

Reducing Assaults Against Staff Using Body-Worn Cameras (BWCs) in Railway Stations

Criminal Justice Review
2019, Vol. 44(1) 76-93
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DOI: 10.1177/0734016818814889
journals.sagepub.com/home/cjr



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Abstract

Workplace violence is a major health and safety phenomenon. We investigate whether body-worn cameras (BWCs) can achieve a cost-effective reduction of assaults. We conducted a randomized controlled trial with train stations exposed to the highest recorded assault rates against staff in England and Wales. Treatment members of staff were equipped with BWCs and control staff were unexposed to BWCs. Official records of assaults against treatment and control staff as well as against any employee at the station complexes are used as outcome measures. Results suggest 47% significant overall reduction in the odds of assaults against BWCs-equipped staff at treatment versus controls locations—or approximately two versus four assaults, on average, per station. In addition, we found a 26% significant reduction in assaults against all employees in the treatment versus control station complexes—9 versus 12 assaults, on average, per station—suggesting that BWCs have a spatial diffusion of benefits effects. We estimate that BWCs can reduce at least 3,000 working days per year lost because of physical violence at work. We conclude that BWCs provide substantial benefits for staff health and safety to those who are equipped with the devices as well as to staff in the vicinity of BWC-equipped employees.

Keywords

workplace violence, aggression, staff, train stations, randomized controlled trial (RCT)

What can be done to reduce the crisis level of workplace aggression? Millions of staff members are injured, assaulted, or threatened each year, in a wide range of public-facing professions. Nurses, doctors, security guards, police officers, and teachers are particularly vulnerable, and the overall

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evidence does not seem to find effective methods to prevent this omnipresent type of violence. The consequences are far-reaching for health outcomes, economic consequences as a result of absences, turnover, and productivity.

One recently suggested technological solution is equipping staff members with body-worn cameras (BWCs). These devices can videotape encounters between members of the public who express aggression and violence against employees. They can serve as an “effective deterrent threat” (Jervis, 1982) by collecting incriminating evidence against transgressors. BWCs can have a civilizing effect on all parties to the interaction (Farrar & Ariel, 2013). Being self-aware that a camera is capturing demeanor is hypothesized to reduce tension and to promote more socially desirable behaviors. Consequently, the likelihood of assaults against the individual equipped with the BWCs is hypothesized to be reduced compared to no-treatment conditions.

However, there is limited published evidence on the merits of BWCs in assaults against staff members. Thus far, research on these devices has been devoted to their use within policing, and there has only been one large-scale experiment dedicated specifically to the effect of BWCs on assaults (Ariel et al., 2017). However, whether these findings are generalizable to other industries is presently unclear—although we hypothesize that the suppression effect of BWCs on aggression is ubiquitous.

In order to investigate the use of BWCs for violence reduction in nonpolicing environments, we turn to staff members of train operating companies (TOCs). These employees are particularly susceptible to workplace violence because they encounter millions of passengers on a daily basis, thus increasing the likelihood of engaging in volatile and aggressive interactions. Would BWCs reduce assaults against these staff members, compared to staff members who are unequipped with these devices?

We conducted a randomized controlled field trial in order to address this question, with England and Wales’ top 33 train stations in terms of assaults against staff, nationwide. During a 6-month trial, about half of the stations were assigned to treatment conditions, where all staff members who work at gate lines were equipped with BWCs. The odds of assaults against them were compared to the odds of assaults against a similar number of control staff in the other half of the sample—as well as the odds of assaults against all staff members in these participating stations, in order to account for potential spatial diffusion of benefit effects. The range of station types, geographic locations across the country, multiple TOCs, and population/interaction types increases the generalizability of our findings. Furthermore, in order to increase the robustness of the analysis, official police statistics on assaults were used in lieu of self-reported assaults by the participating staff members, with or without BWC footage. This article reports the findings of this trial and its implications for prevention.

Theoretical Background

Violence at Work

It is well established that exposure to violence is one of the most common hazards to health and safety at work (Friis, Larsen, & Lasgaard, 2017). While verbal and passive forms of aggression are more frequent than physical and active forms of aggression (Baron & Neuman, 1996; Neuman & Baron, 1997a), homicide is the second leading cause of death in American workplaces (Jenkins, 1996). Two million American workers are victims of workplace violence each year (U.S. Department of Labor, 2002). Some refer to this as a crisis and believe it should be dealt with as such (Taneja, 2014). In some professions, the exposure to violence is dramatic, with a prominent rate of public-facing professionals experiencing firsthand aggression at various levels of harm. For example, at least 38% of police officers are injured during the use of force encounters (Alpert & Dunham,

1997; Kaminski & Sorensen, 1995). In one extreme example in a study of toll booth collectors in Seoul, Korea, 235 (89.0%) subjects of 264 responded that they had experienced workplace violence. These workers reportedly experienced an average of 4.2 violent incidents per month. Most of this violence was from customers (94.4%; Joo & Rhie, 2017).

It seems that the adverse effects of workplace violence are particularly salient for employees in health care, education, public safety, retail, and justice professions (Piquero, Piquero, Craig, & Clipper, 2013). In the United Kingdom, the prevalence of violence in health-care environments has reached an “epidemic proportion” (Kingma, 2001). The prevalence of verbal aggression, threats of assault, and physical acts against security guards at least once a month is 39%, 19%, and 15%, respectively (Leino, Selin, Summala, & Virtanen, 2011). It may be unsurprising, as these professions are characterized by often-confrontational environments, with customers, clients, or patients who are often experiencing acute levels of stress (Collins & Gibbs, 2003; Varca, 1999; Yagil, 2008).

Workplace violence also has substantial consequences for the organizations in which employees are exposed to violence. These are mostly financial, reputational, and structural (Chappell & Martino, 2006). As reviewed by Gramling (2017), workplace violence can be expensive in terms of employees’ lost wages, health-care utilization, legal services, and worker’s compensation. In addition to these direct costs, organizations bear indirect costs associated with burnout and stress, as these lead to increased turnover of staff with its associated costs of hiring, onboarding, and training new staff to take their places (Diers, Duffield, & Catling-Paull, 2010; Estryn-Behar & Van Der Heijden, 2008; Waschgler & Ruiz-Hernández, 2013).

In light of these health, safety, and economic costs, interventions to reduce the incidence of workplace violence are constantly sought—at the level of the transgressor (Edward et al., 2016), the environment (Diers et al., 2010; Salin, 2003), employee training courses (Hills, Ross, Pich, & Hill, 2015), equipping staff with self-defence skills or even Tasers (Gramling, 2017), or increasing the threat of apprehension through enhanced technological detections (Loveday & Gill, 2004). A meta-analysis suggests that, overall, these interventions have limited success (Nikathil, Olaussen, & Gocentas, 2017). Thus, alternative means of prevention should be considered.

