Elevated Police Turnover following the Summer of George Floyd Protests: A Synthetic Control Study*

SCOTT M. MOURTGOS, University of Utah

IAN T. ADAMS, University of Utah

JUSTIN NIX, University of Nebraska Omaha

Several of the largest U.S. police departments reported a sharp increase in officer resignations following massive public protests directed at policing in the summer of 2020. Yet, to date, no study has rigorously assessed the impact of the George Floyd protests on police resignations. We fill this void using 60 months of employment data from a large police department in the western US. Bayesian structural time-series modeling shows that voluntary resignations increased by 279% relative to the synthetic control, and the model predicts that resignations will continue at an elevated level. However, retirements and involuntary separations were not significantly affected during the study period. A retention crisis may diminish police departments' operational capacity to carry out their expected responsibilities. Criminal justice stakeholders must be prepared to confront workforce decline and increased voluntary turnover. Proactive efforts to improve organizational justice for sworn personnel can moderate officer perceptions of public hostility.

Keywords: police turnover, Floyd protests, Bayesian structural time series, resignations

Introduction

Following George Floyd's death at the knee of Minneapolis police officer Derek Chauvin on May 25, 2020, thousands of protests (and in some cases riots) occurred across the United States. As a result, the institution of policing found itself once again embroiled in demands for reform. Concurrently, a significant portion of the rhetoric surrounding policing during this period was exceptionally negative (e.g., "All Cops Are Bastards" or "ACAB" became a rallying cry among some critics of policing). Some allege that sustained public scrutiny of this sort sparked an increase in police resignations across the country. For example, over 100 officers left the Minneapolis Police Department – more than double the departures that occur in a typical year (Bailey, 2020). In Portland and San Francisco, it was reported that police officers were leaving in record numbers (Colton, 2020; Wallace, 2020). The Chicago Police Department experienced a fifteen percent increase in retirements in 2020 compared to 2019 (Main & Spielman, 2021). The monthly loss of officers from the New York City Police Department (NYPD) was approximately double the amount experienced in 2019, leaving the NYPD with its lowest headcount in ten years (DeStefano, 2020). Finally, the Seattle Police Department was reportedly on pace to lose 200 officers by the end of 2020 in what has been described as a "mass exodus," leaving the agency with its fewest police officers since 1990 (Rantz, 2020).

These initial reports are concerning. Fewer officers per capita has been linked to higher crime rates (Kovandzic & Sloan, 2002; Levitt, 1997; Marvell & Moody, 1996; Mello, 2019), and in 2020, many jurisdictions experienced a dramatic increase in homicides and shootings (Rosenfeld et al., 2021). However, year-to-date comparisons regarding police turnover can be misleading. Resignations and retirements from police departments occur every year regardless of public criticism or civil unrest. In fact, a policing 'workforce crisis' was identified well before the events surrounding and following George Floyd's death (PERF, 2019). Policing has been dealing with decreased applicants, increased resignations, increased agency competition in recruitment

and transfers, and a pending retirement bubble for at least a decade (PERF, 2019; Wilson, 2012; Wilson et al., 2010). The challenge, then, is to estimate the counterfactual: how many officers would have retired or resigned in 2020 absent the George Floyd protests? In other words, is the observed increase in police resignations significantly larger than we would have otherwise expected? Or is it merely the continuation of an already existing trend?

This study examined the effect of an abrupt shift in the socio-political climate following George Floyd's death on police turnover in one large, capital city jurisdiction in the western US. Specifically, we considered three categories of police turnover – resignations, retirements, and involuntary separations – using Bayesian structural time-series (BSTS) modeling, a time-series quasi-experimental method (Brodersen et al., 2015). Findings indicate that while retirements and involuntary separations did not experience significant changes during the post-Floyd period, police resignations increased substantially. Further, probabilistic forecasting models predict continued elevated rates of police resignations.

Police Turnover

Understanding trends in police turnover is essential. Though the evidence is quite mixed, some studies have shown that more police per capita is associated with lower levels of crime – particularly violent crime (Chalfin et al., 2020; Chalfin & McCrary, 2018; Kovandzic & Sloan, 2002; Levitt, 1997; Marvell & Moody, 1996; Mello, 2019; Mourtgos & Adams, 2019a)[1]. Specific to police resignations, Hur (2014) found that increased rates of voluntary officer turnover are associated with increased rates of violent and property crime. The direct and indirect costs of police turnover extend beyond crime levels, however. For example, direct costs consist of expenses required to hire replacements: background checks, psychological assessments, medical assessments, and training expenses (Hilal & Litsey, 2020). It is estimated that the cost of losing an officer ranges from one to five times the salary of that officer (Orrick, 2008). Indeed, a police agency's return on investment in an employee is lost when that employee quits after receiving training and education at the agency's expense (Hur, 2014).

Indirectly, when officers leave, both the organization and the community lose accumulated institutional knowledge and specific professional knowledge and skills (Hilal & Litsey, 2020; Hur, 2014). Leavism can lead to decreased quality of service and productivity (Hilal & Litsey, 2020). Often termed a "brain drain," the reduction in performance levels and increased operational risks driven by high turnover are just as real as replacement costs, though they are difficult to quantify (Wilson et al., 2010). On a large enough scale, turnover can hinder a police agency's ability to engage in proactive problem-solving and respond to calls for service, which in turn could contribute to increased crime and further erosion of public trust (Bailey, 2020; MacLean, 2020; Ren et al., 2005).

In sum, high levels of police turnover have harmful effects at the organizational and community levels. Wilson (2012, p. 333) succinctly outlined this problem:

> Police employee success is a function of officer experience and ability to make sensible decisions with little supervision or oversight. By reducing the number of officers with experience, turnover inhibits effective decision making. It diminishes the strength and cohesion a department gains from experienced staff. Agencies with higher turnover and less-experienced officers suffer reduced productivity and more-frequent complaints. The cost of training sworn police officers is substantial, particularly in comparison to other fields. The high level of organizational and job-specific knowledge required of police officers also means that high turnover can impair organizational performance and service delivery while replacement personnel are selected and trained.

---

[1] That said, upon meta-analyzing 62 studies concerned with the relationship between police force size and crime, Lee et al. (2016, p. 431, emphasis added) concluded that "the overall effect size for police force size on crime is negative, small, and not statistically significant."

Police agencies often turn to increased monetary compensation to combat increased turnover (Wilson et al., 2010). Like other organizations, police agencies view increased salaries as a way to encourage employee retention. As Schuck and Rabe-Hemp (2018) found, there is merit to this strategy. Analyzing data from a national sample of over 2,000 law enforcement agencies, they found that agencies paying higher salaries were less likely to experience voluntary and involuntary turnover. As the authors note, investing in higher wages upfront saves organizations from increased costs due to turnover in the long run. Early investment also reduces involuntary turnover, which is typically driven by misconduct and is costly in terms of public trust and legitimacy.

However, monetary compensation is only one of several factors known to influence officer turnover. As Giblin and Galli (2017, p. 398) note, higher salaries may be used in an attempt to offset less favorable considerations: "[T]he supply of prospective officers fluctuates based on the perceived appeal of…law enforcement." For example, while Schuck and Rabe-Hemp (2018) found that higher salaries were associated with lower turnover rates, they also found that police agencies with a higher propensity for dangerous or strained police-citizen encounters were more likely to have elevated levels of turnover. This turnover can hamper organizational efforts to repair damaged relationships between agencies and the public they serve, as the "reality of strained budgets and long-standing issues in the hiring and retention of officers will likely pose significant barriers" to efforts such as community-oriented policing (Peyton et al., 2019, p. 19897).

Other key factors driving police turnover include loss of trust and confidence in leadership (Wilson et al., 2010; Wolfe & Lawson, 2020) and sustained negative attention (Mourtgos et al., 2020; Nix & Wolfe, 2017; PERF, 2019; Saunders et al., 2019). A given job's attractiveness depends significantly on anticipated outcomes (Steers et al., 2004). Suppose an officer's subjective beliefs regarding the non-mutuality of an exchange relationship with the public, political leaders, or organizational leaders are strongly negative. In that case, there is a feeling of loss of control and predictability, resulting in task avoidance (Paoline, 2003; Schott & Ritz, 2018), with the ultimate avoidance being quitting.

