.
- Costs incurred to investigate complaints against LVMPD officers would lessen, as a result of fewer complaints, and as a result of less time required to resolve complaints.
- Costs incurred due to formal complaints filed in court, and LVMPD settlements of court cases brought against LVMPD officers would lessen.

## II. Methods

### A. Research setting

LVMPD provides policing services to some 1.5 million residents of the Las Vegas metropolitan area.<sup>45</sup> In FY 2014–2015, the LVMPD had roughly 2,600 sworn police officers with nearly 1,400 officers assigned to the Patrol Division. At the time of the study, the Patrol Division was divided geographically into eight area commands. The area commands, each headed by a captain, have primary responsibility for preventive patrol, responding to calls for service, and other proactive activities. In 2014, the Las Vegas metropolitan area had a total index crime rate of 3,839.5 and a violent index crime rate of 532.0 per 100,000 residents. In comparison, the overall U.S. index crime rate in 2014 was 2,961.6, and the U.S. violent crime rate was 365.5. Thus, Las Vegas experienced crime rates above the U.S. average in 2014.<sup>46</sup> LVMPD officers responded to 1,139,777 emergency 911 citizen calls for service in 2014.

LVMPD began pilot testing BWCs with a small group of officers in 2011, when the agency was under intense public criticism and scrutiny for its use of force policies, which ultimately resulted in a Collaborative Reform process with the U.S. Department of Justice, Office of Community Oriented Policing Services (Stewart et al., 2012). The pilot-testing period served as an opportunity for the agency to experiment with different BWC vendors, see how officers responded to the technology, and draft the department's initial BWC policy.<sup>47</sup> By 2013, LVMPD selected Taser International and its Axon Flex as the vendor and camera to be worn by officers and developed an official BWC policy. LVMPD planned to conduct a modest implementation of BWCs on 200 officers to test the technology's impacts on a range of outcome measures and to guide a larger deployment of BWCs in the Patrol Division. In 2014, docking stations that

---

<sup>45</sup> The basic statistical information presented here was gleaned from the LVMPD 2014 annual report. Available at <http://www.lvmpd.com/AboutLVMPD/AnnualReports/tabid/153/Default.aspx> (accessed April 15, 2017).

<sup>46</sup> Source: <https://ucr.fbi.gov/crime-in-the-u.s/2014/crime-in-the-u.s.-2014/tables/table-1>, <https://www.fbi.gov/news/pressrel/press-releases/fbi-releases-2014-crime-statistics>.

<sup>47</sup> The American Civil Liberties Union (ACLU) endorsed the LVMPD policy and suggested that it was balanced in terms of transparency and privacy concerns (Lochhead, 2015). The LVMPD BWC policy requires that “whenever possible, safe and practical, officers should inform individuals that they are being recorded” and is available at <http://ipicd.com/ceer/files/LVMPD%20BWC%20Policy.pdf> (accessed February 15, 2017).

recharged BWC batteries and uploaded acquired videos to cloud memory storage were installed in four area commands.

LVMPD's experience with BWCs and willingness to implement and evaluate them set the stage for a rigorous program evaluation. With support from the U.S. Department of Justice, National Institute of Justice, LVMPD partnered with an external research team to develop and execute an RCT involving BWCs. The purpose of this RCT was to examine how the implementation of technology that allows video and audio taping of police-citizen interactions affects police behavior. This research project deployed BWCs in LVMPD over approximately 20 months, observed the pre-implementation and subsequent behavior of patrol officers, and analyzed the extent to which the BWCs affected police behavior. The goal of this project was to implement a randomized experimental design in LVMPD to measure changes in police officer behavior before and after the introduction of BWCs. The behavior measures focused on allegations and findings of police misconduct, use of force incidents, as well as on other administrative records and reports pertaining to police behavior (for example, arrests and police stops of civilians). This study also sought to examine the costs and benefits of BWC use.

Sousa, Coldren, Rodriguez, and Braga documented the implementation of the LVMPD BWC experiment and, despite some operational challenges, concluded that the intervention was implemented with integrity.<sup>48</sup> In this instance, integrity refers to the fact that the desired number of cameras were deployed in the field, the officers wore them consistently and generally complied with the policy, attrition from the study sample was low (approximately 10 percent), contamination between the treatment and control study samples was low (less than 20 percent), and LVMPD maintained the conditions of the experiment for almost 20 months.

However, one implementation challenge involved the recruitment of officers into the RCT. Because of the provisions of the active police union contract in place at the time of the experiment, LVMPD could not mandate its officers to wear the BWCs. Therefore, participants in the RCT had to be volunteers who were willing to wear the BWCs for at least one year. The implications of this design challenge are explored further in the following section.

---

<sup>48</sup> William Sousa, Chip Coldren, Denise Rodriguez, and Anthony A. Braga, "Research on Body Worn Cameras: Meeting the Challenges of Police Operations, Program Implementation, and Randomized Controlled Trial Designs," *Police Quarterly* 19 no. 3 (2016): 363–384.

## B. Methods: Process evaluation<sup>49</sup>

### Research design

Randomized experimental designs allow researchers to assume that the only systematic difference between the control and treatment groups is the presence of the intervention, as long as other intervening factors such as sample attrition and contamination do not interfere, thus permitting a clear assessment of causes and effects.<sup>50</sup> Randomized experiments are valued for their strong internal validity—that is, the extent to which a research design can eliminate competing explanations of an observed correlation. Since randomized experiments control for confounding factors by design, analyses of experimental data do not require extensive statistical modeling to ensure rival causal influences are identified and controlled.<sup>51</sup>

As noted by Sousa et al., (2016) the LVMPD BWC experiment had a straightforward design.<sup>52</sup> Duty rosters from the area commands would provide the sampling frame of approximately 1,100 officers in the LVMPD patrol division, from which a target sample of 400 could be drawn. These 400 would then be randomly assigned into treatment and control groups. After the 200 officers in the treatment group received the appropriate training and were issued BWCs, officers in both groups would then be

---

<sup>49</sup> The following section predominantly summarizes the study's process evaluation as presented in the 2016 Police Quarterly article "Research on Body-Worn Cameras: Meeting the Challenges of Police Operations, Program Implementation, and Randomized Controlled Trial Designs."

<sup>50</sup> Donald Campbell and Julian Stanley, *Experimental and Quasi-Experimental Designs for Research* (Chicago: Rand McNally, 1966).

<sup>51</sup> William Shadish, Thomas Cook, and Donald Campbell, *Experimental and Quasi-Experimental Designs for Generalized Causal Inference* (Boston: Houghton Mifflin, 2002).

<sup>52</sup> William Sousa, Chip Coldren, Denise Rodriguez, and Anthony A. Braga, "Research on Body Worn Cameras: Meeting the Challenges of Police Operations, Program Implementation, and Randomized Controlled Trial Designs," *Police Quarterly* 19 no. 3 (2016): 363–384.

monitored for one year.<sup>53, 54</sup> Comparisons on the dependent variables of interest (including use of force incidents, civilian complaints of police misconduct, and measures of proactive police activities such as arrests and citations) between the BWC treatment officers and the control officers could then be conducted.

## Challenges

Although seemingly straightforward, several challenges surfaced that are related to the stringency of RCT designs, the nature of BWC implementation, and the specific context of a large metropolitan police department like LVMPD. One of the first methodological concerns identified was the issue of attrition, as the analysis plan required officers to remain in the trial for one year. The primary methodological concern, however, related to potential contamination. For the RCT to be conducted properly, officers had to be randomly assigned into treatment and control groups. This design introduced the risk that officers wearing BWCs in the treatment group would interact with those without BWCs in the control group when multiple officers responded to a call for service—a type of contact that could alter control group members' actions if they were aware that a BWC was present. Alternative sampling strategies were initially considered that would keep treatment and control officers separate from each other, but such alternatives were ultimately ruled out because they would violate the assumptions of an RCT and possibly introduce other spurious factors. The final decision, therefore, was to maintain the integrity of random assignment but to monitor for the possibility of contamination.<sup>55</sup>

Several technical issues also surfaced as the RCT was about to begin. One complication, for example, related to the completion of the BWC docking station infrastructure. LVMPD policy required that each officer place his or her BWC in a docking station at shift's end. This process allows for the quick upload of video recordings, the preservation of video evidence, and the recharge of the BWC's battery. From a practical

---

<sup>53</sup> A total of 200 cameras were purchased for the initial implementation and for the RCT, although plans were already in place to acquire funding for more BWCs to support all of LVMPD's uniformed patrol.

<sup>54</sup> The 400 officers in the study sample were recruited on a rolling basis (not all at once); thus, while we monitored officer behavior for one year, we ran the experiment for approximately 20 months to allow for observations of all officers in the study sample for one year. Officers who left the sample were replaced with other study volunteers.

<sup>55</sup> Because LVMPD normally operates with one-officer patrol units, interaction among officers—and thus the potential for contamination while answering calls for service and conducting self-initiated enforcement activities—is infrequent during a typical shift, but does occur when officers from the study sample back up each other. It is worth noting here that police officers do interact with each other informally over the course of a typical shift (e.g., sharing meal breaks). Calls for service data would not capture these informal interactions.

standpoint, this meant that docking stations would be needed to be built at each of the eight area commands; otherwise officers would have to travel outside of their areas before and after their shifts to pick up and drop off the equipment. As the initial stages of the project were developing, however, it became apparent that there would be sufficient time and funding to construct the docking station infrastructure at only four of the eight area commands. As a result, the sampling frame of officers for the project was effectively cut in half from approximately 1,100 to about 550. This still allowed for the necessary target sample of 400, but it raised some methodological questions about the selection of the four area commands and potential differences between officers in those commands and officers from the areas that were not selected.

Some of these issues were further complicated by both external and internal political concerns. During the early stages of the project, LVMPD was under significant community pressure to swiftly implement BWCs. This pressure was especially felt in several communities where police-citizen relations had been strained over many years. These influences from outside the organization hastened the project timeline, but they also played a role in the selection of the four area commands where the BWCs would be implemented. Ultimately, the four area commands for the project were determined, in part, by determining the communities with the greatest concerns about police-citizen relations and the highest demand for the technology.

The more significant political challenges, however, came from within LVMPD itself. Prior to the project's start, the executive staff of LVMPD became concerned that the police union would challenge the implementation of BWCs. Such a challenge would likely result in significant delays to the BWC program in general and to the start of the RCT specifically. Faced with community pressure to begin implementation but concerned that union challenges would delay the program, LVMPD decided to make BWCs voluntary for current officers.<sup>56</sup> This decision had a substantial impact on the sampling frame for the project: before random assignment to treatment and control groups could occur, volunteers willing to wear a BWC would first need to be recruited from the pool of approximately 550 officers. This raised methodological concerns of statistical power (i.e., whether a sufficient number of officers would volunteer such that our analyses would determine small to moderate effects), especially since several influential officers within the agency were vocal about their opposition to BWCs on the grounds that video records could be used against police. It also raised concerns of potential differences between officers who volunteer to wear BWCs and those who do not.