BWCs for Reducing Aggression at the Workplace

BWCs have gained some recognition as a preventer of workplace violence. These are small audio–video recorders that are mounted on the clothes of employees in front-facing professions, most notably police offices, security guards and more recently paramedics, school staff, and ticket enforcers. BWCs aim to achieve two overarching goals. First, by recording employee–public interactions from the employee’s perspective, they are believed to prevent escalations or new crimes from occurring (White, 2014). Second, BWCs may assist in bringing offenders to justice. Once the cameras are visible to members of the public, and as employees are aware that the devices are recording their actions, a deterrence signal is hypothesized to be to those present in the encounter: “Look out! You’re on camera” (Ariel, 2016a, 2016b; Ariel, Farrar, & Sutherland, 2015; Jennings, Lynch, & Fridell, 2015a; Young & Ready, 2015). Theoretically, this deterrent message is understood to create what psychologists refer to as public self-awareness (Morin, 2011), and this self-awareness is meant to lead to acceptable behaviors that are context specific for interactions: less aggression, calmer conduct, and compliance with codes of practice (Ariel et al., 2015). Once people become cognizant that their demeanor, appearance, and actions are being monitored in public, a self-awareness process begins. Self-awareness in turn triggers a complex cognitive process of self-scrutiny and a heightened construction of one’s own identity (Wicklund, 1975). The evidence on these phenomena is ubiquitous and dates back more than five decades (Duval & Wicklund, 1972). More importantly, it is generally agreed that people who are aware of being observed adjust their attitudes and behavior to what they perceive are “acceptable social norms” (Munger & Harris, 1989; Sproull,

Subramani, & Kiesler, 1996), or “socially desirable responses” (Jones & Nisbett, 1971; Paulhus, 1988). Since the risk of apprehension for misconduct or hostile or criminal behavior is elevated to near-certainty (when the cameras are turned on), both parties are believed to “cool off” (Ariel et al., 2015). The “belligerent” member of the public is supposed to become less resistant, and the “thin-skinned” employee responds more professionally, demonstrating fairness, dignity, and respect (Bottoms & Tankebe, 2013; Tyler & Lind, 1992). In this context, BWCs were found to reduce complaints against officers to nearly zero (93% average reduction; (Ariel, Sutherland, & Henstock, 2017) as well as reduce any type of use of force by up to 50% (Ariel et al., 2016; Henstock & Ariel, 2017; Jennings et al., 2015a). Most pertinent to the present study, BWCs were found to reduce assaults against officers by nearly two thirds, on a before-after analysis (Ariel et al., 2017).

Hypotheses

Can BWCs reduce assaults and aggression against nonpolice staff? If BWCs indeed can “cool off” aggressive encounters (Ariel et al., 2015; Jennings et al., 2015a), it seems logical that they are also likely to reduce the likelihood of assaults against any type of employee. Assaulting a member of staff can likely get the transgressor punished severely if the event can be proved in court. Therefore, we would expect that rational individuals will avoid assaulting staff members when the likelihood of the apprehension for assaulting them is high (Whichard & Felson, 2016). This is the case with BWCs: The probability of getting caught assaulting an employee is substantially enhanced because a camera pointing at the transgressor provides unequivocal evidence of the assault. The assumption is therefore that reasonable individuals will not want to be caught and subsequently punished for misbehavior (Margarita, 1980; Ojedokun, 2014) - unless of course if the individual is purposely seeking to assault the employee, for ideological or personal reasons, and has something to gain from the recording and subsequent broadcasting of the assault, despite the punishment. In addition, staff members are less likely to behave in ways that would cause them to be injured, or that would provoke the client, patient, or customer to violate the codes of conduct. As both parties become aware that the camera is observing them, the elevated self-regulation mechanism is hypothesized to reduce the likelihood of an assault. However, there is currently no documented evidence outside law enforcement or beyond the Ariel et al. (2017) experiment, about the use of BWCs to reduce workplace violence.

The UK TOCs BWCs Experiment

The present study is an attempt to test these hypotheses. We also aim to overcome some of the design and methodological shortcomings that we believe have characterized the policing studies on BWCs thus far. Specifically, we sought to measure the effect of these devices in the context of nonpolice staff working for mass transportation systems. These systems experience a high rate of assaults against employees.

Settings

The national rail system in the United Kingdom is owned, operated, and developed by Network Rail. It is a public company, answerable to the government via the Department for Transport, which manages the railway through nine devolved, geographically based businesses called routes. Each of the nine routes manages local TOCs, and each of the TOCs has jurisdiction over (a) particular part(s) of the routes (Network Rail, 2017). Network Rail owns most of Britain’s 2,507 stations and is responsible for their structural repair and renewal; however, there are 23 franchised TOC passenger services.

Of the 23 TOCs, we partnered with *Virgin West Coast*, *Arriva Northern*, *Merseyrail*, *South-eastern*, *Southern*, and *Govia Thameslink*, some of Europe’s largest TOCs, for this trial. The

participating TOCs, each managing a large number of stations across England and Wales, volunteered to take part in the study, following an invitation from the British Transport Police. The participating TOCs formed a for-purpose consortium, led by the British Transport Police and Cambridge University, in order to test the effect of BWCs on assaults against staff.

Assaults against TOC staff in England and Wales are considered a serious problem. In 2015 and 2016, a total of 6,960 assaults were reported against staff working at the stations across the country (Office of Rail and Road, 2017). It may seem like a low figure, as the UK rail industry employs more than 190,000 people who manage and maintain more than 2,500 stations for more than 1.3 billion passenger journeys (Stagecoach Group, 2017). However, the true figures are assumed to be substantially higher as underreporting of assaults is considered a prominent problem (Gifford & Anderson, 2010). More critically, given the costs of assaults against staff, particularly in terms of health and safety of TOC staff, as well as in monetary terms which the transportation system as a whole incurs as a result of delayed train services due to crime (£98,104,520 for 2017/2018 year alone; British Transport Police, 2017/2018), any cost-effective intervention that can reduce assaults has value to thousands of staff across the UK and will be deemed efficient.

Despite being interconnected through trains, the majority of UK train stations can be seen as microcosms, operating in silos from one another. For the stations that participated in the study, the organizational resources and characteristics of each train station were independent from those of other stations. Each station, for example, is maintained by a local place manager. The physical distance between stations is often great. Due to contractual agreements between management and staff, those working at one particular station continue working there, without movement to other locations. The overwhelming majority of rail travelers are regular commuters, thus familiar customers frequent the stations at relatively consistent time intervals. Furthermore, the stations are characterized by consistency: The structural, ecological, and commercial identity of each station is also fairly stable. We are not aware of any major changes that took place in these conditions during the time of the experiment. Likewise, policing tactics, strategies, and priorities have remained stable during the time of the study (British Transport Police, 2017/2018). These figures make stations optimal for the purpose of the issues of treatment contamination biases (see Ariel, Sutherland and Sherman, 2018).

As the participating TOCs are responsible for operating trains to and from hundreds of train stations across the UK, we selected the top locations in terms of crime and footfall during the last 5 years (the minimal threshold is 80 crimes per station and footfall of no less than 3,000,000 passenger travels per annum). These thresholds were set given statistical power purposes as well as given the number of BWCs available for the study. Consequently, we were able to conduct an experiment with 33 stations, which have 1,572 employees across 127 barrier points. Altogether, 340 TOC staff secured these barriers.

To clarify, the job of a gate line officer is to supervise the lawful entries into and exits out of the train platform areas with valid tickets. If passengers do not have a valid ticket or a valid reason for not having one, the train company has a number of options against the unlawful use of the train, including issuing a penalty fare or prosecuting for fare evasion—both of which could lead to a criminal conviction. Detection of fare evasion usually begins when the passenger attempts to enter or leave the premises, but the barriers would not open and she or he would require the assistance of a member of staff. The gate line staff member is then responsible for assessing the reason for not holding a valid ticket, and in these circumstances, which spark an assault by a train user.