Increased turnover resulting from a perceived non-mutual relationship between officers and the public, political leaders, or organizational leaders aligns with the social psychology literature on exchange theory, equity, and reciprocity. Social exchange theory contends that individuals attempt to maximize the ratio of benefits to costs in their relationships (Thibaut & Kelley, 1959). An exchange-based model assumes individuals desire relationships in which equity is experienced. Hatfield and colleagues (1985) describe equity as a state of affairs in which the relationship's benefits and costs are proportional to the benefits and costs incurred by the other half of the relationship. Suppose officers fail to obtain equity in their relationship with their leaders or the public. For example, officers are trained to a legal and professional standard regarding their use of force. There is often, however, a significant gap between the legal and professional standards officers operate under and how some members of the public, media, and political leaders evaluate their actions (Mourtgos & Adams, 2020; Stoughton et al., 2020). Individuals who become police officers tend to do so out of a desire to help others (Moon & Hwang, 2004; White et al., 2010). By doing so, they expose themselves to physical harm (Sierra-Arévalo & Nix, 2020; Tiesman et al., 2018). If an officer uses force to protect themselves or someone else, following the legal and professional standards they have been trained to, but then experience backlash from their leaders or the public, a perception of inequity may result. In such a case, this may reduce an officer's motivation to remain a police officer (or at least remain a police officer in a specific jurisdiction), as it increases their chances of experiencing negative costs[2] (Mourtgos et al., 2020). Indeed, a loss of perceived organizational support is linked to an officer's organizational commitment, job satisfaction, burnout, and turnover intention (Adams & Mastracci, 2019; Gillet et al., 2013).

---

[2]This is not to suggest that backlash from leadership and/or the public is always unwarranted. Public attention to illegitimate police uses of force is an important democratic tool of governance. Because such acts reflect poorly on the profession as a whole, even uninvolved officers are subject to its impacts. The salience of use-of-force in the minds of the public can result in increased backlash against the institution as a whole, which can in turn increase individual officers' stress levels.

The adverse impacts from accumulated stress and burnout in law enforcement are well-studied (Dick, 2000; Mastracci et al., 2012; Mastracci & Mourtgos, 2021; McCarty et al., 2019; Sparger & Giacopassi, 1983). These include individual impacts such as increased chronic medical problems, substance abuse disorders, and marital problems, as well as organizational ones, such as increased job dissatisfaction and leavism. Stress is a multi-faceted concept. In the modern policing context, it includes the perception among officers that they are unusually vulnerable to political and social forces that might follow from even the lawful use-of-force (Mourtgos & Adams, 2019b). Negative costs may include damage to one's reputation, family stress, criminal prosecution, and loss of livelihood, depending on the circumstances (Mourtgos et al., 2020).

Indeed, Saunders, Kotzias, and Ramchand (2019) argue that researchers have not paid enough attention to how the socio-political climate affects police officers. As part of a National Institute of Justice-funded study examining police suicide, Saunders and colleagues conducted interviews in over one hundred law enforcement agencies across the United States, representing a wide range of agency type and size. While the socio-political climate was not the most frequently identified police stressor, those interviewed identified the socio-political climate as the stressor that has increased the most in recent years. Officers reported that excessive scrutiny has led to unfair expectations being placed on officers and the belief that policing is being set up for failure by the media. Many of those interviewed expressed an increasing climate of nonsupport from their communities. Further, interviewees expressed worry regarding how police actions caught on camera would be judged in the public eye without understanding police training and standards.

To be clear, the events following George Floyd's murder in May 2020 are not unique in policing (e.g., the 1968 Chicago riots, the 1992 Rodney King riots, and the riots and protests following the fatal shooting of Michael Brown in Ferguson, Missouri in 2014). Further, officer perceptions that politicians, the media, and the public misunderstand, misrepresent, and dislike them are not new (Mourtgos & Adams, 2019b). Decades ago, Niederhoffer (1967) conducted his seminal work on police cynicism and found that a substantial portion of officers generally harbored negative feelings toward the public, media, and politicians. More contemporary research has continued to reveal that many officers feel they are disliked and not trusted by entities outside their profession (Moon & Zager, 2007; Nix et al., 2020; Yim & Schafer, 2009).

Claims for profoundly adverse outcomes following similar past crises have been empirically scrutinized, with studies often indicating such claims are overblown. For example, following the 2014 protests and unrest in Ferguson, Missouri, commentators claimed that excessive criticism of police had led to a so-called "war on cops" (MacDonald, 2016). However, there is no compelling evidence that officers' working environment became any more or less dangerous than it was before Ferguson (Maguire et al., 2017; Shjarback & Maguire, 2021; Sierra-Arévalo & Nix, 2020). However, some evidence suggests that college students became more apprehensive about a career in law enforcement after Ferguson (Morrow et al., 2019; Todak, 2017). Historically, these crises have been relatively short-lived without documented substantial increases in police turnover (Rhodes & Tyler, 2019). Yet, it is certainly possible that the contemporary socio-political climate surrounding policing may have more staying power due to the salience of social media, the rapid spread of images online, and sustained negative media attention (Rhodes & Tyler, 2019).

Perhaps a tipping point has been reached, where a hostile socio-political climate has become powerful enough to drive a retreat from the police profession. Anecdotal reports from various cities indicate that this may be the case (Bailey, 2020; Colton, 2020; DeStefano, 2020; Main & Spielman, 2021; Wallace, 2020). However, as noted previously, a "workforce crisis" was identified in policing before the events surrounding George Floyd's death (PERF, 2019). For at least a decade, the policing profession has been concerned with staffing issues due to decreased applicants, increased resignations, and a pending retirement bubble (PERF, 2019; Wilson, 2012; Wilson et al., 2010). It remains to be seen whether 2020 was an atypical year in terms of officer retention.

The Current Study

Context

The current study analyzed police officer turnover from January 2016 through December 2020 in one large jurisdiction in the western US. The agency provides full-spectrum policing services to an estimated 200,000 residents and is located within a metropolitan area with a population of over one million. The department employs approximately 600 sworn officers.

George Floyd died on May 25, 2020, in Minneapolis, Minnesota. On May 30, thousands of individuals staged a protest in the studied jurisdiction based on the circumstances surrounding Floyd's death. The protest turned violent when a large crowd surrounded an occupied police vehicle in the downtown area, forcing the officer to abandon it. The vehicle was subsequently flipped and set on fire. The ensuing riot resulted in looting and hundreds of thousands of dollars in property damage (including the agency's public safety building). Several officers sustained serious injuries, and many more received minor injuries during the hours-long process of quelling the riot. Officers from around the state were required to respond to resolve the civil disorder. Following May 30, the National Guard was activated for several weeks to assist in ongoing civil unrest. Between May 30, 2020, and November 2020, the jurisdiction experienced nearly 300 protests directed at police.

In addition to the socio-political climate surrounding George Floyd's death, body-worn camera footage from an officer-involved shooting in the jurisdiction was publicly released in June. The video upset some in the community and gained persistent local media attention, increasing the negative socio-political climate surrounding policing locally. After the video footage was released, a city council member publicly declared the shooting unlawful, despite the investigation not having been completed. The subsequent independent investigation located additional surveillance camera footage clearly showing the individual who was shot had a gun and pointed it at officers. The local district attorney ruled the shooting was legally justified, but this determination prompted yet another violent riot that resulted in additional property damage and officer injuries.