Although unforeseen at the time, an additional administrative matter may have further complicated the recruitment of volunteers for the project. LVMPD's Organizational

---

<sup>56</sup> Officers hired by LVMPD after 2014 are contractually obligated to wear BWCs if the equipment is available.



Development Bureau (ODB) was the administrative entity responsible for the original pilot testing of the equipment and the development of BWC policy. When it was time for the project to begin, LVMPD placed ODB personnel in charge of BWC implementation since they were clearly the most knowledgeable about BWC technology, policy, and practice. A concern among officers may have developed, however, because at the time, ODB was a subunit of LVMPD’s Professional Standards Division—the same division that also contained the Internal Affairs Bureau (IAB). For officers who were already wary about volunteering to wear BWCs, the notion that Professional Standards personnel were involved in the process may have heightened concerns that BWC video could be used against officers.

Table 1 summarizes the various methodological, technological, political, and administrative challenges described in this section. Many of the concerns generated by these challenges were warranted. After the first round of recruitment in spring 2014, only 82 officers volunteered to wear BWCs—far short of the target number of 400 subjects necessary for the RCT. Since half of these officers would be randomly assigned to the control group, this also meant that only 41 BWCs would be deployed in public—a number that LVMPD worried would be unsatisfactory to a community that was pressuring the agency to deploy all 200 BWCs purchased for the project.

Table 1. Summary of BWC RCT Implementation Challenges and Resulting Concerns<sup>57</sup>

	Challenge	Concern(s)
Programmatic	Technical infrastructure only allows for the construction of BWC docking stations at four of the eight area commands.	<ul style="list-style-type: none"> <li>Reduction of subject pool as the number of potential officers is cut in half.</li> <li>Questions about whether officers in subject pool differ from those in other areas.</li> </ul>
	Faced with union concerns and community pressure, LVMPD chooses to make BWCs voluntary for officers.	<ul style="list-style-type: none"> <li>Reduction of subject pool as officer concerns limit willingness to participate.</li> <li>Questions about whether officers who volunteer differ from those who do not.</li> </ul>
	Administrative unit selected to implement BWC program was in the Professional Standards Division.	<ul style="list-style-type: none"> <li>Choice of unit heightens officer concerns, further limiting willingness to participate.</li> </ul>
Methodological	Due to requirements of randomization procedure, experimental (BWC) group is in contact with control group.	<ul style="list-style-type: none"> <li>Potential contamination of treatment effect.</li> </ul>

<sup>57</sup> William Sousa, Chip Coldren, Denise Rodriguez, and Anthony A. Braga, “Research on Body Worn Cameras: Meeting the Challenges of Police Operations, Program Implementation, and Randomized Controlled Trial Designs.” *Police Quarterly* 19, no. 3 (2016): 363–384.



Data requirements necessitate the RCT to run for one year.

- Potential for attrition problems.

Members of the research team who were present during the initial recruitment sessions documented reasons why officers did not volunteer (summarized in Table 2). Some did not volunteer simply because it was not required or because they did not want to bother with another piece of equipment. Many others, however, expressed concern that BWC footage could be used against them. Interestingly, officers were not concerned (at least openly) about the fact the BWCs would record their actions when dealing with civilians. They appeared more convinced that unscrupulous or vindictive supervisors would review their recordings in search of minor policy violations.

Table 2. Summary of Reasons for Officer Refusal to Wear BWCs<sup>58</sup>

Reason	Example
"Wait and See" approach	"I'm not against it [the BWC]... I just want to see how the policy works for a while."
Unconvinced of BWC benefits	"I have never had a problem with complaints against me. The camera is just something else that I would need to worry about."
BWC video will be used against officers	"I don't trust the administration with this."

## Confronting the Challenges

### *Programmatic Modifications*

With the RCT design in jeopardy, LVMPD initiated several modifications to address technical, political, and administrative concerns, primarily by increasing the size of the subject pool. First, a technological solution was put into place allowing for subject recruitment from the four area commands that did not have full docking station infrastructures. This innovation could accommodate only a limited number of officers from each of these area commands, but it increased the number of potential subject

<sup>58</sup> William Sousa, Chip Coldren, Denise Rodriguez, and Anthony A. Braga, "Research on Body Worn Cameras: Meeting the Challenges of Police Operations, Program Implementation, and Randomized Controlled Trial Designs." *Police Quarterly* 19, no. 3 (2016): 363-384.

volunteers by 80.<sup>59</sup> Importantly from a methodological standpoint, this solution also allowed for participation from all patrol area commands—not just those with the full equipment infrastructure.

Simultaneously, LVMPD addressed some internal challenges by revamping their BWC policy and their strategies for recruiting officers into the BWC program. They re-wrote the BWC policy to better emphasize the value of BWCs for officers and to ease officer concerns about the use of video data for disciplinary purposes. For example, the language of the revised policy significantly limited the review of videos by supervisors and others within the organization. LVMPD also capitalized on several “success” stories from its limited BWC deployment. (Most of these stories involved cases in which BWC video footage resulted in an officer’s exoneration after a citizen filed a false allegation of misconduct). Recruitment into the BWC program may also have been helped by controversial events around the country, such as the shooting death of Michael Brown in Ferguson, Missouri, in the summer of 2014. LVMPD officers argued, as did many others, that if the officer had worn a BWC in that case, a different narrative could have been established and a great deal of turmoil avoided.

Perhaps the most significant program modification, however, came in the decision to move the administrative portion of the BWC project from LVMPD’s Professional Standards Division to its Patrol Division. Since the area commands fall under the Patrol Division, it was reasoned that pressure could be placed on the executive staff of each area command to generate support for BWCs among officers. Much more so than personnel from Professional Standards, personnel from the area commands were in positions to convince officers of the value of BWCs, assure officers that video footage would not be used against them without cause, and encourage officers to volunteer for the BWC program.

These programmatic changes reflect the importance that LVMPD leadership placed on BWC deployment. Faced with community pressure to deploy BWCs on officers, the administration demonstrated its commitment to the program by making significant changes to the policy (and to the agency) to encourage officers to wear BWCs.<sup>60</sup> Recruitment into the BWC program increased substantially after these changes were

---

<sup>59</sup> The four area commands with the full equipment infrastructure benefited from an evidence transfer system that allowed for rapid upload of video data from BWCs at the end of officers’ shifts. The system established at the four non-infrastructure area commands also allowed for upload of video data and preservation of evidence, but at a much slower rate. As a result, the number of potential BWC wearers at non-infrastructure area commands was restricted to 10. The project could therefore accommodate 20 officer volunteers from each of the four non-infrastructure area commands (10 for the BWC treatment group; 10 for the control group) for a total of 80.

<sup>60</sup> At one point, the eight area command patrol captains and several deputy chiefs wore BWCs to encourage officers to volunteer.

in place. Although the first round of recruitment produced only 82 volunteers in spring 2014, by the end of summer 2014, 379 officers had volunteered.

## Monitoring the BWC Implementation Process

To monitor the BWC implementation process, information was gathered from officer surveys, officer focus groups, officer interviews, observations on ride-alongs with BWC officers, and a review of BWC videos.

### *Officer Surveys*

Surveys were administered to officers pre- and post-BWC implementation. The primary purpose of the surveys was to gauge officers' comfort level and experience with technology during BWC implementation, although several items also examined police legitimacy and procedural justice issues. The pre-implementation survey was administered to all officers during the recruitment stage of the project and prior to random assignment (N=422).<sup>61</sup> The post-implementation survey was administered via an online mechanism. Although all officers associated with the study were invited to take the post-implementation survey, 95 (23 percent) responded (58 from the treatment group, 37 from the control group).<sup>62</sup>

Officers were first provided with a 3-point scale and asked to report on their experience (not very, somewhat, or very experienced) and comfort level (low, medium, or high) with technology. As shown in Table 3, a greater percentage of officers in the treatment group indicated that they were very experienced with technology after the study period. However, officers in both groups generally reported greater experience with and comfort with technology compared to all officers at the pretest stage. That both groups reported more experience and comfort with technology might reflect institutional changes within LVMPD – officers overall appear to have become more tech-savvy during the BWC study period.

---

<sup>61</sup> 416 officers actually participated in the trial. This discrepancy (422 versus 416) is due to several officers completing the survey during the recruitment stage but then opting to not participate in the study prior to actual random assignment.

<sup>62</sup> The substantial attrition between the pre- and post-implementation surveys can be explained, at least partially, by the mode of administration (group-administered during pre- versus online-administered during post-implementation). Although using the same mode of administration would have been ideal, group-administered surveys were deemed to be not logistically feasible during the post period. Despite several attempts to encourage officers to complete the post survey (including a message from command staff), many officers did not respond. Unfortunately, because of limited personal information collected on the surveys, it is not possible to determine if there were self-selection differences between those who completed the post survey and those who did not (i.e., officers who are more tech savvy).

Table 3. Experience / Comfort Levels with Technology, Pre and Post Survey Results

	Pre N=422	Post N=95	Treat N=58	Control N=37
Percent stating “very experienced” with technology in general	31%	47%	49%	42%
Percent stating “very experienced” with technology specific to policing	23%	49%	54%	42%
Percent rating their level of comfort with technology in general as “high”	42%	53%	54%	52%
Percent rating their level of comfort with technology specific to policing as “high”	39%	57%	57%	57%

Officers were also asked to report on several items related to police legitimacy and procedural justice using a 5-point Likert scale ranging from “strongly disagree” to “strongly agree.” As Table 4 indicates, there were few differences between the pretest and posttest – or between the treatment and control – on four measures asking officers to report their level of approval with a police officer striking a citizen in response to a particular scenario.

Table 4. Percent stating that they “agree” or “strongly agree” with the following...

I would approve of a police officer striking an adult citizen who:	Pre N=422	Post N=95	Treat N=58	Control N=37
Had said vulgar and obscene things to the police officer	1%	4%	4%	3%
Was being questioned as a suspect in a murder case	1%	4%	4%	3%
Was attempting to escape from custody	58%	61%	60%	61%
Was attacking the police officer with his or her fists	99%	98%	98%	97%

Similarly, Table 5 summarizes officer responses to a series of statements that relate to discretion and police ethics. In most cases, there were few differences between the pretest and the posttest – or between the treatment and control officers during the posttest. Several results, however, were somewhat unexpected. For example, on some items, a higher percentage of officers reported greater formal standards during the posttest (such as arresting a fellow officer for DUI, issuing a fellow officer a speeding ticket, or reporting a fellow officer who used unnecessary force). However, in these instances, treatment officers and control officers were relatively consistent (or a higher percentage of control group officers actually reported greater formal standards than treatment group officers).