Data and Methods

Unit of randomization: Train stations. Testing the hypothesized effect of BWCs on assaults under rigorous conditions is problematic given the likelihood of spillover effects (Ariel et al., 2017). In

principle, we expect that any outcome of one unit will not depend on the outcome of any other unit in a randomized experiment. When there is interference, we can assume that the treatment effect is either inflated or deflated, meaning that the true impact of the intervention on the outcome is masked to some degree, depending on the extent of contamination. This is the so-called spillover effect. Spillover effects in randomized trials contaminate the purity of the experimental design. The diffusion can take many forms; it can refer to “bleeding” from treatment to control, between treatment groups, within statistical blocks or clusters, or within individual treatment units (Baird, Bohren, McIntosh, & Özler, 2018; Campbell & Stanley, 1963; Cook, Campbell, & Shadish, 2002). Rubin (1986; see also Cox, 1958) refers to this type of contamination as a violation of the “stable unit treatment value assumption” (SUTVA).

In BWC experiments, spillover can occur when either group of participants is assigned to both treatment and control conditions (e.g., Ariel et al., 2015) or when the control participants directly experience the treatment effect from participants who were assigned to a treatment group (Yokum, Ravishankar, & Coppock, 2017). The latter designs are “doomed to failure” (Weisburd & Britt, 2007), as the level of contamination leaves the treatment and control conditions practically similar (e.g., both experimental and control conditions are exposed to the treatment). There is a general recognition in the BWC literature and beyond that, only large-scale randomized designs can overcome the treatment contamination problem. Instead of shifts (Ariel et al., 2015), individual officers (Jennings, Lynch, & Fridell, 2015; Ready & Young, 2015) or geographic districts (Ariel et al., 2017), we employed *prima facie* units that do not violate the SUTVA (Cox, 1958): entire train stations.

In many ways, discrete stations represent the optimal units of randomization for a variety of reasons. Train stations are spatially, temporarily, and structurally separated from each other. By randomizing entire station complexes, the likelihood of staff equipped with BWCs effecting staff *not* equipped with BWCs—as well as the members of the public who interact with the staff at the train stations—is virtually nil.

Moreover, assaults against public-facing TOC staff are primarily concentrated against two types of staff members: ticket enforcement on trains and at the ticket barriers (British Transport Police, 2017/2018). We ruled out equipping train staff, as such a design presented challenges in terms of spillover effects—precisely what we were attempting to overcome (as they *do* travel between stations). Instead, equipping TOC staff who enforce ticket payments at gate lines was palatable. To be sure, however, we did not randomly allocate the intervention to gate lines staff, but the entire train stations instead served as the unit of randomization. The 33 stations were randomly assigned through a simple random assignment procedure in which we measured the outcomes at the specific locations as well as at the entire station complex.

Treatment and Control Conditions

We provided approximately 200 Axon© BWCs to the 33 treatment sites based on the number of gate line staff employed at these stations. In control sites, no apparatuses were allocated at all. The identity of treatment stations was communicated to the train companies who operate at the participating train stations, while the identity of the control stations was not disclosed. As each TOC operates many dozens and often hundreds of stations, TOCs and their staff members were not able to identify which specific stations are used as comparison sites; moreover, the staff members were not told that they are taking part in an experiment at all. This partial blinding was used to avoid any deliberate or accidental effect on the no-treatment conditions in the control group—despite the fact that staff do not work outside their designated stations. According to the experimental protocol, agreed upon with each participating TOC, TOC gate line staff at the treatment sites had to wear the camera during their entire shift. Cameras were positioned on their uniforms throughout their

Table 1. Baseline Comparability.

Parameter	Treatment Stations	No-Treatment Stations	t Test; p Values
Eligible train stations	15	18	
Mean <i>N</i> of crimes in last 5 years (<i>SD</i>)	138.53 (95.12)	131.39 (66.58)	.253; <i>p</i> = .802
Mean <i>N</i> of gates per station	21.67 (20.53)	22.47 (21.87)	.108; <i>p</i> = .916
Mean <i>N</i> of TOC staff per stations	30.79 (27.62)	27.33 (23.17)	.392; <i>p</i> = .698
Mean <i>N</i> of ticket barrier points per gate	2.87 (2.07)	2.72 (1.93)	.215; <i>p</i> = .831
Mean <i>N</i> of TOC staff at barrier points	9.40 (9.22)	6.56 (5.54)	1.093; <i>p</i> = .283

Note. *SD* = standard deviation; TOC = train operating companies.

shift, whether or not staffs were interacting with the public. However, unlike the policing experiments on BWCs (e.g., Henstock & Ariel, 2017), staffs were not instructed to verbally notify members of the public that they were wearing a camera that was recording their interaction. Instead, the cameras were highly visible and blinked as though they were on standby.

Should an incident emerge that required recording, the staff members were then required to push an activation button on the camera, which would illuminate the device with florescent green light and emit a loud beeping sound in order to notify the parties that the event was being recorded. (A buffer period with pre-event recording exists for 30 seconds.) The videotaped evidence would then be provided to the British Transport Police and subsequently to the Crown Prosecution Office in order to process the case in court, as needed. For more information on the apparatus, see <https://global.axon.com/products/body-2>

Random Assignment

We randomly divided 33 stations into 15 and 18 treatment and control sites (Table 1). This is akin to a health study where researchers randomly allocate 33 hospitals or an education study with 33 schools. There were 158 gate line TOC staff members in the treatment group (of 807 employees) and 182 gate line staff members (of 765 employees) at control stations. The reason for the unbalanced *n* is our use of pure random assignment sequence; however, the random allocation created, on average, equal groups in terms of all the pretreatment variables we had available on these stations, including the dependent variable at its baseline values (Table 1). No statistically significant differences emerged across any of these comparisons.

Modeling Assaults

Official records from the British Transport Police were collated and synthesized for the purposes of this study. Assaults records were provided for the purpose of the experiment in each site, at treatment and control sites, before and after random assignment. Our outcome data therefore included crimes filed with the police by or on behalf of TOC staff members that were victimized by members of the public in the line of duty.

Statistical Procedure

We employed five statistical models to analyze the outcomes. First, (a) we used the Poisson model to assess differences between experimental and control groups at gate line, and (b) then the Poisson model to assess these differences at the level of the station. The Poisson model is appropriate here because each event has a small probability in each condition during the 6-month period of the experiment, and the variance was assumed to be the same as the mean. Group assignment

(experimental [0]/control [1]) was set as an explanatory variable, and the dependent variable was whether or not an assault against the member of staff was recorded by the police. The pretreatment values of these measures during the 6-months period in the year prior to the trial were incorporated in the models as covariates as well (for rationale, see Liu, Lu, Mogg, Mallick, & Mehrotra, 2009). From these models, we then extracted the exponential parameter estimates and the 95% confidence intervals (CIs) associated with these estimates, as the exponential parameter estimate is a measure of the factor change in the odds of the outcome produced by a one-unit increase in the value of the independent variable. This is an improvement upon using variations in the raw coefficients, which are not intuitively interpretable (see Long, 1997 and a similar application in Henstock & Ariel, 2017). As recently stated by the editorial unit of Cochrane Collaboration (2014), “In general, point estimates and CIs, when possible . . . should be used to describe effects based on the size of the effect and the quality of the evidence.” For more in-depth information on these methodological issues, see Greenland et al. (2016).