In early August, the jurisdiction's mayor announced that the agency would be required to revise its use-of-force policy within 30 days. Specifically, the agency's policy would be required to go beyond the Constitutionally defined requirements for using deadly force—an 'objectively reasonable' standard—and move to a 'necessary' standard. This announcement was not well received by the agency's officers, and no other surrounding agency moved to make similar adjustments to their use-of-force policies.[3]

Data

We employed secondary data from the department for the analysis. The data consists of monthly counts of resignations, retirements, and involuntary separations (described in more detail below) from January 2016 through December 2020, providing a total of 60 observations for each measure. With the local civil unrest beginning at the very end of May 2020, a natural inflection point for ascertaining any turnover change is June 2020 (month #54). This sharp inflection point is a critical aspect of the research design. It allows for leveraging a natural experiment's power to analyze trends during the pre- and post-Floyd periods. When a series of measures are broken up by introducing an intervention that occurs at a specific point in time, time-series analysis is appropriate (Shadish et al., 2002). The sharp change in socio-political climate experienced by the agency's officers provides an opportunity for a time-series quasi-experiment to ascertain the impact (or lack thereof) on turnover.

---

[3]The revised use-of-force policy was ultimately modeled after the "necessary" language in another state's use-of-force legislation (California Assembly Bill 392). Due to a lack of clarity about how a 'necessary' standard works at the implementation level, the policy's full impact is likely yet to be felt. Though research is underway, empirical assessment of the effects of California's similar statewide effort has not yet been available.

Measures

As Hur (2014) explains, one should differentiate between voluntary and involuntary turnover due to different etiologies. While voluntary turnover is a decision made by the employee (whether due to individual perceptions, organizational characteristics, labor market conditions, or otherwise), involuntary turnover is not. When an employee is involuntarily terminated, it is because of misconduct (layoffs may be considered another type of involuntary turnover, but no layoffs occurred during the study period). Recognizing this, and to allow for a more nuanced understanding of the socio-political climate's effect on officer turnover, three measures of turnover were constructed: resignations, retirements, and involuntary separations. All three measures were recorded from January 2016 through December 2020, providing 60 time-series data points for each measurement. Table 1 provides the annual counts for each of the three measures.

Resignations

Resignations consist of monthly counts of officers voluntarily leaving the police department before becoming eligible for retirement.

Retirements

Retirements consist of monthly counts of officers voluntarily leaving the police department after being eligible for retirement. Based solely on counts, it is impossible to ascertain the reason why an individual retired (i.e., low job satisfaction, age, or otherwise). In this particular agency, officers are qualified for retirement at either 20 or 25 years, dependent upon their entrance into law enforcement employment. Accordingly, retirements were analyzed separately from resignations.

Involunatary Separations

Involuntary resignations consist of monthly counts of officer terminations. While possible that a socio-political climate calling for additional accountability could lead to an increased level of officer terminations[4], the etiology of any change in this type of turnover is different from voluntary resignations or retirements. Accordingly, it was analyzed separately.

Table 1: 2016 - 2020 Turnover Measures

Year	Resignations	Retirements	Involuntary Separations
2016	5	21	2
2017	9	22	3
2018	18	29	4
2019	19	21	5
2020	37	26	8

Method

Bayesian Structural Time Series (BSTS) modeling was used for the analysis. BSTS models are ideal because they are flexible and modular. They allow the investigator to determine whether short- or long-term predictions are more important, to account for seasonal effects, and whether to include regressors (Scott, 2017). Further,

---

[4]The agency reports there were no involuntary separations in 2020 related to allegations of police misconduct during the protests.

by working in a Bayesian framework, investigators can better acknowledge and incorporate uncertainty into statistical models and discuss outcomes in terms of probabilities (Mourtgos & Adams, 2021).

The analysis proceeds in three steps. First, BSTS models are estimated for each measure. Each model's time series is decomposed, and resulting plots are examined for any apparent change in turnover beginning in June 2020 for all three measures. Second, a causal impact analysis is performed (explained in more detail below) to assess the post-Floyd socio-political climate's effect on police turnover. Finally, a probabilistic one-year turnover forecast is estimated.

Analysis

BSTS Models for Resignations, Retirements, and Involuntary Separations

BSTS models are best described as observation equations, linking observed data with an observed latent state and transition equation. The transition equation describes the development of the latent state over time. The observation equation is defined as

$$y_t = Z_t^T \alpha_t + \varepsilon_t$$

where y_t is a scalar observation, Z_t is an output vector, and α_t is the unobserved latent state. The transition equation is defined as

$$\alpha_{t+1} = T_t \alpha_t + R_t \eta_t$$

where α_t is the unobserved latent state, T_t is the transition matrix, and R_t is the control matrix. $R_t \eta_t$ allows the inclusion of seasonality in the analysis. The error terms (ε_t and η_t) are Gaussian and independent.

Use of BSTS models are ideal for social science (Brodersen et al., 2015) and have been used in other criminological studies to examine the effect of mandatory sexual assault kit testing policies on rape arrests (Mourtgos et al., 2021); the efficacy of COVID-19 vaccinations within a police workforce (Mourtgos & Adams, 2021); violence reduction as a result of gang arrests (Ratcliffe et al., 2017); the deterrent effect of unarmed private patrols (Liu & Fabbri, 2016); and the effects alcohol licensing policies have on crime (de Vocht et al., 2017). Further, BSTS models are preferrable to Auto Regressive Integrated Moving Average (ARIMA) models when examining low-volume count data, as we do here (Ratcliffe et al., 2017).

Model estimation and validation

A BSTS model was estimated for each of the measures with a local linear trend state component and a seasonal state component, allowing for a monthly seasonal parameter. A local linear trend assumes that both the mean and the slope of the trend follow random walks (Scott, 2020). Ten thousand Markov chain Monte Carlo (MCMC) iterations were simulated to fit each model.

Several post-estimation diagnostics were analyzed for all three models. First, autocorrelation plots were examined. Autocorrelation was not a problem in any of the three models. Second, a plot of the posterior distribution residuals was generated for each of the three models, showing the residuals to be normally distributed.

Third, one-step-ahead prediction errors for each model were calculated. A time series has t observed times points $(x_1..., x_t)$. Predictions are made for the model at times $t + 1$, $t + 2$, etc. If we denote the k steps ahead forecast of $x_t + k$ with data $(x_1..., x_t)$ by $x_t(k)$, then $x_t(1)$ is the prediction of $x_t + 1$ based on data up to and including time t. The one-step-ahead prediction error, then, is described as $e_t(k) = x_t +_k -x_t(k)$ and is the amount by which the model differs from the actual value once it becomes available. The mean one-step-ahead prediction errors for resignations, retirements, and involuntary separations are 0.14, -0.20, and 0.08, respectively. As explained below, the mean prediction error for resignations reported here is inflated.

However, even keeping this in mind, the average one-step-ahead prediction errors are minimal, indicating a good predictive fit for all three models.

Decomposition and assessment

Figure 1 shows the individual state components (i.e., trend and seasonal components) for each model. Decomposing and plotting trend and seasonal components separately allow one to see trends in time series data more clearly without seasonal noise. A regression line is added to each measure's trend plot. This addition allows for easy assessment of whether a significant increase occurred in any turnover measures beginning in June 2020 (the dashed vertical line).

A few observations can be made from Figure 1. First, all three measures show a positive trend over the entire period, lending credence to past concerns of a growing 'workforce crisis' in policing (PERF, 2019; Wilson, 2012; Wilson et al., 2010). Second, retirements and involuntary separations did not experience any noticeable change in trends in the post-Floyd period. Third, one can see a substantial jump in resignations above the regression line immediately in the post-Floyd period[5].

Recall that the mean one-step-ahead prediction error is inflated for the resignations model. With such a noticeable jump in resignations following the post-Floyd period, one would not expect the BSTS model to adequately predict resignations during that time. The model's predictions are based on the preceding years without the apparent exogenous shock. Accordingly, the mean one-step-ahead prediction error was recalculated for the resignation model from January 2016 through May 2020 and June 2020 through December 2020. When measured separately, the mean prediction error for the resignation model is -0.11 and 1.96, respectively—an absolute difference of 2.07. This measure is a further indication that the post-Floyd period had a significant effect on officer resignations. Based on the above observations, causal impact analysis is appropriate.