Overall, the survey results do not suggest that BWC implementation had a dramatic influence on officer experience levels with technology or measures of legitimacy and procedural justice. Compared to the pretest, a higher frequency of officers during the

posttest may have reported higher technical experience and—in several instances—greater ethical standards, but these results were generally consistent between the treatment and control group officers.

Table 5. Percent stating that they “agree” or “strongly agree” with the following...

	Pre N=422	Post N=95	Treat N=58	Control N=37
I would arrest a fellow officer for driving while intoxicated	64%	79%	70%	94%
I would give another officer a speeding ticket	13%	20%	15%	29%
I would report a fellow officer for using unnecessary force (e.g. hitting, kicking, punching) when making an arrest	85%	94%	94%	94%
Police officers are more effective if they are able to decide on their own when to enforce particular laws	59%	64%	60%	71%
Police officers must sometimes use unethical means to accomplish enforcement of the law	8%	2%	4%	0%
Sometimes police are justified in using “questionable practices” to achieve good ends	16%	14%	13%	16%
When a police officer is accused of using too much force, only other police officers are qualified to judge	41%	55%	60%	48%
Police officers should treat all persons they contact with equal amounts of dignity and respect	89%	92%	91%	94%
Police officers should treat all persons they contact according to the facts as they understand them, and not according to other factors such as race, sexual orientation, and religion	96%	95%	96%	93%
Police officers should clearly explain what they are doing, and why, to citizens they come into contact with	80%	79%	81%	74%
Police officers should consider peoples’ explanations when they make decisions about how to handle a situation	77%	71%	68%	77%

## Focus Groups

In addition to the officer surveys, we conducted several focus groups—separate focus groups with sergeants and patrol officers during the early phase of the study project. The purpose of the focus groups was to learn about LVMPD officers’ thinking and frame of mind about BWCs before and during the early introduction of the BWCs. This

information would prove helpful to LVMPD as they introduced BWCs into the agency and as they recruited officers to take part in the study.

The focus group questions were as follows:

1. How much of an adjustment to your daily law enforcement activities has introduction of the BWCs required, and what, if any, are the adjustments you have had to make?
2. What was your frame of mind about the introduction of the BWCs prior to their actual implementation?
3. Has your thinking about the BWCs changed since their introduction? If so, how?
4. Do you feel the Department prepared adequately for the introduction of the BWCs? Why or why not? How might the Department have prepared better?
5. Do you think the cameras will improve the Department's relationship with the people it serves as a result of the introduction of the BWCs? Why or why not?
6. If you could give one piece of advice to other departments contemplating the introduction of BWCs, what would it be?

Most officers felt that the introduction of BWCs would not require a significant adjustment to their daily law enforcement activities, other than getting used to the new equipment and docking the cameras for downloading at the end of their shifts. They seemed willing to make the adjustments with little problem or concern. Officers' thinking about BWCs fluctuated from curious to nonchalant, but some officers were suspicious of supervisors' intentions to scour through BWC videos for officer policy infractions. In the short time that had passed from the introduction of BWCs to the time of the focus groups, officers' thinking about BWCs changed little, and if at all their thinking about BWCs was more positive and accepting.

Officers had some criticisms about how the department prepared for the introduction of BWCs. The several criticisms we heard had to do with lack of information about the program provided to patrol officers, a rushed implementation, and complexity of the BWC policy. Most officers thought that the cameras would improve their relationship with the community, primarily because of the transparency effect and the likelihood that BWCs would help keep some interactions from escalating to troublesome or violent situations. Most advice that officers had about how to introduce BWCs into other departments concerned the technological aspects of BWCs—for example, better options for how to mount the cameras on the uniform (the wiring needed to operate the cameras was cumbersome and sometimes the wires malfunctioned or became easily detached from the camera).

The focus groups with sergeants did not reveal many differences from the officer focus groups. For the most part, the sergeants expressed the same thoughts and concerns as the officers did. Interestingly, the sergeants found the officers' concerns about supervisor review of BWC videos for policy violations a bit humorous—they explained that they were very busy on their shifts and simply would not have the time to review the large volume of videos that the BWCs were producing.<sup>63</sup>

### *Officer Interviews*

Throughout the research project, we interviewed a random sample of officers from the treatment group to assess several phenomena, such as their level of comfort with technology; their perceptions of civilians, their perceptions of self, and their perceptions of how other officers related to BWCs; and other positive or negative thoughts they had regarding BWCs. Table 6 below summarizes the information gleaned from the officer interviews. Regarding their level of comfort with BWC technology, they reported few problems, such as the need for time to develop the muscle memory required for consistent activation and de-activation of BWCs according to policy,<sup>64</sup> and several officers commented on the cumbersome nature of the equipment (primarily the wiring, see the section on focus groups). The interviews revealed little in the way of significant new perceptions of officers regarding BWCs. They reported few problems regarding civilian reactions to BWCs, little change in their own behavior while wearing BWCs, and few issues regarding how non-camera wearing officers reacted to BWCs. On balance, officers mentioned more positives than negatives regarding BWCs, noting their satisfaction with how BWCs protected them when civilians filed complaints and allowed them to introduce their own narratives as they approached a call for service or a potentially serious incident. Still, they had reservations about whether the BWC videos would be used against them by supervisors who could review the videos and catch officer policy infractions that would not be as easily noticed for officers not wearing cameras.

---

<sup>63</sup> LVMPD policy remains relatively restrictive when it comes to random review of officer videos by supervisors. Several accountability mechanisms, however, are in place. First, the BWC system allows supervisors to see the percent of calls for service that produce a BWC video for any given officer. If this “activation percentage” is low, supervisors are to remind officers about activation policy. Second, internal affairs personnel and supervisors are allowed to review videos if a citizen complaint is registered against a particular officer. Third, critical incidents (such as officer involved shootings) are automatically reviewed by supervisory personnel.

<sup>64</sup> LVMPD personnel overseeing BWC implementation told us that initially, activation compliance with policy was at about 50 percent, and it gradually increased to 75 percent or higher during the course of the study.

Table 6. Summary of Interviews with BWC Officers (N= 50)

Topic	General Themes:
Comfort with the Technology	<ul style="list-style-type: none"> <li>Officers often reported a learning curve in terms of activation / deactivation and “tagging” events.</li> <li>Several complaints about hardware (wiring, equipment, etc.).</li> </ul>
Officer Perceptions of Citizens	<ul style="list-style-type: none"> <li>Officers often reported little reaction from citizens.</li> <li>To some extent, citizens appear more compliant / polite.</li> <li>To a lesser extent, citizens “play up” to the BWC.</li> </ul>
Officer Perceptions of Self	<ul style="list-style-type: none"> <li>Officers generally reported little change in their own behavior.</li> <li>To some extent, officers reported more verbal caution with citizens and when communicating with other officers.</li> </ul>
Officer Perceptions of Other Officers	<ul style="list-style-type: none"> <li>Officers often reported some initial caution from non-BWC officers, but primarily when the technology was new.</li> <li>BWC officers will often give a courtesy “heads up” to other officers when the BWC is activated.</li> </ul>
Positives and Negatives	<ul style="list-style-type: none"> <li>Several reported that BWC video prevented misconduct complaints.</li> <li>Value of BWCs in terms of evidence gathering / “narrating” events.</li> <li>Some are still concerned that video could be used against them.</li> </ul>

## Ride-Alongs

In order to observe how the BWCs were operating in practice, we conducted several ride-alongs with BWC officers during the study period. Our purpose here was to understand how officers were using BWCs and whether the presence of BWCs noticeably impacted interactions with citizens or other officers. Table 7 below summarizes the ride-along observations. A total of 15 ride-alongs produced a total of 72 observed interactions between officers and citizens. Nearly 25 percent of these interactions were the result of officer initiated actions – either discretionary traffic stops or person stops. The remainder were the result of calls for service, many of which were related to domestic disputes or types of minor disturbances.

Although the BWCs were activated in nearly all the interactions with citizens, officers rarely announced the presence of the BWC to citizens. Few citizens appeared to react to the BWC, but this may be because they were unaware of the technology. (In one notable case involving a missing child where an officer did notify a citizen about the BWC, the officer honored the citizen’s request to not record the interview). In cases where other officers were present at the scene, they generally did not appear to react to the BWC, although some of the other officers were BWC wearers themselves—and in at least one case, the BWC officer notified other officers at the scene that the BWC was activated.

In terms of the behavior of BWC-wearing officers, their discretion remained high overall. In several cases, the BWC officer had legal evidence of a violation, but elected to warn the citizen rather than take formal action. It should also be noted that in some



cases, officers would narrate the events and their decisions for the BWC to aid in later report writing.

Table 7. Summary of Observations of BWC Interactions on Ride-Alongs (N= 72)

Topic	General Observations:
Types of Events	<ul style="list-style-type: none"> <li>• 24% self-initiated (traffic or person stops)</li> <li>• 76% calls for service (majority for domestic violence or disturbance calls)</li> </ul>
Activation / Deactivation	<ul style="list-style-type: none"> <li>• BWC activation occurred with nearly all interactions with citizens</li> <li>• Most officers did not announce the activation of the BWC to citizens</li> </ul>
Citizen Reaction / Other Officer Reaction	<ul style="list-style-type: none"> <li>• Most citizens did not appear to notice or react to the BWC</li> <li>• In one case, a citizen who was aware of the BWC requested that it not be turned on</li> <li>• Most other officers on scene did not appear to react to the BWC</li> </ul>
Officer Behavior	<ul style="list-style-type: none"> <li>• Some officers dictated events and their decisions for the BWC</li> <li>• Officer discretion remained high; many interactions resulted in warnings even when legal violation was recorded</li> </ul>

### *BWC video review*

We conducted a review of a random sample of just over 50 BWC activations (N=53) during the study. The primary purpose of this review was to monitor the quality of the audio and video features of the BWCs as they were implemented during the evaluation period, although some information on the events was also noted. The following summarizes the analysis from these 53 activations.

#### *Description of Events*

Just over half of the 53 activations (54 percent) were officer self-initiated activities, including vehicle stops (29 percent) and person stops (25 percent). The remaining activations (46 percent) were responses to calls for service. Most of the self-initiated vehicle stops were for minor traffic violations (broken taillights, expired license plates, etc.), while most of the self-initiated person stops were for minor disorders (public

intoxication, loitering, etc.). The calls for service were for a range of emergencies, including domestic violence; burglary; larceny; threats of suicide; welfare checks; and numerous other types of disorders, disturbances, and suspicious activities (noise complaints, prostitution, destruction of property, etc.).

In terms of subject demeanor during the encounters, in a small percentage of cases subjects offered some verbal (8 percent) or physical (4 percent) resistance, but for the most part, the subjects presented little or no verbal or physical protest. Most of the encounters in the sample (74 percent) involved no use of force by the BWC officer or other officers at the scene. Some (23 percent), however, involved a physical search of a subject, and in two cases the BWC officer physically restrained a subject. As for final outcomes, half of the encounters ended with no action taken by the BWC officer, whereas others ended with verbal warnings (14 percent), citations issued (15 percent), or arrests made (17 percent).