Statistical Power Calculations

We are cognizant that our study looks, *prima facie*, underpowered. We were limited by the number of BWCs available for the study. However, the experiment should not be considered a “simple” 15 versus 18 units (see Hemming, Girling, Sitch, Marsh, & Lilford, 2011). Each “unit” was comprised of dozens of gate line staff members—340 in total, to be exact—with hundreds of gate lines where treatment staff members were positioned. Therefore, the required statistical power calculations resemble analyses in the context of place-based rather than subject-based trials—that is, cluster-randomized trials (on the issue of sufficient statistical power in clustered place-based experiments, see Hinkle, Weisburd, Famega, & Ready, 2013; Weisburd & Gill, 2014). Using Optimal Design Plus (Spybrook et al., 2013), we determined that with 33 stations—or clusters—with an average number of staff members at each station of 6–10, the dependent variable measure at baseline as a covariate, and assuming a bidirectional $\alpha = .05$ and statistical power of .80, the minimum detectable effective size of this trial is .45 to .40 (see also Cohen, 1988). Given the available literature in this area (e.g., Ariel et al., 2018), which indicates an overall 66% pretest and posttest reductions in assaults against officers as a result of using BWCs, our study is not handicapped by the relatively small number of clusters and robust enough to detect statistically significant effects of the predicted magnitude.

Results

Police records indicate that, during the experimental period, 72 assaults against gate line staff were reported in the control station, whereas 34 reports on assaults on staff were reported from treatment stations. As shown in Table 2, our test produced a statistically significant reduction in assaults against TOC staff at all the treatment stations compared to the control stations, in the magnitude of approximately 47%, $\text{Exp}(B) = .531$, 95% CI [.351, .802], $p \leq .001$). Taking into account, the baseline values of the dependent variable, the raw total figures show the pattern as well (see Figure 1).

Table 2 shows a statistically significant 26% reduction in assaults against all employees in the train stations compared to those of control stations, $\text{Exp}(B) = .744$, 95% CI [.601, .920]. These findings indicate a diffusion of the benefits of the intervention to surrounding areas within the station complexes (Clarke & Weisburd, 1994).

Discussion

Workplace violence, especially in public-facing professionals such as health, security, and education, is a daunting reality. Characterized as a “crisis” or as an “epidemic,” the prevalence of assaults

Table 2. Parameter Estimates and Exponential Parameter Estimates.

				95% CI for Exp(B)	
	B	SE	Exp(B)	Lower	Upper
Assaults against staff at gate lines					
Treatment	−0.633***	.211	0.531	0.351	0.802
Baseline	0.041***	.012	1.042	1.018	1.067
Intercept	0.807***	.215	2.241	1.471	3.412
All assaults in stations					
Treatment	−0.296***	.109	0.744	0.601	0.920
Baseline	0.051***	.006	1.052	1.040	1.065
Intercept	1.757***	.116	5.796	4.616	7.276

Note. CI = confidence interval.

* $p < .05$. ** $p < .01$. *** $p < .001$.

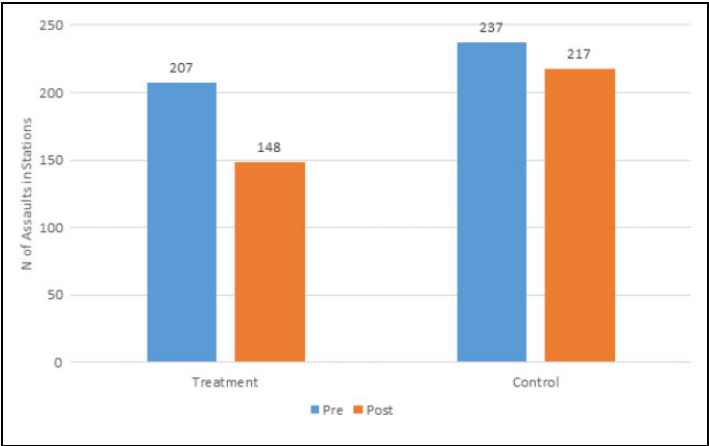


Figure 1. Total number of assaults in participating stations—6 months pretest and posttest: Treatment versus control conditions.

against staff is dramatic, with millions of staff members being assaulted at work each year. Programs to reduce the likelihood of work-related aggression have thus far shown limited success. CCTVs installed in public places, training courses for staff members, additional police presence, and screening models have been evaluated through rigorous tests, but the findings have produced mixed or unsupported results. These interventions have not resolved workplace violence because acute stress, adversarial confrontations, and hostile encounters recurrently characterize these public-facing professions: anxious patients, aggressive suspects, or destructive teenagers in addition to long work hours, endless patient or customer lists, low wages, and often challenging working environments. Workplace violence is yet to be robustly understood, with a wide range of antecedents including ecological, cultural, psychological, and institutional factors, as well as the formidable interactions between these various elements in more specific contexts.

For these reasons and others discussed below, our findings provide a promising new way to reduce workplace violence. A significant 47% reduction in the odds of an assault against a staff member who is equipped with a BWC, compared to his or her counterpart who is not equipped with a BWC, should spark interest not only in the railway industry but also, *prima facie*, in other front-

facing professions. Our randomized controlled trial illustrates that, on average, BWCs provide TOC staff with a “protective cushion,” which reduces physical aggression toward them. Moreover, our findings suggest what Clarke and Weisburd (1994) refer to as the “diffusion of benefits of social control mechanisms.” That is, the dispersion of the preventative effect of BWCs observed at the gate lines throughout the entire train station complex. The significant 26% reduction in assaults is attributable to the intervention (BWCs) and not to other factors, given our randomized trial methodology, and this specific finding carries both practical and theoretical consequences.

First, the diffusion of the benefits to nonequipped employees suggests that BWCs affect not only the interactions between staff members and the public but also wider circles. Assaults were substantially reduced for those unequipped yet working in proximity to equipped staff members. It is not clear from the data whether the effect of BWCs affects the behavior of staff, citizens, or both, thus we are unable to characterize the causal mechanism that is at play here in terms of the spillover. However, the overall results suggest that BWCs transmit not only a specific deterrence effect (transgressor x_1 vis-à-vis staff member y_1) but also a general deterrence effect (all transgressors X_n vis-à-vis all staff members Y_n , as a result of staff member y_1 who is equipped with a BWC) - at least within the spatio-localized sense of “general”. By equipping approximately 200 of 800 staff members with BWCs, the spillover effects benefited the entire sample of participating treatment train station employees.