Causal Impact Analysis

BSTS models can be used to infer causal impact by predicting the counterfactual treatment response in a synthetic control that would have occurred if no intervention had taken place. The synthetic control is constructed using the experimental group's time-series behavior before and after the intervention and combining control variables predictive of the target series before the intervention (Brodersen et al., 2015).

The use of synthetic controls is not new in criminal justice research (e.g., Becker & Klößner, 2017; Donohue et al., 2019; Mourtgos et al., 2021; Mourtgos & Adams, 2021; Saunders et al., 2015). Historically, however, the

---

[5]One can observe an increase in the decomposed resignation time-series trend line before the post-Floyd period. This does not mean that a substantial rise in resignations began to occur before the post-Floyd period. Instead, this is due to the plot visualizing the model's trend rather than actual values. That is, as with any trend measure, the values before and after a specific point in time affect the trend across the entire period, not necessarily indicating what occurred during that particular point in time. In this case, November 2020 through February 2021 was a low resignation period, with zero resignations. One can see this uncharacteristically quiet resignation period pulling the decomposed trend line below the regression line. However, from March 2021 through May 2021, resignations begin to occur again, with a total of four resignations (one, two, and one, respectively), thus resulting in an increasing trend line. We do not know of any plausible explanation for the zero resignations occurring from November through February and expect it to be naturally occurring 'noise.' Beginning in June 2020, resignations begin a significant jump with 29 resignations in total—five, four, zero, six, eleven, and three, respectively. The five resignations in June 2021 alone total more than the previous three months combined (seven months if one includes November 2020 through February 2021 when zero resignations occurred) or any other single month in the entire preceding time-series. The sustained substantial increase forces the decomposed trend line to elevate rapidly, affecting when the increasing trend appears to begin. However, when one examines the absolute values rather than the trend line, it is clear that a substantial jump in resignations did not start until June 2020 (i.e., the post-Floyd period). The decomposed BSTS models presented in Figure 1 are not meant to provide causal inference. Instead, they are meant for preliminary analysis, which indicates a sustained increase in resignations in the post-Floyd period. Using the estimated BSTS models that Figure 1 visualizes, the Causal Impact analysis provides the causal inference portion of our analysis.
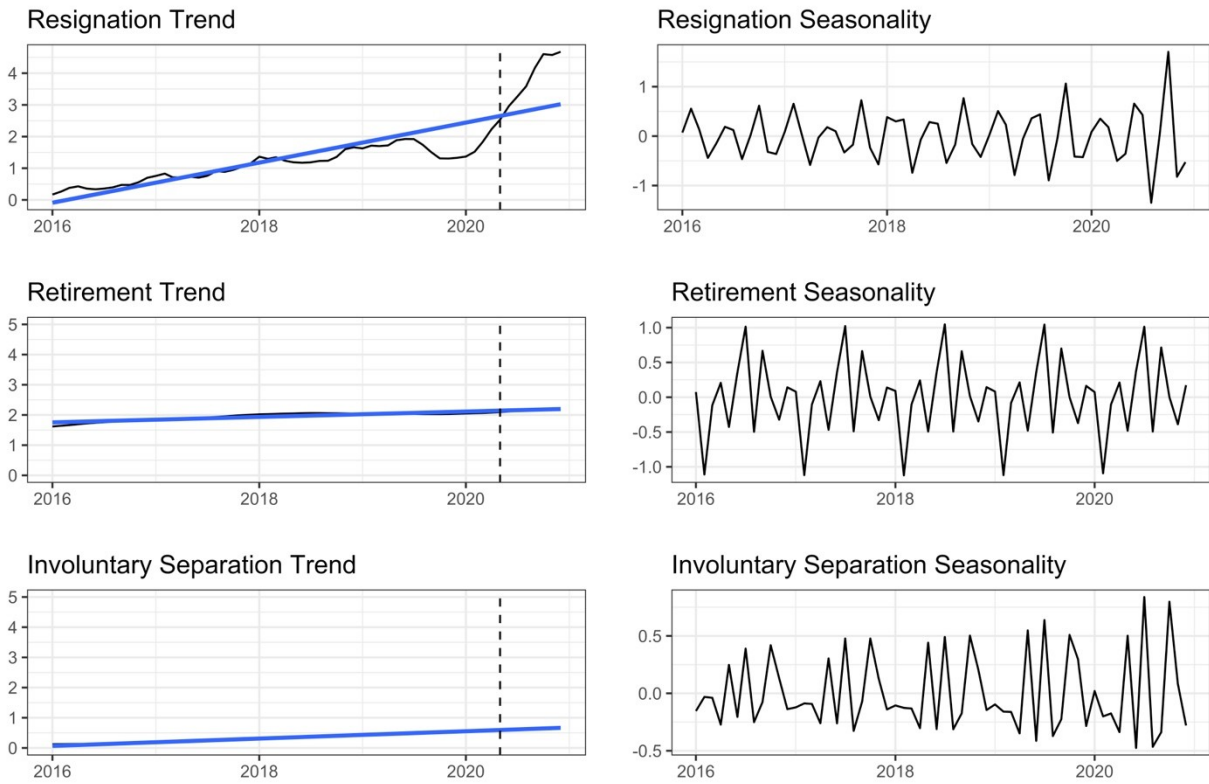
Figure 1: "Resignation, Retirement, and Involuntary Separation Trend"

selection of comparison groups has often been made "on the basis of subjective measures of affinity between affected and unaffected units" (Abadie et al., 2010, p. 493). Accordingly, as synthetic models have matured, data-driven procedures to construct synthetic controls have been advocated for and adopted, requiring researchers to demonstrate the appropriateness of their selected units for comparison.

Yet, even as counterfactual methods have advanced in sophistication, the construction of a counterfactual still typically relies on units of analysis endogenous to the entity that receives the intervention of interest. For example, Wu and colleagues (2021) construct a synthetic counterfactual to test the impact of recreational marijuana legalization on crime in Oregon by using a pool of counties within states that had not legalized marijuana. Donohue and colleagues (2019) follow a similar approach to test the effect of right-to-carry laws on violent crimes, as do Saunders and colleagues (2015) to test the efficacy of focused deterrence on crime but at the neighborhood (instead of state) level. While this method has been shown to be robust (Becker & Klößner, 2017), it still requires comparing the experimental unit to a synthetic control constructed from nonequivalent controls. That is, there is an assumption that unknown confounding variables between the experimental unit and nonequivalent controls (e.g., states, neighborhoods, police departments, etc.) are being accounted for in the statistical model.

For example, if we were to build a synthetic counterfactual for turnover based on similarly sized police agencies within the US, we would be making the assumption that (1) differences between those agencies and the communities they serve do not affect the differences observed (if any) with the experimental agency, or (2) the statistical model is adequately accounting for the differences. Police agency culture, practices, surrounding communities, and political idiosyncrasies vary greatly (Bottoms & Tankebe, 2012; Crank, 2014; Paoline, 2003). And while the more conventional synthetic control method (Abadie et al., 2010) has been shown to be robust (Becker & Klößner, 2017) and can arguably account for this variation, we believe one advantage of our methodological approach is not having to invoke this assumption. That is, we are able to build the synthetic counterfactual using the time series behavior of the experimental group prior to and after the intervention, as well as predictors specific to the agency being studied.