With only a few exceptions, officers did not noticeably announce the presence of the BWC at any point during the encounter, nor did subjects clearly appear to take notice of the BWC on the officer. However, the subjects' knowledge of the presence of the BWC was not always clear from the BWC video and audio. Of the four cases where the subject clearly had knowledge of the BWC, only once did the BWC appear to alter the subject's demeanor (the subject became more compliant).

#### *Audio and Video Quality*

Each of the 53 BWC activations was rated on a three-point scale (low, medium, high) in terms of audio clarity, video quality, and camera positioning. In almost all cases, the BWC audio clarity and video quality were high. In a small number of cases, outside interference (e.g., noise from the street) or the physical distance between the officer and the subject lessened the sound quality—and in two cases the video quality was less than ideal (generally due to poor lighting). For the most part, however, the BWC officer, the subject, and others at the scene could be clearly heard, and the visual recording was generally clear in the direction that the BWC was pointing.

As for BWC positioning, however, the direction in which the BWC was pointing was occasionally problematic. For most of the cases in the sample (85 percent), the BWC was pointed in the proper direction where the subject and event were clearly (or at least adequately) framed. For the remaining cases, however, the BWC was pointed in a direction where the subject could not be observed. In some cases, this was because the officer was addressing someone who was not directly in front of him. More frequently though, it appeared that the BWC lapel or collar mount had adjusted out of position, resulting in the BWC pointing at the ground or at the sky rather than at the subject. In these cases, the audio was clear, but the video did not capture the officer's interaction with the subject.

Overall, the audio and video quality of the BWCs were high during the study period, although perhaps some changes could be made to ensure appropriate camera

positioning that will properly capture the interactions between officers and subjects. These could include technological enhancements (BWCs with wider angle lenses, sturdier mounts for lapels and collars, etc.) or implementation suggestions for officers (such as asking officers to periodically check on the direction of the BWC).

## C. Methods: Impact evaluation<sup>65</sup>

### Analytical Approach

This RCT tested the impact of BWCs on citizen complaint reports, police use of force incidents, and police activity measures (e.g., arrests and citations) for treatment officers compared with control officers over pre-intervention and intervention periods. Treatment officers were requested to wear the BWCs for at least 12 months. As noted in the previous section, 416 volunteer patrol officers were identified and randomized to treatment and control groups beginning in February 2014 and continuing through September 2015. This extended period was needed to recruit eligible patrol officers through informational sessions held in each of the area commands, randomize volunteer officers from each area command into treatment and control groups, equip the treatment officers, and train them on BWC operations and policy.

In anticipation of higher levels of attrition in the treatment group, the randomization procedure was weighted so that 10 percent more officers would be allocated to wear BWCs. The randomization process resulted in the assignment of 218 officers to the treatment group and 198 officers in the control group.

LVMPD provided the evaluation team with detailed information on the patrol officers who did participate (N=416) in the randomized controlled trial as well as the remaining patrol officers (N=955) who did not participate. This information included age, race, sex, rank, time on the job, current assignment, complaints filed, use of force incidents, and their unique identification number. We collected data on all officers in the RCT over the course of the March 1, 2014–September 30, 2015, intervention period. The data on the officers not participating in the randomized controlled trial represented a “snapshot” of nonexperimental officers as of the start of the experiment on March 1, 2014.

---

<sup>65</sup> The following section predominantly summarizes the study’s impact evaluation as presented in the forthcoming 2018 *Journal of Criminal Law and Criminology* article, A. Braga, W. Sousa, J. Coldren, and D. Rodriguez. “The Effects of Body Worn Cameras on Police Activity and Police-Citizen Encounters: A Randomized Controlled Trial.”

Official data on complaint reports and police officer use of force reports were acquired from the LVMPD Professional Standards Division for the time period between March 1, 2011, and September 30, 2015. The evaluation team matched the unique officer identification numbers for RCT participants and nonparticipants to officer identification numbers in the complaint and use of force report data. Complaints are investigated by the Internal Affairs Bureau and originate externally from citizens who file reports and internally from LVMPD personnel. The complaint report data included the date and time of the alleged misconduct, the types of allegations made against the officers, the unique identification number of the officer(s) alleged to be involved in the misconduct, and disposition information.

According to LVMPD policy,<sup>66</sup> officers are not required to submit reports on low-level use of force incidents (such as empty hand tactics not involving strikes, use of baton as an escort tool, handcuffing, use of other restraints, and minimum lateral vascular neck restraint) unless the subject is injured or complains of injury. Police officers are required to submit reports on intermediate use of force incidents (such as use of electronic discharge devices, empty hand strikes, low-lethality shotguns, baton use with impact, and pepper spray) and deadly force incidents. Police officer use of force data included the date and time of the incident, the unique identification number of the officer(s) involved in the incident, and the types of force used in the incident. These data do not distinguish between excessive and non-excessive force applied by LVMPD officers, nor do they distinguish between appropriate and inappropriate uses of force.

### *Assessing experimental group balance and generalizability*

Randomization provides a simple and convincing method for achieving comparability in treatment and control groups.<sup>67</sup> If randomization is done correctly, the only systematic difference between treatment and control groups should be the presence or absence of the treatment. To test the balance between the treatment and control groups on key officer variables, we used independent samples *t* tests and standardized mean differences, known as Cohen's *d*.<sup>68</sup> Table 8 presents basic descriptive information on officers participating in the experiment and the results of these tests; for binary variables, means are expressed as percentages. A positive *t* test indicates that the treatment group has a higher mean than the control group. Covariate imbalance would be exhibited by Cohen's *d* in excess of .20 and a *t* in excess of 1.96. The equality of

---

<sup>66</sup> LVMPD Directive GO-021-12, "Use of Force" effective June 22, 2012.

<sup>67</sup> William Shadish, Thomas Cook, and Donald Campbell, *Experimental and Quasi-Experimental Designs for Generalized Causal Inference* (Boston: Houghton Mifflin, 2002).

<sup>68</sup> Jacob Cohen, *Statistical Power Analysis for the Behavioral Sciences*, 2nd ed., (Hillsdale, NJ: Lawrence Earlbaum Associates, 1988).

variances was tested and confirmed for all variables. This reveals that the randomization created balanced treatment and control groups.

Table 8. Summary Characteristics

Officer Characteristics	Treatment v. Control Groups, N=416			Participants v. Non-Participants, N = 1,371		
	Mean (SD)	Balance Diagnostics		Mean (SD)	Balance Diagnostics	
Experimental Group	52.4%	--	--	30.3%	--	--
Male	91.6%	.12	.006	90.6%	.83	.023
White	72.4%	.72	.035	71.4%	.51	.014
Hispanic	13.2%	-.53	.026	14.1%	-.90	.024
Black	8.9%	-.82	.041	7.4%	1.40	.038
Asian/Other	5.5%	.41	.019	7.1%	-1.47	.039
Mean Age	36.77 (7.89)	-1.40	.068	36.40 (7.68)	1.17	.031
Mean Years on the Job	9.15 (5.21)	-1.56	.076	8.91 (5.65)	1.07	.028
Patrol Officer II	76.4%	1.01	.049	79.7%	-1.99*	.054
Patrol Officer I	8.7%	-.30	.015	11.0%	-1.84	.049
Sergeant	14.9%	-.96	.047	9.3%	4.79**	.128
Yearly Complaints 2012-2014	.856 (1.131)	1.51	.074	.891 (1.51)	-1.21	.032
Bolden	13.5%	1.05	.051	13.1%	.24	.006
Convention Center	7.5%	.65	.032	11.7%	-3.45 <sup>b</sup>	.093
Downtown	8.4%	-1.54	.075	11.3%	-1.30	.035
Enterprise	19.5%	-.85	.042	14.6%	3.39 <sup>b</sup>	.091
Northeast	20.0%	-.61	.030	13.9%	4.16 <sup>b</sup>	.111
Northwest	17.5%	.71	.034	11.1%	4.88 <sup>b</sup>	.131
South Central	7.7%	.08	.004	11.1%	-2.84 <sup>b</sup>	.076
Southeast	6.0%	.78	.038	13.2%	-5.42 <sup>a</sup>	.145

\*p < .05

\*\*p < .01

We also tested for any systematic differences between patrol officers who participated in the experiment (N=416) and patrol officers who did not participate in the experiment (N=955) using the same approach (Table 8). There were no statistically significant differences in sex, race, age, years on the job, and mean yearly complaints noted between the patrol officers who volunteered to participate in the randomized controlled trial and those who did not. These data suggest that officers with higher

numbers of complaints did not seem to avoid participating in the BWC pilot program. Indeed, on most observable characteristics, the volunteer officers seemed no different from the officers who chose not to volunteer for the program.

Volunteer officers were somewhat more likely than their non-volunteer counterparts to be sergeants and to be assigned to the Enterprise, Northeast, and Northwest area commands and somewhat less likely to be patrol officers and to be assigned to the Convention Center, Southeast, and South Central area commands.<sup>69</sup> These observed differences were driven largely by implementation decisions. During the pre-implementation recruitment period, LVMPD commanders highly encouraged sergeants to “lead by example” by volunteering for the BWC program. These data suggest that many sergeants responded to this call. LVMPD located the BWC docking stations in four area commands: Bolden, Enterprise, Northeast, and Northwest. Participating officers were required to place their cameras in the docking stations at the end of their shift so that acquired videos could be uploaded to cloud memory storage. Patrol officers not assigned to an area command with a docking station could still participate through an alternative mechanism that LVMPD established for uploading videos. However, the lack of docking station infrastructure at those area commands limited the number of officers who volunteered from them.

The equivalence observed between the treatment and control groups supports the internal validity of the design and suggests that the randomized controlled trial was well positioned to isolate the impact of BWCs on the study outcome measures.<sup>70</sup> External validity, however, gauges the extent to which study findings can be

---

<sup>69</sup> Although the *t* tests revealed that the observed differences were statistically significant at the  $\alpha=.05$  level, the Cohen’s *d* standardized mean difference metric suggested that these differences were small ( $ES<.20$ , see Cohen).

<sup>70</sup> During the implementation of the RCT, there were some very concerning police-involved shootings, killings of police officers and other events that could have plausibly influenced officer behavior in Las Vegas and throughout the United States. This threat to internal validity is known as “history” and is defined by Shadish, Cook, and Campbell as “events occurring concurrently with treatment that could cause the observed effect” (55). They further suggest that historical threats to experimental outcomes can be reduced by “selecting groups from the same general location and by ensuring that the schedule for testing is the same in both groups (56).” In this RCT, treatment officers were randomly selected from the same area commands and the observation time period was the same for both treatment and control officers. Any influence of historical events on experimental outcomes would be the same for treatment and control officers. As such, the threat of history to the internal validity of this study is not a large concern.

generalized to the population of interest.<sup>71</sup> A study can have very high internal validity but be relevant only to a very limited number of contexts or problems. Inferences about cause-effect relationships based on a specific scientific study are said to possess external validity if they may be generalized from the unique and idiosyncratic experimental settings, procedures, and participants to other populations and conditions. The available data presented here suggests that the findings of this study can be generalized to other LVMPD officers with the caveat that there are some small differences in rank and command area.