Second, the immediate policy implication seems to be that equipping *all* staff, at least in this specific working environment, is defensible. At least in comparison with other interventions reviewed earlier, BWCs appear to be an effective measure for protecting staff members. At a minimum, immediate replications are needed in order to understand more fully the scope of this effect on a wider scale, the extent of the prevention of assaults in other locations, with more units. In this respect, it would be a mistake to view the posttreatment mean number of assaults against staff at gate lines—approximately two versus four in treatment and control conditions, respectively—as the entire gamut of the treatment effect. Recall that, for practical purposes related to the number of devices available for the trial, the number of TOCs that participated in this experiment and our initial motivation to reduce aggression specifically against staff at gate line locations, we focused on a smaller portion of staff (approximately 25%), within 33 stations across England and Wales. While our study was not small and satisfied the requirements for detecting small-to-medium effect sizes (given our design), it was inexpensive (see Moore, 2016). Therefore, the inference to the entire rail network is the appropriate outcome rather than at the level of the study sample. Since more than 190,000 people are responsible for managing and maintaining 2,500 stations and the network’s 20,000 miles of track (Stagecoach Group, 2017), our trial tested the effects of BWCs on 2% of the population at approximately 1% of UK stations. Hence, generalizing our results—a nearly 50% reduction in the odds of assaults once staff are equipped with BWCs—may have dramatic consequences for this UK industry, for similar industries in other countries, and potentially for all public-facing industries that are susceptible to workplace aggression (discussed below).

In order to further contextualize these results, consider the potential impact of BWCs in monetary terms and specifically in the cost of absences due to workplace violence. A handful of studies have specifically examined the effects of exposure to workplace aggression on absence (Aagestad et al., 2014; Clausen, Høgh, & Borg, 2012; Rugulies, Christensen, Borritz, & Villadsen, 2007). Collectively, the studies illustrate that threats and physical violence at work are predictors of future sickness absence at the short-term as well as the long-term follow-up. For example, Friis, Larsen, and Lasgaard (2017) recently found that in a 10-year follow-up period, employees exposed to physical workplace violence had 1.67 times higher odds of health-related absence than nonexposed employees (particularly women, persons over 40 years of age, and educated employees). In the context of the railway industry as noted earlier, 6,960 assaults were reported in 2015–2016 alone, of which 27% were physical assault (Office of Rail and Road, 2017). If we conservatively estimate a 26% reduction in assaults associated with the equipping of *some* staff members (as detected in this

trial), the overall reduction amount is 489 preventable physical assaults per annum. Furthermore, the Health and Safety Executive of the UK estimates that, on average, a physical assault at work leads to 5.58 lost days at work (www.hse.gov.uk/statistics/sources.htm). Thus, a conservative calculation for equipping some staffs with BWCs would reduce nearly 2,728 working days per year lost as a result of violence at work. Assuming a 47% reduction would be associated with preventing 4,928 working days per year lost. Using the same metrics, should we incorporate all types of workplace violence (physical, verbal, threats, etc.) the network rail could save between 10,094 and 18,252 days, per year. These figures do not account for undocumented or unreported workplace violence. In short, the benefits of using BWCs to reduce assaults against staff have quantifiable economic consequences, beyond the promotion of enhanced health and safety of staff.

At the same time, we are cognisant that equipping *other* professions may clash with privacy concerns. Jeopardizing patient confidentiality or the privacy of minors, for example, can become a real risk when videotaping encounters without obtaining prior consent. Paramedics, nurses, school teachers, and retail employees often interact with individuals who share private and often sensitive information. Therefore, the large-scale use of BWCs would necessarily require attention to these matters. Some cross-industry lessons do however exist. For law enforcement agents, who are also exposed to sensitive circumstances, a “legitimate interest” test is applied in relation to BWCs. If there is a legitimate interest in violating the right of privacy in the public or private domains, public authorities, such as the police, are allowed to videotape people without their consent (see Buckley & Hunter, 2011). In particular, the legitimate interest can serve as the reasonable and necessary interest of protection of the officer from assault and balance it against the individual’s interests, rights, and freedom. A similar test can be applied in these other professions, *mutatis mutandis*. It seems to us that paying the price for reducing our right to privacy in exchange of personal security is reasonable, provided that checks and balances are put in place. The point to remember is that the concern should not be about the recording of privacy, but rather how the stored content can be used. There are both institutional as well as technological solutions for these questions, as well as some experience with other recording devices such as CCTV and digital tracking software. Nevertheless, as BWCs become ubiquitous in this and other industries, a more developed perspective should be incorporated about these legal, social and otherwise broader issues.

The overall findings suggest that BWCs should be used as a preventative apparatus. This is what White (2014) referred to as the “civilizing effect” of BWCs. When people are aware that their interaction is being video-recorded, both the person equipped with the device and the person facing the camera—or at least one party involved in the interaction—behaves differently, in a way that reduces the “heat” in these volatile situations. BWCs thus increase the transparency of behavior (Ready & Young, 2015; Scheindlin, 2015), as well as serve as a direct deterrence against transgression and violence. What can be recorded can be subsequently reviewed or scrutinized, and members of the public and staff became more accountable (Lumina, 2006; Reiner, 1993; Walsh & Conway, 2011). Therefore, BWCs have shown promise in prevention of aggression against staff members.

Limitations

We note an additional methodological limitation in terms of the external validity of our outcome variables: Official statistics on most crimes notoriously suffer from misrepresentation threats because many if not most incidents are reported to the police (what Biderman and Reiss (1967) referred to as the “dark figures”). In the case of assaults of staff, the problem is exacerbated (see, e.g., Ferns, 2006; Lion, Snyder, & Merrill, 1981; Peek-Asa, Howard, Vargas, & Kraus, 1997). Self-reported incidents are, in principal, a way to mitigate the problem through triangulation (Gonyea, 2005). However, this triangulation of multiple sources was not feasible in the present study because we were not provided access to participant-level information that would allow us to match cases.

Furthermore, each of the participating TOCs has its own policies and practices of recording assaults, which creates issues when amalgamating several data sources. Finally, and perhaps the most decisive reason for excluding self-reported assaults in this context is the threat of a reporting bias: the “selective revealing or suppression of information (e.g., about past medical history, smoking, sexual experiences)” (Porta, 2014, p. 247). There is a concern of an interaction effect between the treatment and the design: The BWCs affected the motivation to report incidents internally, which would result in an increase of reported assaults rather than a true variation in the incidence of assaults.

We argue that a reporting bias is less of a concern in terms of reporting assaults to the police because we would not expect a reporting artefact when it comes to dealing with the police—and in fact, our evidence does not suggest an increase in reporting by treatment participants. (We should not expect a reporting bias in the control group either, as they were blinded about taking part in the experiment as a no-treatment group.)

Future Research

It has long been recognized that official statistics have poor validity—or what is commonly referred to as the tip of the criminological iceberg (Skogan, 1974). Many crimes—especially violence—are underreported, and it is likely that assaults against staffs are often unreported altogether. This is especially the case with less harmful but are nevertheless offensive transgressions (Hindelang, Hirschi, & Weis, 1981). We recommend future studies that focus on assaults or aggression more broadly and to concentrate on multiple sources of data, to reduce the potential threat of a reporting bias and, by implication, enhance the validity of the outcomes.

Second, our study does not advance our understanding on the effects of BWCs on criminal proceedings in court, or the prosecution of aggressive individuals in nonpolice environments. More research is needed in order to understand the underlying mechanisms in this context—at least through qualitative inquiries about the ways in which prosecutors and judges would use BWCs footage for criminal proceedings.

Finally, future research should look more rigorously at the role of environment factors and how they interact with BWCs. Recently, Ceccato, Uittenbogaard, and Bamzar (2013) have shown that opportunities for crime are dependent on the environmental attributes of mass-transit stations in Stockholm, as well as the type of neighborhood in which they are located and city context (see also Ceccato, 2013). These factors also contribute to feelings of safety in these environments (Ball & Wesson, 2017; Ceccato, 2014; Natarajan et al., 2015). The ways in which these factors (as well as other features of mass transit systems, such as the place manager [see Welsh, Mudge, & Farrington, 2010]) and BWCs act together is presently unknown—and the implications for practice are strong. For example, we may need fewer BWCs to deploy on the transit network, rather than deploy these devices to all stations or all staff members at specific station location. Given the costs of BWCs, understanding these ecological and environmental factors should be addressed in future research.