Model Predictors

A key component of utilizing BSTS models for causal impact analysis is the identification of predictors. Predictors are linearly regressed onto the observed values of the target series, creating the composite synthetic control series (along with the experimental group's time-series behavior before and after the intervention). Based on the analysis above, the retirement and involuntary separation measures are used for building the synthetic control for causal impact analysis. Using a Markov Chain Monte Carlo (MCMC) algorithm, computation of the posterior distribution of the counterfactual time-series is accomplished. A Gibbs sampler and Kalman filter are used to simulate from a Markov chain with a stationary distribution for model parameters θ; $p(\theta, \alpha | y_1 : n)$. The posterior incremental effect is described by $p(\widetilde{Y}_{n+1:m} | Y_{1:n} , X_{1:m})$, where $\widetilde{y}_{n+1}, \dots, \widetilde{y}_m$ describe the counterfactual response. The resulting posterior density is conditional only on the observed data and the priors. Parameter estimates and the inclusion or exclusion of covariates with static regression coefficients are all integrated out (de Vocht et al., 2017).

By placing a spike-and-slab prior over coefficients, the model can choose the proper variables to construct the synthetic control through Bayesian model averaging techniques. This ensures a particular set of covariates do not have to be committed to, nor point estimates of their coefficients, avoiding arbitrary selection of covariates and overfitting (Brodersen et al., 2015). All predictors are weighted by averaging of marginal inclusion probabilities for each regression coefficient (Dablander, 2019; de Vocht et al., 2017).

The pre-intervention time series began in January 2016 and ended in May 2020. The post-Floyd time-series started in June of 2020 and continued through December of 2020. Accordingly, the pre-intervention series is

53 months in length, with a post-intervention span of 7 months. Ten thousand MCMC samples were drawn for the analysis, with 95% posterior distribution credible intervals generated[6]. Results for the model assessing change in resignations are presented in Figure 2.
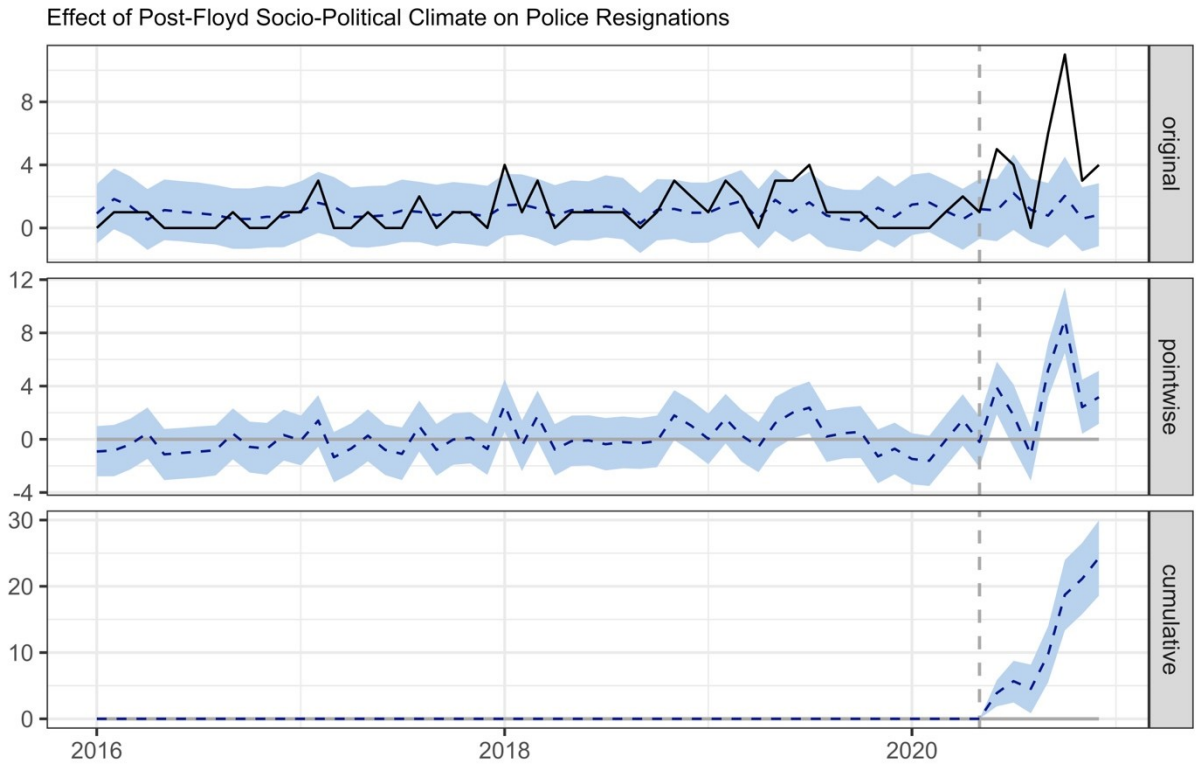

Figure 2: "Effect of Post-Floyd Socio-Political Climate on Police Resignations"

Figure 2 contains three panels. The panel labeled "original" shows the data and a counterfactual prediction for the post-treatment period. The counterfactual prediction is the horizontal dashed line, with a corresponding 95% credible interval surrounding it. The solid line represents the observed data. The panel labeled "pointwise" represents the pointwise causal effect, as estimated by the model. That is, it shows the difference between observed data and counterfactual predictions. The panel labeled "cumulative" visualizes the intervention post-treatments cumulative effect by summing the second panel's pointwise contributions. The dashed vertical line represents the intervention date (i.e., June 2020).

Table 2: Causal Impact Posterior Inference

Parameter	Average	SD	95% CI
Actual Resignations Post-Intervention	4.71		
Predicted Resignations Post-Intervention	1.24	0.42	[0.43, 2.1]

---

[6]The frequentist analog to a credible interval is a confidence interval, yet the two concepts are statistically different. In a frequentist paradigm, confidence intervals are based on repeated sampling theory. A 95% confidence interval indicates that if the same experiment is repeated ad infinitum, the unknown, but fixed coefficient will fall within it. A credible interval can be interpreted as the probability that the population parameter is between the upper and lower bounds of the credible interval, based on the available information.

Absolute Effect	3.47	0.42	[2.65, 4.28]
Relative Effect	2.79	0.34	[214%, 344%]

Posterior probability of a causal effect > .99

As indicated in Table 2, the post-Floyd socio-political climate is associated with increased police officer resignations at the studied police department. During the post-intervention period, the study had an average of five (4.71) officers resigning per month. By contrast, in the absence of an intervention, a counterfactual average of one (1.24) officer resignations per month would be expected. Subtracting this prediction from the observed response yields an estimate of the absolute causal effect the intervention had on resignations (3.47), resulting in a 279% relative increase in officer resignations. The posterior probability of the observed effect is >.99. In other words, there is an extremely high probability that the post-Floyd socio-political environment exerted a positive effect on officer resignations at the studied police department.

Forecasting

Assessing the effect of past events is not the only interest of this study. Of practical consequence is forecasting continued officer resignations into the future. The BSTS model for resignations can be used to provide a probabilistic forecast for future resignations. Figure 3 plots the resignation forecast for one year beyond December 2020.

In Figure 3, the blue line represents the median number of resignations the forecast model predicts. The dashed lines represent 95% credible intervals. The one-year forecast indicates continuing increases in resignations, predicting a median value of five (5.43) officer resignations per month. Noteworthy are the credible intervals in the forecast, allowing for a greater probability of increased resignations than a decrease in resignations. According to the forecast, it is more probable that the studied department will experience increasing resignations over the next year than decreasing resignations.

Forecasts are not destiny. Any number of external factors (the economy, pay increases, political shifts, etc.) could affect resignations (negatively or positively). The forecast cannot account for these possibilities. Rather, the forecast takes the BSTS model in its entirety (both pre- and post-Floyd) and estimates a probabilistic projection for the next 12 months based on the preceding data. Moreover, at some point one would expect a threshold to be met, at which officers prompted to leave by the post-Floyd socio-political environment have done so, and the studied agency returns to 'normal' attrition levels[7].

One way to assess the above-listed forecasting limitations is by comparing the forecast with continued observations. We obtained an additional two months of resignation data since the one-year forecast was projected (January and February 2021). The one-year forecast posterior distributions estimated a median value of five (5.019) resignations in January 2021 and five (5.396) resignations in February 2021. Actual resignations in each month were four additional officers. The observed values are below the projected resignation values, possibly indicating a pending reduction in resignations. However, the error is low. Thus, the studied agency may not yet be out of the woods regarding continued resignations.