### *Attrition and statistical power*

Attrition represents a threat to the internal validity of randomized experiments, as it introduces bias into the analysis of experimental data.<sup>72</sup> Attrition from this randomized controlled trial was low; only 10.1 percent (42 of 416) of the officers left their assignments during their 12-month intervention periods. However, differential attrition was noted for the treatment officers (N=26, 11.9 percent of 218) when compared with the control officers (N=16, 8.1 percent of 198). In the treatment group, 14 officers changed assignments from the Patrol Division and did not continue wearing BWCs, seven officers withdrew from the program but stayed in their current assignment, two officers retired, two officers resigned from LVMPD, and one person took a medical leave for a surgical procedure. In the control group, 13 officers changed assignments from the Patrol Division, two officers resigned from LVMPD, and one officer retired.

To address the observed attrition issue, we used intention-to-treat (ITT) analyses based on the initial random assignment to treatment rather than analyses of the treatment as actually received. ITT analyses provide fair comparisons between treatment and control groups because they avoid the bias associated with the nonrandom loss of study participants.<sup>73</sup> Therefore, all 218 treatment officers and 198 control officers

---

<sup>71</sup> William Shadish, Thomas Cook, and Donald Campbell, *Experimental and Quasi-Experimental Designs for Generalized Causal Inference* (Boston: Houghton Mifflin, 2002).

<sup>72</sup> Donald Campbell and Julian Stanley, *Experimental and Quasi-Experimental Designs for Research* (Chicago: Rand McNally, 1966).

<sup>73</sup> Sally Hollis and Fiona Campbell, "What Is Meant by Intention to Treat Analysis? Survey of Published Randomised Controlled Trials," *British Medical Journal* 319 (1999): 670-674.

were included in our analyses.<sup>74</sup> For a two-tailed test with  $\alpha = .05$ , this randomized controlled trial had an estimated statistical power of .531 to detect a small standardized effect size of .20 and statistical power of .999 to detect a medium standardized effect size of .50.<sup>75</sup>

### *Contamination of Control Conditions*

Another possible threat to the internal validity of any randomized experiment is the diffusion of the treatment into the control group.<sup>76</sup> Put simply, contaminated control conditions undermine the counterfactual contrast between subjects that receive the treatment and subjects that do not receive the treatment. In the context of the LVMPD experiment, this could include effects of treatment officers responding to the same dispatched calls for service as control officers. The well-known Rialto, California, BWC randomized experiment experienced possible diffusion of treatment effects, but this was a result of the randomization of BWCs by shift rather than by individual officer.<sup>77</sup> In the Rialto experiment, the same officers participated in treatment (BWC on during shift) and control conditions (no BWC during shift). Therefore, it was possible that participating officers “carried over” the treatment effect into control shifts. Although the evaluation did still find significant reductions in citizen complaints and use of force incidents during treatment shifts relative to control shifts, Ariel et al. also observed reductions in these outcome measures during the control shifts, which suggest possible contamination.<sup>78</sup>

The LVMPD randomized controlled trial attempted to minimize these kinds of contamination effects by using different officers in control and treatment groups.

---

<sup>74</sup> As suggested above, it is important to note here that N=5 treatment officers and N=3 control officers were not observed for the entire twelve month intervention time period due to resignations, retirement, and medical leave. However, all 8 censored officer were observed for at least 6 months of the intervention time period. The results reported here included these officers. However, the results do not substantively change if the 8 officers are excluded from the analysis.

<sup>75</sup> Lipsey, Mark. *Design Sensitivity: Statistical Power for Experimental Research* Thousand Oaks, CA: Sage Publications. 1990.

<sup>76</sup> Donald Campbell and Julian Stanley, *Experimental and Quasi-Experimental Designs for Research* (Chicago: Rand McNally, 1966); and William Shadish, Thomas Cook, and Donald Campbell, *Experimental and Quasi-Experimental Designs for Generalized Causal Inference* (Boston: Houghton Mifflin, 2002).

<sup>77</sup> Barak Ariel, Tony Farrar, and Alex Sutherland, “The Effect of Police Body-Worn Cameras on Use of Force and Citizens’ Complaints Against the Police: A Randomized Controlled Trial,” *Journal of Quantitative Criminology* 31 (2015): 1-27.

<sup>78</sup> Ibid.

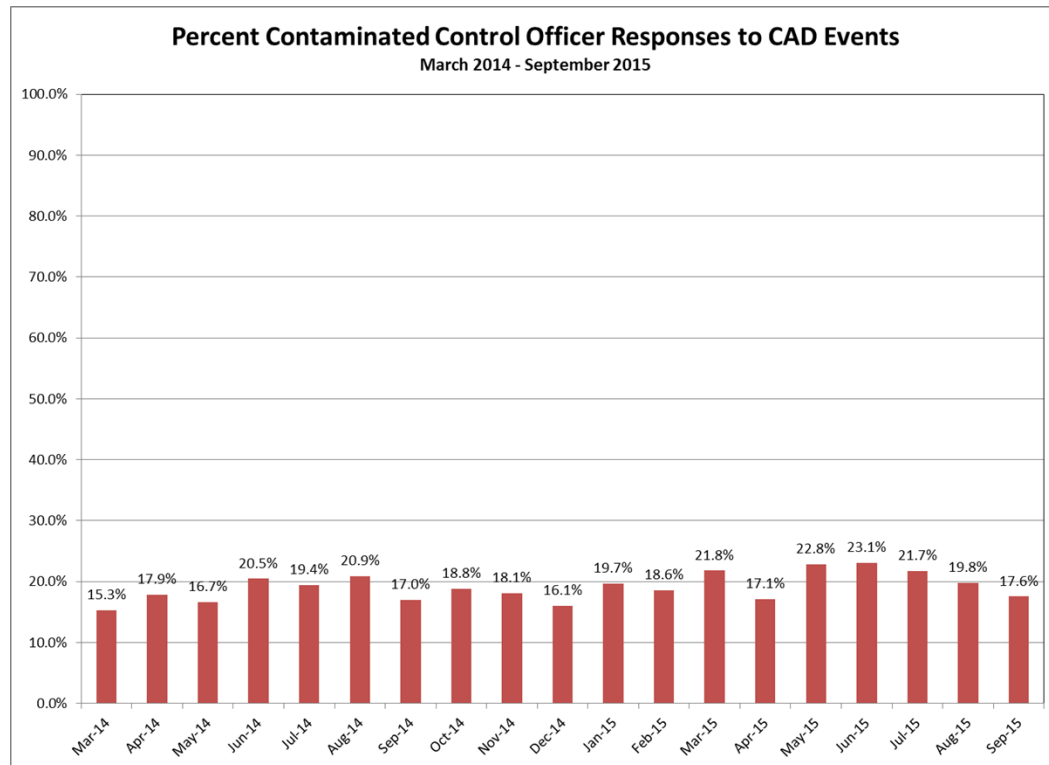


Because LVMPD normally operates with one-officer patrol units, interaction between officers—and thus the potential for contamination—is infrequent during a typical shift but does occur when one officer backs up another on particular calls. It is also possible for contamination to occur when officers have informal interactions over the course of a typical shift. Ideally, our randomized controlled trial would have also separated treatment and control officers into different policing areas to minimize interactions further. Unfortunately, this was not possible because of our reliance on volunteer officers to form treatment and control groups.

We were, however, able to use data from LVMPD's computer-aided dispatch (CAD) system to monitor and assess the extent of possible contamination in the execution of official police duties during the experiment. LVMPD also provided the evaluation team with CAD data recording citizen calls for service and officer-initiated calls made between March 1, 2014, and September 30, 2015. In this study, the CAD data analyzed represented unique call events where duplicate citizen calls for service for the same event were removed. The CAD data included the event date and time, call event type, and the officer(s) responding to the call event; these data also included basic disposition information that indicated whether the call event generated a crime incident report, whether responding officer(s) issued citation(s), and whether responding officer(s) made arrest(s). The evaluation team matched the unique officer identification numbers for officers in the randomized controlled trial to officer identification numbers in the CAD data.

These data allowed us to determine which officers responded to each call during the intervention period. Therefore, we were able to estimate the percentage of calls for service that involved one or more treatment and control group officers. Figure 1 reveals that very modest contamination between treatment and control officers occurred each month (from March 2014 to September 2015); contamination ranged from a low of 15.3 percent in March 2014 to a high of 20.9 percent in August 2014, with an average of 19.1 percent per month.

Figure 1. Percentage of Contaminated Control Officer Responses to CAD Events



### *Analysis of Outcome Measures*

Civilian complaints against officers and use of force reports were rare events for LVMPD officers. Indeed, during the one-year period preceding inclusion in the randomized controlled trial, 45.4 percent of treatment officers (99 of 218) and 52.0 percent of control officers (103 of 198) did not experience a single citizen complaint, and 68.8 percent of treatment officers (150 of 218) and 73.7 percent of control officers (146 of 198) did not generate a single use of force report. When these events occurred, a large majority of treatment officers and control officers generated only a single incident during the 12 months immediately preceding the experiment.<sup>79</sup> Given these

<sup>79</sup> For instance, for the 68 treatment officers who experienced at least one use of force report during the pre-test time period: 48 had 1 incident (70.6 percent), 14 had 2 incidents (20.6 percent), 4 had 3 incidents (5.9 percent), 1 had 4 incidents (1.5 percent) and 1 had 5 incidents (1.5 percent). For the 52 control officers who experienced at least one use of force report during

rare event distributions, we collapsed the observed counts into binary outcomes (0 = no event, 1 = one or more events) for both citizen complaint events and use of force events outcomes during 12-month pre-intervention and 12-month intervention time periods. Differences-in-differences of proportions Z tests<sup>80</sup> were used to determine whether treatment officers were less likely to experience complaints and generate use of force reports relative to control officers between the pre-intervention and intervention periods.