Lessons for Practice

Workplace violence is a major health and safety phenomenon in various professions, while interventions to stop it have thus far lead to limited results. Can BWCs achieve a reduction in assaults against staff? We report on the first field experiment, conducted with staff members of TOCs in England and Wales. We used a randomized controlled trial design, with England and Wales’ stations exposed to the highest recorded assault rates against staff, with official statistics on assaults. The study shows a nearly 50% reduction in the odds of assaults against TOC staff at treatment versus controls conditions. These results suggest that BWCs provide a promising solution to workplace violence, with significance to all public-facing professions exposed to aggression.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

References

- Aagestad, C., Tyssen, R., Johannessen, H. A., Gravseth, H. M., Tynes, T., & Sterud, T. (2014). Psychosocial and organizational risk factors for doctor-certified sick leave: A prospective study of female health and social workers in Norway. *BMC Public Health*, 14, 1016. doi:10.1186/1471-2458-14-1016
- Alpert, G. P., & Dunham, R. G. (1997, October). *The force factor: Measuring police use of force relative to suspect resistance*. Washington, DC: Police Executive Research Forum. ISBN: 9781878734525.
- Ariel, B. (2016a). Increasing cooperation with the police using body worn cameras. *Police Quarterly*, 19, 326–362. doi:10.1177/1098611116653723
- Ariel, B. (2016b). Police body cameras in large police departments. *The Journal of Criminal Law and Criminology*, 106, 729–768. doi:0091-4169/16/10604-0729
- Ariel, B., Farrar, W. A., & Sutherland, A. (2015). The effect of police body-worn cameras on use of force and citizens' complaints against the police: A randomized controlled trial. *Journal of Quantitative Criminology*, 31, 509–535. doi:10.1007/s10940-014-9236-3
- Ariel, B., Sutherland, A., Henstock, D., Young, J., Drover, P., Sykes, J., . . . Henderson, R. (2016). Report: 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*, 12, 453–463. doi:10.1007/s11292-016-9261-3
- Ariel, B., Sutherland, A., Henstock, D., Young, J., Drover, P., Sykes, J., . . . Henderson, R. (2017). "Contagious accountability" a global multisite randomized controlled trial on the effect of police body-worn cameras on citizens' complaints against the police. *Criminal Justice and Behavior*, 44, 293–316. doi:10.1177/0093854816668218
- Ariel, B., Sutherland, A., Henstock, D., Young, J., Drover, P., Sykes, J., . . . Henderson, R. (2017). Paradoxical effects of self-awareness of being observed: Testing the effect of police body-worn cameras on assaults and aggression against officers. *Journal of Experimental Criminology*, 1–29. doi:10.1007/s11292-017-9311-5
- Ariel, B., Sutherland, A., Henstock, D., Young, J., Drover, P., Sykes, J., . . . Henderson, R. (2018). Paradoxical effects of self-awareness of being observed: Testing the effect of police body-worn cameras on assaults and aggression against officers. *Journal of Experimental Criminology*, 14, 19–47.
- Ariel, B., Sutherland, A., & Sherman, L. W. (2018). Preventing treatment spillover contamination in criminological field experiments: the case of body-worn police cameras. *Journal of Experimental Criminology*.
- Baird, S., Bohren, J. A., McIntosh, C., & Özler, B. (2018). Optimal design of experiments in the presence of interference. *Review of Economics and Statistics*. doi:10.1162/REST_a_00716
- Ball, K. S., & Wesson, C. J. (2017). Perceptions of unwanted sexual behaviour on public transport: Exploring transport density and behaviour severity. *Crime Prevention and Community Safety*, 19, 199–210.
- Baron, R. A., & Neuman, J. H. (1996). Workplace violence and workplace aggression: Evidence on their relative frequency and potential causes. *Aggressive Behavior*, 22, 161–173. doi:10.1002/(SICI)1098-2337(1996)22:3<161::AID-AB1>3.0.CO;2-Q
- Biderman, A. D., & Reiss, A. J. Jr. (1967). On exploring the "dark figure" of crime. *The Annals of the American Academy of Political and Social Science*, 374, 1–15.

- Bottoms, E. A., & Tankebe, J. (2013). "A voice within": Power-holders' perspectives on authority and legitimacy. In J. Tankebe & A. Liebling (Eds.), *Legitimacy and criminal justice: An international exploration*. Oxford, England: Oxford University Press. doi:10.1093/acprof:oso/9780198701996.003.0005
- British Transport Police home. (2017/2018). Report Retrieved February 9, 2018, from <http://www.btp.police.uk/>
- Buckley, B., & Hunter, M. (2011). Say cheese! Privacy and facial recognition. *Computer Law & Security Review*, 27, 637–640. doi:10.1016/j.clsr.2011.09.011
- Campbell, D. T., & Stanley, J. C. (1963) *Experimental and quasi-experimental designs for research*. Boston, MA, US: Houghton, Mifflin and Company.
- Ceccato, V. (2013). *Moving safely: Crime and perceived safety in Stockholm's subway stations*. UK: Lexington books.
- Ceccato, V. (2014). Safety on the move: Crime and perceived safety in transit environments. *Security Journal*, 27, 127–131.
- Ceccato, V., Uittenbogaard, A., & Bamzar, R. (2013). Security in Stockholm's underground stations: The importance of environmental attributes and context. *Security Journal*, 26, 33–59.
- Chappell, D., & Martino, V. D. (2006). Violence at Work. *International Labour Organization*. Retrieved from http://www.ilo.org/wcmsp5/groups/public/-dgreports/-dcomm/-publ/documents/publication/wcms_publ_9221108406_en.pdf%20ISBN:%209221179486
- Clarke, R. V., & Weisburd, D. (1994). Diffusion of crime control benefits: Observations on the reverse of displacement. *Crime Prevention Studies*, 2, 165–184.
- Clausen, T., Høgh, A., & Borg, V. (2012). Acts of offensive behaviour and risk of long-term sickness absence in the Danish elder-care services: A prospective analysis of register-based outcomes. *International Archives of Occupational and Environmental Health*, 85, 381–387. doi:10.1007/s00420-011-0680-1
- Cochrane Collaboration. (2014). *Results should not be reported as statistically significant or statistically non-significant*. Retrieved February 10, 2018, from <http://community.cochrane.org/sites/default/files/uploads/inline-files/Interpreting%20statistical%20significance.pdf>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum. ISBN: 9780805802832.
- Collins, P. A., & Gibbs, A. C. C. (2003). Stress in police officers: A study of the origins, prevalence and severity of stress-related symptoms within a county police force. *Occupational Medicine*, 53, 256–264. doi:10.1093/occmed/kqg061
- Cook, T. D., Campbell, D. T., & Shadish, W. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Boston, MA: Houghton Mifflin. ISBN: 0395615569.
- Cox, D. R. (1958). *Planning of experiment*. Oxford, England: Wiley. ASIN: B01NAN4FDV.
- Diers, D., Duffield, C., & Catling-Paull, C. (2010). Violence toward nurses, the work environment, and patient outcomes. *Journal of Nursing Scholarship*, 42, 13–22. doi:10.1111/j.1547-5069.2009.01321.x
- Duval, S., & Wicklund, R. A. (1972). *A theory of objective self awareness*. Oxford, England: Academic Press. ISBN: 9780122256509.
- Edward, K., Stephenson, J., Ousey, K., Lui, S., Warelow, P., & Giandinoto, J. A. (2016). A systematic review and meta-analysis of factors that relate to aggression perpetrated against nurses by patients/relatives or staff. *Journal of Clinical Nursing*, 25, 289–299. doi:10.1111/jocn.13019
- Estryn-Behar, M., & Van Der Heijden, B. (2008). Violence risks in nursing—Results from the European "NEXT" study. *Occupational Medicine*, 58, 107–114. doi:10.1093/occmed/kqm142
- Farrar, W., & Ariel, B. (2013). *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.
- Ferns, T. (2006). Under-reporting of violent incidents against nursing staff. *Nursing Standard (through 2013)*, 20, 41.
- Friis, K., Larsen, F. B., & Lasgaard, M. (2017). Physical violence at work predicts health-related absence from the labor market: A 10-year population-based follow-up study. *Psychology of Violence*. doi:10.1037/vio0000137