---

[7]We are not able to investigate how the post-Floyd socio-political environment affects recruitment. While a resignation maximum threshold will likely be met at some point, recruitment could potentially continue to suffer. However, this is an empirical question – one which this and other agencies should be assessing.

Figure 3: "1-Year Forecast of Officer Resignations"

Discussion

For the past decade, there has been growing concern about a "workforce crisis" in policing, characterized by an increase in officers leaving the profession (through resignation or retirement), as well as fewer individuals applying to become police officers (PERF, 2019; Wilson, 2012; Wilson et al., 2010). Since the fallout from the fatal police shooting of Michael Brown in Ferguson, Missouri, in August 2014, these concerns have only grown. Yet, the impact of the socio-political climate on police recruitment remains unclear. While Morrow and colleagues (2019, 2020) provide evidence of college students being more reticent to become police officers post-Ferguson (see also Todak, 2017), Rhodes and Tyler (2019) found no evidence of a post-Ferguson decrease in police applicants in one major metropolitan police department.

While empirical research on police recruitment is scant, empirical research on police turnover is even more lacking. A better understanding of police turnover dynamics is crucial as it affects both police organizations and the communities they serve. In the present study, we examined the effect of a sharp change in the socio-political climate on officer turnover in a large metropolitan police department. We show the socio-political environment did not significantly affect retirements or involuntary separations (although both showed an increasing trend across the full period, lending credence to previous concerns about a shrinking police workforce). However, shortly after protests surrounding George Floyd's murder began, there was a 279% increase in officer resignations compared to the synthetic counterfactual.

Empirical evidence of such a substantial increase in police resignations, paired with anecdotal accounts from other agencies country-wide (Bailey, 2020; DeStefano, 2020; Main & Spielman, 2021; Rantz, 2020; Wallace, 2020), is concerning for many reasons. A large exodus of experienced officers from a police department can result in a "brain drain," where institutional knowledge, along with job experience and skill, are lost from a department. This loss can reduce performance levels and increase operational risks as newer, less experienced officers replace veterans (Hilal & Litsey, 2020; Hur, 2014; Wilson, 2012). Prior research indicates that experience is associated with decreased verbal and physical force (Paoline & Terrill, 2007) and better performance (Sanders, 2008). That being said, prior research also points to experienced officers having lower levels of job satisfaction (Johnson, 2012) and higher levels of cynicism (Hickman et al., 2004). Future research must continue to study the correlates and consequences of police turnover, particularly in agencies where turnover is characterized by rapid replacement of veterans with rookie officers.

On a large scale, turnover can lead to a police agency's inability to respond to calls for service, increased crime, and erosion of public trust (Bailey, 2020; Oliveira et al., 2020). Indeed, some studies indicate that more police officers are associated with less crime (Kovandzic & Sloan, 2002; Levitt, 1997; Marvell & Moody, 1996; c.f. Lee et al., 2016). Recent research suggests a correlation between police force size and community violence, such that each additional ten officers abates approximately one homicide (Chalfin et al., 2020). The authors also note that "although the total reduction in homicide is roughly equal across Black and white victims, the decline in homicide is twice as large for Black victims in per capita terms" (p. 4). Thus, a rapid departure of police officers from a jurisdiction may have a disproportionately negative impact on communities of color (Nix & Wolfe, 2020). Using RAND's cost of crime calculator and open-source crime data from the studied agency's website, the experienced loss of 33 officers to resignation can be expected to result in an $11.64 million increase in crime costs over a year's period, with the value of each individual officer estimated at $357,533 (RAND, 2021).

More analogous to this study is a recent study published by Piza and Chillar (2020), who found that when the Newark Police Department laid off 13% of its officers in 2010, violent and property crime promptly increased. Further, overall crime and violent crime became progressively worse each year following the police layoffs. While the cause of the turnover examined by Piza and Chillar is different from the reason examined in this study (i.e., layoffs versus resignations), the two studies inform each other as they are both concerned with sudden, substantial increases in turnover, rather than gentle ebbs across time. It was beyond our study's scope

to ascertain the causal effect of rapid resignations on crime in the jurisdiction. However, it should be noted that – similar to other cities across the United States – this jurisdiction experienced a 22% increase in violent crime and a 25% increase in property crime in 2020. This could be due at least in part to the agency abruptly becoming understaffed in the summer of 2020, but of course, it might also be a function of societal disruptions caused by the COVID-19 pandemic (Rosenfeld & Lopez, 2020).

Concerns regarding police turnover and crime are compounded by the realities of how police hiring works. For starters, a months-long hiring process is required to ensure high standards are met. The hiring process typically consists of a psychological exam, medical screening, interview, background check, and more. Once hired, though, police officers are not "road-ready." They must graduate from a police academy and then complete a field training phase. While the length of academy and field training varies from jurisdiction to jurisdiction, it takes approximately ten months to have an officer ready to function as a solo police officer in the agency we studied. Our forecasting analysis is instructive when considering the ability of the agency to recover resignations through increased hiring. Assuming that the police department could recruit and hire 33 officers (approximately 6% of its entire sworn staff) to replace those who resigned (i.e., not including the officers who retired or were terminated during the same period), it would take almost a year for those 33 new officers to fill the vacancies. In the meantime, during every month of the year it takes to train the new officers, the above forecasting model predicts an additional five officers will be resigning, equating to a continuing net loss. Accordingly, for this agency to adequately address their turnover, they will need to hire well ahead of their authorized size to experience substantial staffing improvements. Considering that retirements and involuntary separations will likely also continue to occur, it is clear that it will take some time until the agency can return to its full strength. While forecasting is not destiny, this agency, and others experiencing similar trends, have good cause for concern.

Financial Costs

There are significant financial costs associated with police turnover. These costs include the actual hiring process and new officers' equipment (Hilal & Litsey, 2020). It is estimated that the cost of losing an officer ranges from one to five times the salary of that employee (Orrick, 2008). There have been well-publicized calls to "defund" or even "abolish the police" since George Floyd's death (Kaba, 2020; Vitale, 2017). While the modern concept is relatively ill-defined, the potential impacts of "defunding" could resemble what has historically occurred following significant police budget cuts.. For example, during the Great Recession many cities were forced to decrease police staffing out of financial necessity (Wilson et al., 2010). Along with the decrease in officers working in the community, more crimes went unsolved, community outreach programs suffered, and response times increased. Moreover, officers were required to work more overtime, and use-of-force complaints rose (Weichselbaum & Lewis, 2020). Supporting research further shows that when Newark Police Department laid off approximately 13% of its police force in response to the 2008 recession, violent, property, and overall crime increased in response (Piza & Chillar, 2020), with the well-known costs of crime passed onto the city.

Similar problems may be compounded contemporarily with an exceptionally hostile socio-political climate surrounding policing, as officers experiencing an antagonistic relationship with the public more strongly endorse coercive tactics and use more physical force (Marier & Moule, 2019; Muir, 1977; Terrill et al., 2003). If violent crime continues to increase, we may enter a negative feedback cycle, as increased victimization is associated with decreased confidence in the police (Ren et al., 2005). While reasonable people can disagree on the merits of "reimagining policing," a socio-political climate that results in substantial increases in police turnover may be failing to remember what recent history taught us.

Perhaps public monies invested in policing are better suited for other crime reduction efforts or community outreach programs, as proponents of the #DefundThePolice movement contend. If cities move forward with

"defunding" their police departments, it will be imperative that they (1) have a plan for how the money saved will be reallocated, (2) establish clear goals and objectives, and (3) rigorously evaluate outcomes.