The CAD data were used to develop key officer activity measures for the treatment and control officers in the RCT during 12-month pre-intervention and 12-month intervention periods. Key officer activity measures included mean monthly responses to dispatched call events, mean monthly self-initiated call events, mean monthly call events that generated crime incident reports, mean monthly call events that resulted in citations, and mean monthly call events that resulted in arrests per month during the intervention and pre-intervention study periods. The impact of BWCs on treatment officer activity (N=218) relative to control officer activity (N=198) was estimated through the difference-in-differences (DID) estimator. The DID estimates the difference in a treatment officer's post-intervention outcomes at time  $t$  compared with their pre-intervention outcomes, relative to the same difference for the control officers in the experiment.<sup>81</sup> Using dispatched call events as an example, our panel regression model was as follows:

$$(1) \quad Y_{it} = \beta_0 + \beta_1 \text{Group}_i + \beta_2 \text{Period}_t + \beta_3 \text{Group}_i \times \text{Period}_t + u_i$$

In this model, the monthly mean number of dispatched call events per officer was our exemplar outcome measure ( $Y_{it}$ ). The regressor  $\text{Group}_i$  is a dummy variable identifying whether an individual officer ( $i$ ) was in the treatment group (1) or not (0). The omitted group comprises control officers in the experiment. The regressor  $\text{Period}_t$  is a dummy variable for whether monthly mean number of dispatched call events per officer was during the intervention period (1) or during the pre-intervention period (0). The coefficient  $\beta_3$  conforming to the product of the group dummy with the period dummy, is the DID estimate of the effect of BWCs on the monthly count of officer-initiated call events. The XTREG command in Stata 14.1 was used to provide maximum likelihood estimates of differences in differences described above. To ensure that the coefficient

---

the pre-test time period: 37 had 1 incident (71.2 percent), 10 had 2 incidents (19.2 percent), 2 had 3 incidents (3.8 percent), 2 had 4 incidents (3.8 percent) and 1 had 7 incidents (1.9 percent).

<sup>80</sup> Hubert Blalock, *Social Statistics*, 2nd ed. (New York: McGraw-Hill, 1979).

<sup>81</sup> See, e.g., David Card and Alan Krueger, "Minimum Wages and Employment: A Case Study of the Fast-Food industry in New Jersey and Pennsylvania," *American Economic Review* 84 (1994): 772–793.

variances were robust to violations of the homoskedastic error assumption of linear regression models, robust standard errors clustered by officer were used.

## D. Methods: Cost-Benefit Analysis

### Analytical Approach

To better understand the costs and benefits of implementing the BWCs, we measured the annual costs and benefits per user (officer wearing a BWC for a year). The benefits derive from the estimated decrease of 25 complaints per 100 users, as well as the reduced cost to investigate each complaint (because of the available BWC video evidence), and the reduced amount of time it takes to resolve a complaint when video evidence is available. The average processing and investigation cost for a typical complaint (with and without BWCs) was provided by LVMPD.

LVMPD covered the BWC installation, training, operation, and maintenance costs incurred during the study period. These costs included both one-time (e.g., facilities and infrastructure upgrades) and recurring costs (e.g., licenses and storage). Our analysis assumed an average call activity level similar to that observed during the period of analysis (approximately 30 call events per officer per month between March 1, 2011, and September 30, 2015). Assuming a higher call activity (together with a constant rate of complaints per call) would result in greater benefits because of a larger number of complaints avoided.

We also assumed that the benefits from BWCs may also include less officer time spent in court or on disciplinary leave (e.g., suspension without pay). However, we did not find statistically significant differences between the treatment and control groups in these outcomes and have excluded these potential sources of savings from the analysis.

Further, because of data limitations, we did not consider potential benefits associated with fewer (or lower) court settlements arising from citizen complaints. Given the length of time required for court proceedings regarding complaints of police misconduct (several years in most cases), the inclusion of these data were not feasible within the timeframe of the study. Also, we did not estimate the potential costs and benefits associated with the increased citations and arrests observed for the treatment group.

To estimate the cost of labor per work hour, we used the OMB productive work year of 1,776 hours to account for holiday and leave costs. This adjustment scales the hourly wage up by a factor of 1.17 (2080/1776). To account for LVMPD non-pay contributions for taxes and benefits, we apply an average fringe multiplier of 1.5,

resulting in an hourly wage multiplier of 1.755. We verified these average multipliers against actual pay and leave patterns using historical data provided by LVMPD.

This page intentionally left blank.

## III. Results

### A. Results: Impact Evaluation

#### Citizen Complaints and Use of Force Outcomes

Between the pre-intervention and intervention periods, the percentage of treatment officers that generated at least one complaint decreased by 16.5 percent from 54.6 percent to 38.1 percent (Table 9). By comparison, the percentage of control officers that generated at least one complaint decreased by only 2.5 percent from 48.0 percent to 45.5 percent. The absolute differences in the share of officers with at least one complaint between the treatment and control groups over the pre-intervention and intervention periods represented a 14.0 percent reduction in favor of the treatment group ( $Z = 2.035$ ,  $p < .05$ ). The proportional difference between the two groups over time represented a larger 25.0 percent reduction in the percentage of treatment officers relative to control officers who generated at least one complaint.

Similar significant reductions were noted in the likelihood that a treatment officer generated at least one use of force report during the intervention period. Between the pre-intervention and intervention periods, the percentage of treatment officers that generated at least one use of force report decreased by 11.5 percent from 31.2 percent to 19.7 percent (Table 9). By comparison, the percentage of control officers that generated at least one use of force report increased by 1.0 percent from 26.3 percent to 27.3 percent. The absolute differences in the share of officers with at least one use of force report between the treatment and control groups over the pre-intervention and intervention periods represented a 12.5 percent reduction in favor of the treatment group ( $Z = 2.057$ ,  $p < .05$ ). The proportional difference between the two groups over time represented a larger 40.7 percent reduction in the percentage of treatment officers relative to control officers who generated at least one use of force report.

Table 9. Percentage of Officers with at Least One Complaint and at Least One Use of Force Incident

	Citizen Complaint Reports		Officer Use of Force Incidents	
	Treatment, N=218	Control, N=198	Treatment, N=218	Control, N=198
Pre-intervention	54.6%	48.0%	31.2%	26.3%

Intervention	38.1%	45.5%	19.7%	27.3%
% absolute change	-16.5%	-2.5%	-11.5%	+1.0%
% proportional change	-30.2%	-5.2%	-36.9%	+3.8%
Differences-in-differences				
% absolute difference	-14.0%		-12.5%	
% proportional difference	-25.0%		-40.7%	
Z-test results	2.035*		2.057*	

\* p<.05

These analyses also suggest that the modest contamination of control conditions noted by our analyses of call event responses did not result in diffusion of treatment effects or stable unit value treatment assumption violations in complaint and use of force incidents for control officers during the intervention period. Indeed, between the pre-intervention and intervention periods, the percentage of control officers with at least one complaint decreased by only 2.5 percent and the percentage of control officers with at least one use of force incident increased by 1.0 percent. The presence of treatment officers with BWCs at roughly 1 in 5 call events attended by control officers during the intervention period had no significant influences on how the control officers handled interactions with citizens.

## Officer Activity Outcomes

Table 10 presents the DID estimator results of the regression models comparing pre-intervention and post-intervention monthly work activity levels for treatment officers with monthly work activity levels for control officers. It also presents the pre-intervention and intervention means and their percent differences for the various activity outcomes for the treatment and control officers. Holding group and period constant, the BWC intervention was not associated with any statistically significant changes in the monthly count of responses to dispatched call events, officer-initiated call events, and call events involving crime reports. However, controlling for group and period, the BWC intervention was associated with a statistically significant 6.8 percent increase ( $p<.01$ ) in the monthly count of call events with citations issued and a statistically significant 5.2 percent increase ( $p<.01$ ) in the monthly count of call events with arrests by the treatment officers relative to the control officers.

Table 10. Body-Worn Camera Impacts on Monthly Activity of LVMPD Officers Participating in the RCT (N=416 officers)

	Dispatched Calls	Officer-Initiated	Crime Incidents	Citations	Arrests
Impact (DID interaction)	.021 (.025)	.006 (.008)	.002 (.009)	.685 (.036)**	.352 (.019)**



Treatment officers					
Pre-test mean	29.85	9.44	11.00	10.27	6.87
Post-test mean	30.24	9.56	11.13	11.08	7.30
Percent mean difference	+1.3%	+1.3%	+1.2%	+7.9%	+6.3%
Control officers					
Pre-test mean	30.61	9.68	11.28	10.53	7.04
Post-test mean	30.98	9.80	11.41	10.65	7.12
Percent mean difference	+1.2%	+1.2%	+1.2%	+1.1%	+1.1%
Percent mean difference-in-differences	+0.1%	+0.1%	0.0%	+6.8%	+5.2%

Note: Clustered robust standard errors are in parentheses. There were N=218 treatment officers and N=198 comparison officers included in this analysis.

\* =  $p < .05$

\*\* =  $p < .01$

## B. Results: Cost-Benefit Analysis

Table 11 presents the estimated cost of labor required to investigate an average complaint, with and without BWC evidence. As indicated in the table, BWCs save over \$6,200 in officer time spent investigating an average complaint.

Table 11. Labor Cost per Complaint Investigation, with and without BWCs (\$ dollars)

Labor category	Hourly wage	Hourly wage, with multiplier	Without BWC		With BWC	
			Time spent on complaint, hours	Cost	Time spent on complaint, hours	Cost
Detective	\$40.75	\$71.52	80	\$5,721	6	\$429
Sergeant	\$50.94	\$89.40	7	\$626	1	\$89
Lieutenant	\$61.13	\$107.28	4	\$429	0.33	\$35
Total				\$6,776		\$554
Total Savings: \$6,222						

Table 12 presents the estimated annual monetary benefits per BWC user, based on Table 11 and the results of the impact evaluation. As a baseline, we use the average complaints per user among the BWC users in the 12 months following implementation (0.59). Based on the difference-in-difference estimate, this group would have had an average of 0.25 (25 complaints per 100 users) more complaints (0.84) without the BWCs. Recent data provided by LVMPD indicate that BWC implementation allows approximately 66 percent of complaints to be cleared based on BWC video evidence

alone. Video evidence alone is not sufficient to clear the remaining 34 percent of complaints, and a traditional investigation is still required in addition to the video review. As indicated in the table, we estimate that LVMPD realizes benefits of \$4,006 per BWC user per year. These benefits are driven primarily by the reduced cost of investigating complaints.

Table 12. Complaint Investigation Costs Avoided because of BWCs

	With BWC (assume average activity level)	Without BWC	Cost avoidance per user per year
Annual complaint investigations per user	0.59	0.84	
Cost per investigation, average	\$554	\$6,776	
Percentage of investigations cleared based on BWC video evidence alone	66%	0%	
Total investigation cost per user	\$1,686	\$5,692	\$4,006

Table 13 lists the costs incurred by LVMPD during FY14 to implement the BWC program. Many of the costs were up-front investments in assets that have useful lives exceeding one year and/or that can support BWC users beyond the initial 200. In consultation with LVMPD personnel, we estimated the useful life of these assets and apportioned the cost equally over the useful life. To calculate a standard cost per user per year we also indicate the number of BWC users to which each cost applies. We estimate the total cost incurred for the BWC implementation was \$1,097 per BWC user per year.