- Gifford, M. L., & Anderson, J. E. (2010). Barriers and motivating factors in reporting incidents of assault in mental health care. *Journal of the American Psychiatric Nurses Association*, 16, 288–298. doi:10.1177/1078390310384862
- Gonyea, R. M. (2005). Self-reported data in institutional research: Review and recommendations. *New Directions for Institutional Research*, 2005, 73–89.
- Gramling, J. J. (2017). Protecting the protectors: Violence-related injuries to hospital security personnel and the use of conducted electrical weapons. *Journal of Emergency Nursing*. doi:10.1016/j.jen.2017.06.008
- Greenland, S., Senn, S. J., Rothman, K. J., Carlin, J. B., Poole, C., Goodman, S. N., & Altman, D. G. (2016). Statistical tests, P values, confidence intervals, and power: A guide to misinterpretations. *European Journal of Epidemiology*, 31, 337–350. doi:10.1007/s10654-016-0149-3
- Hemming, K., Girling, A. J., Sitch, A. J., Marsh, J., & Lilford, R. J. (2011). Sample size calculations for cluster randomised controlled trials with a fixed number of clusters. *BMC Medical Research Methodology*, 11, 102. doi:10.1186/1471-2288-11-102
- Henstock, D., & Ariel, B. (2017). Testing the effects of police body-worn cameras on use of force during arrests: A randomised controlled trial in a large British police force. *European Journal of Criminology*, 14, 720–750. doi:10.1177/1477370816686120
- Hills, D. J., Ross, H. M., Pich, J., & Hill, A. T. (2015). *Education and training for preventing and minimising workplace aggression directed toward healthcare workers*. *The Cochrane Library*. doi:10.1002/14651858.CD011860
- Hindelang, M. J., Hirschi, T., & Weis, J. G. (1981). *Measuring Delinquency*. Retrieved from <https://www.ncjrs.gov/App/Publications/abstract.aspx?%20ID=79068>
- Hinkle, J. C., Weisburd, D., Famega, C., & Ready, J. (2013). The problem is not just sample size: The consequences of low base rates in policing experiments in smaller cities. *Evaluation Review*, 37, 213–238. doi:10.1177/0193841X13519799
- Jenkins, L. (1996). *Violence in the workplace: Risk factors and prevention strategies*. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Division of Safety Research. ISSN 1559–9388.
- Jennings, W. G., Lynch, M. D., & Fridell, L. A. (2015). Evaluating the impact of police officer Body-Worn Cameras (BWCs) on response-to-resistance and serious external complaints: Evidence from the Orlando Police Department (OPD) experience utilizing a randomized controlled experiment. *Journal of Criminal Justice*, 43, 480–486. doi:10.1016/j.jcrimjus.2015.10.003
- Jervis, R. (1982). Deterrence and perception. *International Security*, 7, 3–30. doi:10.2307/2538549
- Jones, E. E., & Nisbett, R. E. (1971). *The actor and the observer; divergent perceptions of the causes of behavior*. Morristown, NJ: General Learning Press.
- Joo, Y., & Rhie, J. (2017). The relationship between emotional labor status and workplace violence among toll collectors. *Annals of Occupational and Environmental Medicine*, 29, 34–42. doi:10.1186/s40557-017-0193-9
- Kaminski, R. J., & Sorensen, D. W. (1995). A multivariate analysis of individual, situational and environmental factors associated with police assault injuries. *American Journal of Police*, 14, 3–48.
- Khamisa, N., Oldenburg, B., Peltzer, K., & Illic, D. (2015). Work related stress, burnout, job satisfaction and general health of nurses.
- Kingma, M. (2001). Workplace violence in the health sector: A problem of epidemic proportion. *International Nursing Review*, 48, 129–131. doi:10.1046/j.1466-7657.2001.00094.x
- Leino, T., Selin, R., Summala, H., & Virtanen, M. (2011). Work-related Violence against security guards—who is most at risk? *Industrial Health*, 49, 143–150. doi:10.2486/indhealth.MS1208
- Lion, J. R., Snyder, W., & Merrill, G. L. (1981). Underreporting of assaults on staff in a state hospital. *Psychiatric Services*, 32, 497–498.
- Liu, G. F., Lu, K., Mogg, R., Mallick, M., & Mehrotra, D. V. (2009). Should baseline be a covariate or dependent variable in analyses of change from baseline in clinical trials? *Statistics in Medicine*, 28, 2509–2530. doi:10.1002/sim.3639