Long-term Effects

Finally, a substantial increase in turnover not only can have immediate negative effects on the organization and community, it can also have negative consequences throughout the organization for decades to come by disrupting workforce cohorts. As Wilson and Heinonen (2012) demonstrate, balance in a police agency's workforce structure is important. For example, suppose there is a high level of turnover at the senior level. In that case, the organization may have to progress junior officers to higher ranks before they possess the skills or experience to fulfill those duties. Likewise, needing to quickly replace large numbers of personnel results in a large pool of junior officers, thus inflating the pool of individuals looking to eventually progress to higher ranks. If progression comes too slowly because of a large cohort competing for a small number of senior positions, the organization can face a future of frustrated and less satisfied members, possibly resulting in increased future turnover.

Wilson and Heinonen (2012) provide several detailed progressions of workforce structure imbalances and the resultant negative consequences. Due to data limitations, we cannot determine if the experienced turnover at the studied department may result in a workforce structure imbalance. However, we call attention to an increased likelihood of these imbalances resulting from sudden, increased turnover and suggest this is an area demanding attention from policing scholars.

Addressing a Resignation Crisis

So, what can be done to reduce police resignations given the current socio-political climate? We offer several suggestions. First, more police agencies should publish data (e.g., use-of-force, stops, arrests, staffing) promptly—either on their website or repositories like the Police Data Initiative. Such transparency is critical for policing in the 21st Century (President's Task Force on 21st Century Policing, 2015). Generally speaking, open access to police data can help nurture trust between the police and the community. When a controversial incident (like the killing of George Floyd or the shooting of Jacob Blake) occurs, journalists and citizens can quickly ascertain how the police in their community perform in regards to use-of-force, racial disparities, and other outcomes, rather than being left to assume issues in one city are representative of all cities.

Second, police executives and their political sovereigns must carefully balance their responsibilities to investigate and discipline misconduct quickly, while doing so in a way that is likely to be perceived by officers as fair (Nix & Wolfe, 2017). There is a statistically significant and sizeable relationship between perceived organizational justice and desirable officer attitudes and behaviors (Wolfe & Lawson, 2020). Recent work suggests that officers who perceive greater organizational justice are less sensitive to the ill effects of heightened public scrutiny (Nix & Wolfe, 2016). Further, they are less likely to "de-police" in response to a legitimacy crisis (Mourtgos & Adams, 2019b) and instead appear to remain committed to working with residents to solve problems in their communities (Wolfe & Nix, 2016). More generally, research indicates that officers who believe their agencies treat them fairly are less cynical (Bradford & Quinton, 2014), hold more favorable views toward the public (Myhill & Bradford, 2013; Tankebe, 2014; Trinkner et al., 2016), and are less likely to engage in misconduct (Wolfe & Lawson, 2020). Research expects that organizationally-just policy has secondary effects that may help agencies retain officers during times of crisis, through lower levels of depression (Y. Wu et al., 2017), distress and maladaptive behaviors (Trinkner et al., 2016), and work-related burnout among officers (Adams & Mastracci, 2019).

In other words, while agencies have little control over how nationalized stories of police misconduct affect

public opinion, leaders *can* select and train their front-line supervisors to provide a buffer between community hostility and their sworn personnel (Wolfe et al., 2018). President Obama's *Taskforce on 21st Century Policing* recognized that organizational justice must precede enhanced trust between police and the communities that depend upon them (President's Task Force on 21st Century Policing, 2015). The organizational literature is vast (see Wolfe & Lawson, 2020, for a recent meta-analysis), but some general approaches to improving organizational justice include giving room for officers to express their feelings about current events affecting them; revisiting and revising policies with an eye towards clarity of procedure and expectations; enhancing due process for officers facing investigation; and ensuring that resulting discipline is consistent and fair. Executive leadership can model these behaviors, train their supervisors to follow suit, and work to ensure their officers carry those same behaviors out to their street-level behavior and decision making.

Finally, politicians and journalists should resist going along with poorly framed narratives. The use of descriptors like "epidemic" to describe civilian deaths resulting from .0002% of *all* police-citizen encounters (Harrell & Davis, 2020; Washington Post, 2021) is at best misleading, at worst dangerous. The framing of how often and why police-involved fatalities occur can have powerful effects on the way individuals think about police use-of-force specifically, and policing more generally. Labeling *every* police-involved death as the result of "police violence" wrongly suggests the officer is the sole cause of every police-involved fatality, diminishing the citizen's contribution to the outcome (Nix, 2020).

Poorly framed narratives foster a 'no-win' socio-political climate for police officers. For example, the initial video footage of the Jacob Blake shooting in Kenosha, Wisconsin, was inconclusive. While the local police union asked for the public to withhold judgment until the investigation was complete, the narrative of an unarmed Black man being shot in the back while entering his vehicle quickly spread across the nation (McLaughlin & Vera, 2020). Even after an independent investigation found that Jacob Blake was armed with a knife while actively resisting a lawful arrest—Jacob Blake also gave a public interview admitting to being armed with a knife (Winsor et al., 2021)—prominent news agencies continued to describe the incident as a police officer shooting an unarmed Black man (Wulfsohn, 2021). While this incident's effects on police retention and morale in Kenosha remain to be seen, the rushed and inaccurately framed narrative led to rioting in Kenosha, exacerbating an already hostile socio-political environment. This incident also serves as a reminder that police officers are not the only ones impacted by such poorly framed narratives: the damage to buildings and businesses from the Kenosha riots was estimated at $50 million (Flores, 2020).

To be clear, we are not advocating for indiscriminate defense of all police behavior. All stakeholders must ardently oppose police misconduct. However, political and organizational leaders (if not news agencies) have an ethical responsibility to their employees and communities to lead with patience and reason. For politicians and police executives, this is accomplished by ensuring comprehensive and independent investigations and addressing any misconduct appropriately when and if it is found. For journalists, it means, at a minimum, doing their due diligence to speak with researchers who can situate incidents within the proper broader context. For their part, researchers who have subject matter expertise should pick up the phone – or click "reply" – when journalists contact them about stories. In this regard, entities like the Crime and Justice Research Alliance are an excellent resource – they can help connect journalists with researchers, and provide training for researchers interested in learning about how to communicate their research to broader audiences.

Limitations

Some limitations impact our ability to confidently generalize this study's findings, suggesting the need for further research in varying contexts. At a broad level, the debate over potential linkages between protests and police turnover does not end with the findings presented here. Undoubtedly, there are differences among

states, jurisdictions, and law enforcement modalities that were not addressable in the current study. Of considerable interest: did cities that experienced significant protesting suffer higher officer turnover rates than nearby/similar jurisdictions that did not experience such incidents? More evidence is required to determine if the large effect detected here can be generalized to other jurisdictions. While the advent of social media and telecommunication technology allows an event in Minneapolis to be viewed by individuals from Portland, Oregon to Portland, Maine, local responses to these 'national' events varies. While George Floyd's death had a substantial effect on policing in Minneapolis (Bailey, 2020), it may have had less of an effect on police turnover in other areas of the country. Some cities with early re-imaginings of policing have since re-litigated the question, with some locales moving from an initial "defunding" position to much smaller budget decreases, or even substantive increases to police budgeting (Akinnibi et al., 2021). The current study cannot address this class of limitation due to the lack of timely and accessible police staffing data, but we urge future scholars to consider a design capable of answering it.

We are also unable to point to the exact reasons individual officers chose to resign. As Paoline and Gao (2020) show, there is substantial variation in how satisfied and dissatisfied officers perceive various dimensions of their work. For example, satisfied officers appear to prioritize public perception and respect more than dissatisfied officers, while dissatisfied officers seem more attentive to factors such as pay and benefits. This variation could conceivably explain which officers are more likely to resign in the face of circumstances similar to the protests of 2020. There may also be variation in resignations by officer demographics, including tenure length, age, race and ethnicity, and gender. Again, data limitations at the agency level preclude our own analysis at the individual level. We resist speculation without investigation and suggest future scholarship to pursue related research questions to understand personal motivation better. Agencies themselves should also consider using detailed exit and "stay" interviews to build an evidence base of what is, and is not, driving resignations in their organization. Researchers can assist in analyzing such data, but the agencies themselves should begin with proactive efforts to collect the data in the first instance.