The most recent BWC vendor invoice for FY 2017 provided by LVMPD indicates a per user annual cost for cameras and storage of \$550 per user. Adjusting for inflation, this is \$269 lower than the FY14 cost of \$802 shown in the table, and suggests a current overall per user per year cost of \$828.

Table 13. Itemized Costs of the LVMPD BWC Implementation

(in \$2014)	FY 14 cost	Useful life /appropriate amortization period (years)	BWC users supported	Cost per user per year
	(1)	(2)	(3)	= (1)/((2)x(3))
Camera and storage, total				\$802
Cameras	\$99,990	5	200	\$100

Electronic transfer module	\$29,997	5	200	\$30
Basic license	\$11,940	1	200	\$60
Ultimate license	\$94,080	1	200	\$470
Warm storage	\$23,718	1	200	\$119
Cold storage	\$4,743	1	200	\$24
IT infrastructure, total				\$109
Professional services	\$4,950	1	1400	\$4
Equipment maintenance	\$30,547	1	1400	\$22
Small equipment	\$65,046	5	1400	\$9
Software & licenses	\$50,709	1	1400	\$36
Capital (infrastructure upgrades)	\$348,455	10	1400	\$25
ETF racks for 2 area commands	\$6,500	10	400	\$2
Cabling/Power for 2 area commands	\$17,469	10	400	\$4
Circuit upgrades	\$55,866	10	1400	\$4
Infrastructure buildout labor for 2 area commands	\$11,849	10	400	\$3
Training, total				\$100
Student time	\$434	5	1	\$87
Instructor time	\$12,516	5	200	\$13
Monitoring and auditing BWC use	\$9,298	1	200	\$46
Responding to freedom-of-information requests for videos: labor	\$7,333	1	200	\$37
Responding to freedom-of-information requests for videos: software license	\$5,950	1	1800	\$3
<b>Total</b>	<b>\$891,390</b>			<b>\$1,097</b>

In examining training costs, we note that initial and refresher training cost per user includes student and instructor time as follows:

- Student time (5.5 hours per user x \$45/hour x 1.755 fringe factor) = \$434 per user
- Instructor time (0.7 instructor hours per user x \$50.94 x 1.755 fringe factor) = \$63 per user

We also note that training is required every five years, as technology is refreshed and users turn over. We noted that the monitoring and auditing of BWC use is largely automated by software that checks BWC transaction logs against call activity. Further, we also included two hours per week of a sergeant's time for oversight and follow-up of monitoring and auditing issues.

BWC implementation at LVMPD also entails costs for responding to members of the public who request videos in accordance with Nevada's public records (freedom of information) laws. Individuals requesting a video have the option to pre-screen the

video (at no cost) at an LVMPD location during a supervised session. If they subsequently decide to obtain a copy of the requested video, they must first pay estimated LVMPD labor costs (at \$50 per hour) for video processing.

During the study period, the public had limited access to videos. Following the study period, public access to videos has expanded with the wider rollout of BWCs. In the most recent 8 months between January and August 2017 (during which time there were 1,800 BWCs deployed), there have been approximately 200 total requests (or an annual rate of 300 requests).

LVMPD incurs non-reimbursed costs for locating requested videos, responding to requests, arranging for and attending screenings, and administering orders and payments for those who proceed with requests after screenings. LVMPD reported that 1.5 full time employees (FTEs) are required to handle the current workload of approximately 300 requests per year. LVMPD estimates that 0.5 of these FTEs are required for work provided at no cost to requestors, and 1 FTE is required for video processing work that is paid for by requestors. LVMPD provided the annual wage and fringe benefits (\$103,200 per FTE) for a Forensic Multimedia Analyst who typically conducts this work. Multiplying by 1.5 FTEs and deducting the reimbursed cost of \$88,800 (1 FTE's productive work year, or 1,776 hours at \$50 per hour) results in an annual net cost of \$66,000 to handle 300 complaints supporting 1,800 users. We have included this estimated cost in Table 13, pro-rated for 200 users. We have also reported the annual licensing cost (\$5,950) for video processing software. The estimated labor and software cost per user per year for responding to freedom of information requests is \$40.

## IV. Conclusions

### A. Discussion of the findings

The results of our randomized controlled trial suggest that the placement of BWCs on LVMPD officers reduced complaints<sup>82</sup> and use of force reports for treatment officers relative to non-BWC comparison officers. These results support the position that BWC may de-escalate aggression or have a “civilizing” effect on the nature of police-citizen encounters. Research suggests that police disproportionately use force when attempting to control or apprehend suspects in disadvantaged, minority neighborhoods.<sup>83</sup> Minority citizens are also more likely to feel that they experience disrespectful treatment at the hands of officers.<sup>84</sup> The complaint and use of force reductions associated with placing BWCs on police officers may be particularly important for improving police-community relations in impoverished, minority neighborhoods. We found that BWC officers generated moderately more arrests and issued more citations than their control counterparts.

In examining the costs and benefits of BWCs we estimated that BWCs cost between \$828 and \$1,097 per user per year, and generate net annual savings of between \$2,909 and \$3,178 per user. BWCs generate savings mainly through significantly faster investigation of complaints. We have assumed that there would be 0.84 complaints per officer each year in the absence of BWCs (the average during the pre-implementation period of the BWC study). The “break-even” level of complaints occurs between 0.23 and 0.27 complaints per officer per year.<sup>85</sup> At the break-even level, the costs avoided by BWCs would just offset the costs to implement BWCs.

---

<sup>82</sup> We also observed a two-week reduction in the time required to resolve complaints for officers wearing BWCs.

<sup>83</sup> Robert Kane, “The Social Ecology of Police Misconduct,” *Criminology* 40 (2002): 867–896.

<sup>84</sup> Rod Brunson, “‘Police Don’t Like Black People’: African American Young Men’s Accumulated Police Experiences,” *Criminology & Public Policy* 6 (2007): 71–102; and Victor Rios, *Punished: Policing the Lives of Black and Latino Boys* (New York: New York University Press, 2011).

<sup>85</sup> The range for the break-even level reflects uncertainty about the reduction in complaints due to BWCs. If we assume that complaints would go down by the same percentage observed in the

Most notably, further applying the cost-benefit estimates to all 1,400 patrol officers (again assuming there would be 0.84 complaints per officer each year in the absence of BWCs) suggests BWC net annual savings of \$4.1m to \$4.4m department-wide.

## B. Implications for policy and practice

President Obama's Task Force on 21st Century Policing recommended that police departments should to include "an evaluation or assessment process to gauge the effectiveness of any new technology, soliciting input from all levels of the agency, from line officer to leadership, as well as assessment from members of the community."<sup>86</sup> Unfortunately, BWCs have been adopted by many urban police departments without such assessments and with little scientific evidence available to guide implementation.<sup>87</sup> To some observers, such as the ACLU, BWCs are "a win for all" when implemented with the right policies in place.<sup>88</sup> However, without fuller understanding of the intended and unintended consequences of this new technology, it is difficult to know what the "right" policies are.

The findings of this study suggest that BWCs have strong potential to benefit police agencies and communities alike. Not only do they reduce complaints against officers and use of force incidents in large measure (and the corresponding costs of resolving those complaints and use of force incidents), they seem to increase police productivity, evidenced by the modest but significant increases in police stops and arrests. Further research is needed on this count to determine whether bias exists in the increased stops and arrests, and whether this increase in productivity has negative effects on community perceptions of police. Our study also suggests that the benefits of cameras

---

RCT, then the break-even level is 0.23. The break-even level of 0.27 reflects an assumption that the number of complaints would not change with the introduction of BWCs.

<sup>86</sup> President's Task Force on 21st Century Policing, *Final Report of the President's Task Force on 21st Century Policing*, Washington, DC: Office of Community Oriented Policing Services, 2015, 35.

<sup>87</sup> Cynthia Lum, Christopher Koper, Linda Merola, Amber Scherer, and Amanda Reiou, *Existing and Ongoing Body Worn Camera Research: Knowledge Gaps and Opportunities*, New York: The Laura and John Arnold Foundation, 2015.

<sup>88</sup> Jay Stanley, *Police Body-Mounted Cameras: With Right Policies in Place, A Win for All*, Version 2.0, Washington, DC: American Civil Liberties Union, 2015, 1.

(at least in terms of cost savings due to the reduction in complaints) far outweigh the costs of the BWC program. This too requires additional research – the benefits might not be so great in a community characterized by positive police-community relations prior to the introduction of BWCs.<sup>89</sup> As the policing profession moves towards further implementation of BWCs, jurisdictions implementing BWCs will hopefully be open to rigorous research regarding outcomes and cost-benefit analyses, as well as the unintended benefits or consequences of their implementation.

## C. Implications for further research

Further research is needed to determine whether the increases in enforcement activity were driven by enhanced officer confidence that the video evidence collected would be used to hold offenders accountable for their transgressions, officers' concerns that supervisors who view videos of the interactions would hold them accountable for their discretionary actions, or both. Further research would help determine whether increased arrest and citation activity affected communities of color or other concerned communities disproportionately. It is also unknown how the observed increased enforcement activity of BWC officers might influence police legitimacy. It is possible that increased enforcement activity associated with BWCs might enhance legitimacy by improving police effectiveness in controlling crime and/or their capacity to hold offenders accountable.

Alternatively, increased enforcement activity could undermine police legitimacy if citizens view heightened arrests and citations as harmful to their communities. Citizens' appraisals of the police are largely influenced by the style of policing in their communities. Policing strategies that emphasize increased investigative stops, criminal summonses, and misdemeanor arrests across jurisdictions have been shown to generate concern about racial disparities<sup>90</sup> and are suggested to contribute to the

---

<sup>89</sup> We note, however, the LVMPD had substantially reduced its complaints and use of force incidents after 2011, as a result of its involvement with the COPS Office Collaborative Reform Initiation (cite the reports here), and still posted significant reductions in both outcomes as a result of BWCs.

<sup>90</sup> For a summary, see: Jeffrey Fagan, Amanda Geller, Garth Davies, and Valerie West, "Street Stops and Broken Windows Revisited: The Demography and Logic of Proactive Policing in a Safe and Changing City," in *Race, Ethnicity, and Policing*, ed. S. Rice and M. White (New York: New York University Press, 2010).

increased incarceration of young minority males.<sup>91</sup> The findings of this randomized controlled trial raise the possibility that, in our most vulnerable neighborhoods, increased enforcement activity associated with the placement of BWCs on officers could possibly undermine improvement in citizen perceptions of the police generated by reductions in complaints and use of force incidents.

---

<sup>91</sup> Charles Epp, Steven Maynard-Moody, and Donald Haider-Markel, *Pulled Over: How Police Stops Define Race and Citizenship* (Chicago: University of Chicago Press, 2014); James Jacobs, *The Eternal Criminal Record* (Cambridge, MA: Harvard University Press, 2015); and Kathryne Young, and Joan Petersilia, “Keeping Track: Surveillance, Control, and the Expansion of the Carceral State,” *Harvard Law Review* 129, (2016): 1318–1360.