- Long, J. S. (1997). Regression models for categorical and limited dependent variables. *Advanced Quantitative Techniques in the Social Sciences*, 7. ISBN:9780803973749.
- Loveday, K., & Gill, M. (2004). The impact of monitored CCTV in a retail environment: What CCTV operators do and why. *Crime Prevention and Community Safety*, 6, 43–55. doi:10.1057/palgrave.cpcs.8140194
- Lumina, C. (2006). Police accountability and policing oversight mechanisms in the Southern African development community. *African Security Studies*, 15, 92–108. doi:10.1080/10246029.2006.9627392
- Margarita, M. (1980). Killing the police: Myths and motives. *The ANNALS of the American Academy of Political and Social Science*, 452, 63–71. doi:10.1177/000271628045200107
- Moore, R. (2016). *The use of body worn cameras in law enforcement*. Huntsville, TX. Retrieved from shsur.tdl.org: <http://hdl.handle.net/20.500.11875/2161>
- Morin, A. (2011). Self-recognition, theory-of-mind, and self-awareness: What side are you on? *Laterality*, 16, 367–383. doi:10.1080/13576501003702648
- Munger, K., & Harris, S. J. (1989). Effects of an observer on handwashing in a public restroom. *Perceptual and Motor Skills*, 96, 733–734. doi:10.2466/pms.1989.69.3.733
- Natarajan, M., Clarke, R., Carcach, C., Ponce, C., Sanfeliú, M. B., Polanco, D. E., . . . Shi, M. (2015). Situational prevention and public transport crime in El Salvador. *Crime Science*, 4, 29.
- Network Rail. (2017). About us. Retrieved February 9, 2018, from <https://www.networkrail.co.uk/who-we-are/about-us/>
- Neuman, J. H., & Baron, R. A. (1997a). Aggression in the workplace. In R. Giacalone & J. Greenberg (Eds.), *Anti-social behavior in organizations* (pp. 37–57). Thousand Oaks, CA: Sage. ISBN:0803972369.
- Nikathil, S., Olaussen, A., & Gocentas, R. A. (2017). Workplace violence in the emergency department: A systematic review and meta analysis. *Emergency Medicine Australasia*, 29, 265–275. doi:10.1111/1742-6723.12761
- Office of Rail and Road. (2017). *Workforce assaults, threats and verbal abuse—Table 5.7*. Retrieved December 10, 2017, from <http://dataportal.orr.gov.uk/displayreport/report/html/2868afa5-3edb-4f87-aafd-fe3fdaf969f9>
- Ojedokun, U. A. (2014). Contributing factors to police homicide in Nigeria. *The Police Journal*, 87, 41–48. doi:10.1350/pojo.2014.87.1.651
- Paulhus, D. L. (1988). Assessing self-deception and impression management in self-reports: The balanced inventory of desirable responding. Unpublished manual, University of British Columbia, Vancouver, Canada.
- Peek-Asa, C., Howard, J., Vargas, L., & Kraus, J. F. (1997). Incidence of non-fatal workplace assault injuries determined from employer's reports in California. *Journal of Occupational and Environmental Medicine*, 39, 44–50.
- Piquero, N. L., Piquero, A. R., Craig, J. M., & Clipper, S. J. (2013). Assessing research on workplace violence, 2000–2012. *Aggression and Violent Behavior*, 18, 383–394. doi:10.1016/j.avb.2013.03.001
- Porta, M. (2014). *A dictionary of epidemiology* (6th ed.). New York, NY: Oxford University Press.
- Ready, J. T., & Young, J. T. N. (2015). The impact of on-officer video cameras on police–citizen contacts: Findings from a controlled experiment in Mesa, AZ. *Journal of Experimental Criminology*, 11, 445–458. doi:10.1007/s11292-015-9237-8
- Reiner, R. (1993). Police accountability: Principles, patterns and practices. In R. Reiner & S. Spencer (Eds.), *Accountable policing: Empowerment, effectiveness and equity* (pp. 1–24). London, England: Institute for Public Policy Research. ISBN: 9781872452630.
- Rubin, D. B. (1986). Comment: Which ifs have causal answers. *Journal of the American Statistical Association*, 81, 961–962. doi:10.1080/01621459.1986.10478355
- Rugulies, R., Christensen, K. B., Borritz, M., & Villadsen, E. (2007). The contribution of the psychosocial work environment to sickness absence in human service workers: Results of a 3-year follow-up study. *Work & Stress*, 21, 293–311. doi:10.1080/02678370701747549

- Salin, D. (2003). Ways of explaining workplace bullying: A review of enabling, motivating and precipitating structures and processes in the work environment. *Human Relations*, 56, 1213–1232. doi:10.1177/00187267035610003
- Scheindlin, S. A. (2015). Will the widespread use of police body cameras improve police accountability? *Americas Quarterly*, 9, 24–27.
- Skogan, W. G. (1974). The validity of official crime statistics: An empirical investigation. *Social Science Quarterly*, 55, 25–38.
- Sproull, L., Subramani, M., & Kiesler, S. (1996). When the interface is a face. *Human-Computer Interaction*, 11, 97–124. doi:10.1207/s15327051hci1102_1
- Spybrook, J., Bloom, H., Congdon, R., Hill, C., Liu, X., Martinez, A., & Raudenbush, S. (2013). Optimal design plus empirical evidence (version 3.01) [Computer software]. Retrieved from <http://hlmssoft.net/od/3030004006>
- Stagecoach Group. (2017). Retrieved February 9, 2018, from <http://www.stagecoach.com/>
- Taneja, S. (2014). Violence in the workplace: A strategic crisis management issue. *Journal of Applied Business and Economics*, 16, 32–42.
- Tyler, T. R., & Lind, E. A. (1992). A relational model of authority in groups. *Advances in Experimental Social Psychology*, 25, 115–191. doi:10.1016/S0065-2601(08)60283-X
- U.S. Department of Labor. (2002). *Occupational safety and health administration*. Retrieved February 6, 2018, from <https://www.osha.gov/SLTC/workplaceviolence/>
- Varca, P. E. (1999). Work stress and customer service delivery. *Journal of Services Marketing*, 13, 229–241. doi:10.1108/08876049910273853
- Walsh, D. P. J., & Conway, V. (2011). Police governance and accountability: Overview of current issues. *Crime, Law and Social Change*, 55, 61–86. doi:10.1007/s10611-011-9269-6
- Waschglar, K., & Ruiz-Hernández, J. A. (2013). Patients' aggressive behaviours towards nurses: Development and psychometric properties of the hospital aggressive behaviour scale-users. *Journal of Advanced Nursing*, 69, 1418–1427. doi:10.1111/jan.12016
- Weisburd, D., & Britt, C. (2007). *Statistics in criminal justice*. Berlin, Germany: Springer Science & Business Media. ISBN: 978-1-4614-9169-9.
- Weisburd, D., & Gill, C. (2014). Block randomized trials at places: Rethinking the limitations of small N experiments. *Journal of Quantitative Criminology*, 30, 97–112. doi:10.1007/s10940-013-9196-z
- Welsh, B. C., Mudge, M. E., & Farrington, D. P. (2010). Reconceptualizing public area surveillance and crime prevention: Security guards, place managers and defensible space. *Security Journal*, 23, 299–319.
- Whichard, C., & Felson, R. B. (2016). Are suspects who resist arrest defiant, desperate, or disoriented? *Journal of Research in Crime and Delinquency*, 53, 564–591. doi:10.1177/0022427816632571
- White, M. D. (2014). *Police officer body-worn cameras: Assessing the evidence*. Washington, DC: Office of Justice Programs, US Department of Justice.
- Wicklund, R. A. (1975). Objective self-awareness. *Advances in Experimental Social Psychology*, 9, 202–219. doi:10.1016/S0065-2601(08)60252-X
- Yagil, D. (2008). When the customer is wrong: A review of research on aggression and sexual harassment in service encounters. *Aggression and Violent Behavior*, 13, 141–152. doi:10.1016/j.avb.2008.03.002
- Yokum, D., Ravishankar, A., & Coppock, A. (2017). *Evaluating the effects of police body-worn cameras: A randomized controlled trial*. LAB@ DC. Retrieved from https://bwc.thelab.dc.gov/TheLabDC_MPD_BWC_Working_Paper_10.20.17.pdf
- Young, J. T. N., & Ready, J. T. (2015). Diffusion of ideas and technology: The role of networks in influencing the endorsement and use of on-officer video cameras. *Journal of Contemporary Criminal Justice*, 31, 243–261. doi:10.1177/1043986214553380

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Lorna McEwan is a uniform chief inspector with British Transport Police based in Leeds. She has a passionate interest in making the rail network safer and more effective use of technology to do this. Her day to day work focuses on reducing crime within her geographic area of responsibility working with both stakeholders and public to do so. She loves people watching and meeting people so this role provides her that opportunity daily.

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