## V. References

- Ariel, Barak. "Increasing Cooperation With the Police Using Body Worn Cameras," *Police Quarterly* 19 (2016): 326-362.
- Ariel, Barak, Alex Sutherland, Darren Henstock, Josh Young, Paul Drover, Jayne Sykes, Simon Magicks, and Ryan Henderson. "Wearing Body-Cameras Increases Assaults Against Officers and Do Not Reduce Police-Use of Force: Results from a Global Multisite Experiment," *European Journal of Criminology* 13a (2016): 744-755.
- Ariel, Barak, Alex Sutherland, Darren Henstock, Josh Young, Paul Drover, Jayne Sykes, Simon Magicks, and Ryan Henderson. "Increases in Police Use of Force in the Presence of Body-Worn Cameras are Driven by Officer Discretion: A Protocol-Based Subgroup Analysis of Ten Randomized Experiments," *Journal of Experimental Criminology* 12b (2016): 453-463.
- Ariel, Barak, Tony Farrar, and Alex Sutherland. "The Effect of Police Body-Worn Cameras on Use of Force and Citizens' Complaints Against the Police: A Randomized Controlled Trial," *Journal of Quantitative Criminology* 31(2015): 1-27.
- Blalock, Hubert. *Social Statistics*, 2nd ed. (New York: McGraw-Hill, 1979).
- Blumstein, Alfred, Jacqueline Cohen, and Daniel Nagin, eds. *Deterrence and Incapacitation: Estimating the Effects of Criminal Sanctions on Crime Rates* (Washington, DC: National Academy of Sciences, 1978).
- Brunson, Rod. "'Police Don't Like Black People': African American Young Men's Accumulated Police Experiences," *Criminology & Public Policy* 6 (2007): 71-102.
- Campbell, Donald, and Julian Stanley. *Experimental and Quasi-Experimental Designs for Research* (Chicago: Rand McNally, 1963).
- Cohen, Jacob. *Statistical Power Analysis for the Behavioral Sciences*, 2nd ed., (Hillsdale, NJ: Lawrence Earlbaum Associates, 1988).
- Cook, Philip. "Research in Criminal Deterrence: Laying the Groundwork for the Second Decade," *Crime and Justice* 2 (1980): 211-268.
- David Card and Alan Krueger. "Minimum Wages and Employment: A Case Study of the Fast-Food industry in New Jersey and Pennsylvania," *American Economic Review* 84 (1994): 772-793.
- Duval, T. Shelley, and Robert Wicklund. *A Theory of Objective Self-Awareness* (New York: Academic, 1972).

- Epp, Charles, Steven Maynard-Moody, and Donald Haider-Markel. *Pulled Over: How Police Stops Define Race and Citizenship* (Chicago: University of Chicago Press, 2014).
- Fachner, George, and Steven Carter. "Collaborative Reform Model: Final Assessment Report of the Las Vegas Metropolitan Police Department," Washington, DC: Office of Community Oriented Policing Services, 2014.
- Fagan, Jeffrey, Amanda Geller, Garth Davies, and Valerie West. "Street Stops and Broken Windows Revisited: The Demography and Logic of Proactive Policing in a Safe and Changing City," in *Race, Ethnicity, and Policing*, ed. S. Rice and M. White (New York: New York University Press, 2010).
- Farrar, Tony, and Barak Ariel. *Self-Awareness to Being Watched and Socially Desirable Behavior: A Field Experiment on the Effect of Body-Worn Cameras and Police Use of Force*, Washington, DC: Police Foundation, 2013.
- Gibbs, Jack. *Crime, Punishment, and Deterrence*, (New York: Elsevier, 1975).
- Goodall, Martin. *Guidance for the Police Use of Body-Worn Video Devices*, (London: Home Office, 2007).
- Grossmith, Lynne, Catherine Owens, Will Finn, David Mann, Tom Davies, and Laura Baika. *Police, Camera, Evidence: London's Cluster Randomised Controlled Trial of Body Worn Video*. London: College of Policing and the Mayor's Office for Policing and Crime, 2015.
- Hedberg, E.C., Charles Katz, and David Choate. "Body-Worn Cameras and Citizen Interactions with Police Officers: Estimating Plausible Effects Given Varying Compliance Levels," *Justice Quarterly*. Vol. 34 , Iss. 4, 2017.
- Hollis, Sally, and Fiona Campbell. "What Is Meant by Intention to Treat Analysis? Survey of Published Randomised Controlled Trials," *British Medical Journal* 319 (1999): 670-674.
- Jacobs, James. *The Eternal Criminal Record* (Cambridge, MA: Harvard University Press, 2015).
- Jennings, Wesley G., Mathew Lynch, and Lorie Fridell. "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 (2015): 480-486.
- Kane, Robert. "The Social Ecology of Police Misconduct," *Criminology* 40 (2002): 867-896.

Katz, Charles, David Choate, Justin Ready, and Lidia Nuno. *Evaluating the Impact of Officer Worn Body Cameras in the Phoenix Police Department*, Phoenix, AZ: Center for Violence Prevention & Community Safety, Arizona State University, 2014.

Lipsey, Mark. *Design Sensitivity: Statistical Power for Experimental Research* Thousand Oaks, CA: Sage Publications. 1990.

Lovett, Ian. "In California, a Champion for Police Cameras," *The New York Times*, August 21, 2013.

Lum, Cynthia, Christopher Koper, Linda Merola, Amber Scherer, and Amanda Reioux. *Existing and Ongoing Body Worn Camera Research: Knowledge Gaps and Opportunities*, New York: The Laura and John Arnold Foundation, 2015.

Mesa Police Department. *On-Officer Body Camera System: Program Evaluation and Recommendations*, Mesa, AZ: Mesa Police Department, 2013.

Munger, Kristen, and Shelby Harris. "Effects of an Observer on Hand Washing in a Public Restroom," *Perceptual and Motor Skills* 69 (1989): 733-734.

Nagin, Daniel. "Deterrence in the Twenty-First Century," *Crime and Justice* 42 (2013): 199-263.

ODS Consulting. *Body Worn Video Projects in Paisley and Aberdeen, Self Evaluation*, Glasgow, UK: ODS Consulting, 2011.

Owens, Catherine, David Mann, and Rory Mckenna. *The Essex BWV Trial: The Impact of BWV on Criminal Justice Outcomes of Domestic Abuse Incidents*, London: College of Policing, 2014.

Paternoster, Raymond. "The Deterrent Effect of the Perceived Certainty and Severity of Punishment: A Review of the Evidence and Issues," *Justice Quarterly* 4 (1987): 173-217.

Paulhus, Delroy. "Two-Component Models of Socially Desirable Responding," *Journal of Personality and Social Psychology* 46 (1984): 598-609.

Police Executive Research Forum. *Implementing a Body-Worn Camera Program: Recommendations and Lessons Learned*, Washington, DC: Office of Community Oriented Policing Services, 2014.

President's Task Force on 21st Century Policing, *Final Report of the President's Task Force on 21st Century Policing*, Washington, DC: Office of Community Oriented Policing Services, 2015.

Rios, Victor. *Punished: Policing the Lives of Black and Latino Boys* (New York: New York University Press, 2011).

Shadish, William, Thomas Cook, and Donald Campbell. *Experimental and Quasi-Experimental Designs for Generalized Causal Inference* (Boston: Houghton Mifflin, 2002).

Sousa, William, Chip Coldren, Denise Rodriguez, and Anthony A. Braga. "Research on Body Worn Cameras: Meeting the Challenges of Police Operations, Program Implementation, and Randomized Controlled Trial Designs," *Police Quarterly* 19 no. 3 (2016): 363-384.

Stanley, Jay. *Police Body-Mounted Cameras: With Right Policies in Place, A Win for All*, Version 2.0, Washington, DC: American Civil Liberties Union, 2015.

Stewart, James K., George Fachner, Denise Rodriguez King, and Steve Rickman. *Collaborative Reform Process: A Review of Officer-Involved Shootings in the Las Vegas Metropolitan Police Department*, Washington, DC: U.S. Department of Justice, Office of Community Oriented Policing Services, 2012.

Tanya L. Chartrand and John A. Bargh. "The Chameleon Effect: The Perception-Behavior Link and Social Interaction," *Journal of Personality and Social Psychology* 76 (1999): 893-910.

Tilley, Nick. *Understanding Car Parks, Crime, and CCTV: Evaluation Lessons from Safer Cities*, London: Home Office, 1993.

Weisburd, David. "Justifying the Use of Non-Experimental Methods and Disqualifying the Use of Randomized Controlled Trials." *Journal of Experimental Criminology* 6, (2010): 209-227.

White, Michael D. "Police Officer Body-Worn Cameras: Assessing the Evidence." Washington, DC: Office of Community Oriented Policing Services, 2014.

White, Michael D., Janne Guab, Natalie E., Todak. "Exploring the Potential for Body-Worn Cameras to Reduce Violence in Police-Citizen Encounters." *Policing* (2017): pp 1-11.

Young, Kathrynne, and Joan Petersilia. "Keeping Track: Surveillance, Control, and the Expansion of the Carceral State," *Harvard Law Review* 129, (2016): 1318-1360.

Zimring, Franklin and Gordon Hawkins. *Deterrence: The Legal Threat in Crime Control* (Chicago: University of Chicago Press, 1973).

This page intentionally left blank.

## VI. Dissemination of Research Findings

The following publications and presentations have resulted from this award:

William H. Sousa, James R. Coldren, Jr., and Denise Rodriguez, "Body Worn Cameras: Implementation Challenges," 2015 Academy of Criminal Justice Sciences Meeting, March 5, 2015.

William H. Sousa, James R. Coldren, Jr., and Denise Rodriguez, "Evaluating the Use of Body Worn Cameras: Randomized Control Trials in Four Jurisdictions: The Randomized Experiment with Body Worn Cameras at the Las Vegas Metropolitan Police Department," 2015 American Society of Criminology Meeting, November 18, 2015.

William H. Sousa, James R. Coldren, and Anthony A. Braga, "Research and Issues Regarding Body Worn Cameras," 2016 American Society of Criminology Meeting, November 19, 2016.

William H. Sousa, James R. Coldren, Jr., Denise Rodriguez, and Anthony A. Braga, "Research on Body Worn Cameras," *Police Quarterly* 19 no. 3 (2016): 363-384.

Braga, Anthony A., William Sousa, James Coldren, and Denise Rodriguez, "The Effects of Body Worn Cameras on Police Activity and Police-Citizen Encounters: A Randomized Controlled Trial," *Journal of Criminal Law and Criminology* 108 no. 3 (Forthcoming).

This page intentionally left blank.