We must also withhold any speculation regarding potential impacts on law enforcement recruitment in the face of shifting socio-political winds. We were not able to secure access to recruitment data for this study. Further research in this area, particularly regarding any impact from the 2020 protests, is strongly recommended in order to present a balanced assessment of the overall employment crisis in policing.

Our study's single-agency nature leaves at least one other outstanding question: Are officers permanently leaving the profession, or just relocating to other departments? It may be that officers in our study chose to leave a sizeable, capital city police jurisdiction that has been the focal point of local protests and riots for the perceived safety (professional and political, if not physical) of nearby suburban or rural departments (Bradley, 2020; PERF, 2019). Locally, at least twenty geographically contiguous jurisdictions reported shortages in their hiring and retention efforts over the past several years. Our conversations with local chiefs in these agencies, who report hiring back officers who had previously left, provide anecdotal support that at least some of the studied agency's turnover may be attributable to this phenomenon.

Additionally, we were unable to control for the potential impact of COVID-19 on police officer turnover in our model. The biological exposure risks of policing are genuine (Mourtgos & Adams, 2021), and it is entirely possible that pandemic-related stress among officers in this agency accumulated over time, reaching a tipping point during the protests. It is also possible that economic anxiety about being unemployed protected against pandemic-related leavism in law enforcement. Ultimately, we are not aware of any contemporaneous accounts of officers leaving the profession due to pandemic-related concerns, but given the likelihood of increased officer stress during the pandemic, the possibility should not be dismissed without further investigation (Stogner et al., 2020). Indeed, the intertwining of pandemic and protest in 2020 and their effects on crime and the justice system are likely to be the focus of ongoing academic debate.

Finally, while our findings point to a concerning spike in voluntary resignations, we withhold judging all police turnover as having a negative impact. As discussed earlier, there are valid reasons to design hiring, training, discipline, and separation systems to ensure police employees can deliver the critical public service expected of them. It is conceivable that within the population of officers who resign and retire are some officers who should have been involuntarily separated. Under some analyses, less sudden and severe staffing pressure can produce pro-organizational outcomes, such as more effective resource allocation (Wilson & Weiss, 2012). It is well outside the scope of this study to make such determinations, and future work should aim to unpack competing explanations as more evidence from other contexts emerge.

Conclusion

There have been many assertions from police leaders across the US that in the wake of sustained policing protests, their agencies have experienced a significant uptick in officer turnover throughout the latter half of 2020. There have also been claims that excessive criticism has hampered or even harmed police agencies and their sworn employees in previous police legitimacy crises. While previous analyses have usually shown those claims to be overblown or even non-existent (Maguire et al., 2017; Shjarback & Maguire, 2021; Sierra-Arévalo & Nix, 2020), the present study suggests that with respect to police officer retention, there is cause for legitimate concern. Our analysis of 60 months of data shows that while resignations and involuntary separations were not significantly altered in the post-Floyd period, voluntary resignations were. Officers resigned at a 279% increased rate relative to the synthetic control expectations, and this rise has a posterior probability greater than .99.

While questions remain about whether resigned officers are leaving this agency for law enforcement employment elsewhere, or are leaving the profession altogether, the forecast model for this particular agency is alarming. The greatly increased resignation rate is forecasted to continue. The increased loss of officers to resignation is not easily remedied through recruitment, and places significant budgetary pressure on the agency, with the costs of hiring a single officer estimated to be up to five times the annual salary for that position. Further, a deficit of officers may contribute to an already increased violent crime rate in the studied agency, which has already become local headline news. The potential cohort effects of a broad-based retention crisis in policing could ripple across communities for years into the future. We hope researchers will rigorously evaluate the relationship between police staffing levels and community crime and disorder in the months and years ahead.

References

Adams, I. T., & Mastracci, S. H. (2019). Police Body-Worn Cameras: Effects on Officers' Burnout and Perceived Organizational Support. Police Quarterly, 22(1), 5–30. https://doi.org/10.1177/1098611118783987

Bailey, H. (2020, November 13). Minneapolis violence surges as police officers leave department in droves. Washington Post. https://www.washingtonpost.com/national/minneapolis-police-shortage-violence-floyd/2020/11/12/642f741a-1a1d-11eb-befb-8864259bd2d8_story.html

Bradford, B., & Quinton, P. (2014). Self-legitimacy, police culture and support for democratic policing in an English constabulary. British Journal of Criminology, 54(6), 1023–1046. https://doi.org/10.1093/bjc/azu053

Brodersen, K. H., Gallusser, F., Koehler, J., Remy, N., & Scott, S. L. (2015). Inferring causal impact using bayesian structural time-series models. Annals of Applied Statistics, 9(1), 247–274. https://doi.org/10.1214/14-AOAS788

Chalfin, A., Hansen, B., Weisburst, E. K., & Williams Jr., M. C. (2020). Police force size and civilian race [Working Paper].

Colton, E. (2020, August 19). "Just the beginning": San Francisco police officers leaving department in record numbers. Washington Examiner. https://www.washingtonexaminer.com/news/just-the-beginning-san-francisco-police-officers-leaving-department-in-record-numbers

Dablander, F. (2019). Spike-and-Slab. In Fabiandablander.com.

de Vocht, F., Tilling, K., Pliakas, T., Angus, C., Egan, M., Brennan, A., Campbell, R., & Hickman, M. (2017). The intervention effect of local alcohol licensing policies on hospital admission and crime: A natural experiment using a novel Bayesian synthetic time-series method. Journal of Epidemiology & Community Health, 71(9), 912–918. https://doi.org/10.1136/jech-2017-208931

DeStefano, A. M. (2020, October 8). NYPD: Head count lowest in 10 years. Newsday. https://www.newsday.com/long-island/nypd-retirements-shea-1.50031351

Flores, T. (2020, September 9). Damage due to rioting, unrest in Kenosha tops $50 million; 2,000 Guard assisted here. Kenosha News. https://www.kenoshanews.com/news/local/damage-due-to-rioting-unrest-in-kenosha-tops-50-million-2-000-guard-assisted-here/article_26473ec9-c08a-5490-9d09-cc2b840b65f1.html

Giblin, M. J., & Galli, P. M. (2017). Compensation as a police candidate attraction tool: An organizational-level analysis. Police Quarterly, 20(4), 397–419. https://doi.org/10.1177/1098611117713679

Gillet, N., Huart, I., Colombat, P., & Fouquereau, E. (2013). Perceived organizational support, motivation, and engagement among police officers. Professional Psychology: Research and Practice, 44(1), 46–55. https://doi.org/10.1037/a0030066

Harrell, E., & Davis, E. (2020). Contacts between police and the public, 2018—Statistical tables (NCJ 255730). https://www.bjs.gov/content/pub/pdf/cbpp18st.pdf

Hatfield, E., Traupmann, J., Sprecher, S., Utne, M., & Hay, J. (1985). Equity and intimate relationships: Recent research. In Compatible and incompatible relationships (pp. 1–27). Springer-Verlag.

Hickman, M. J., Piquero, N. L., & Piquero, A. R. (2004). The validity of Niederhoffer's cynicism scale. Journal of Criminal Justice, 32(1), 1–13. https://doi.org/10.1016/j.jcrimjus.2003.10.001

Hilal, S., & Litsey, B. (2020). Reducing police turnover: Recommendations for the law enforcement agency. International Journal of Police Science & Management, 22(1), 73–83. https://doi.org/10.1177/1461355719882443

Hur, Y. (2014). Turnover, voluntary turnover, and organizational performance: Evidence from municipal police departments. Public Administration Quarterly, 37(1), 3–35.

Jackman, T. (2020, November 21). Homicides skyrocket across U.S. during pandemic, while robberies and rapes plummet. Washington Post. https://www.washingtonpost.com/nation/2020/11/21/murder-rises-in-

pandemic/

Johnson, R. R. (2012). Police Officer Job Satisfaction: A Multidimensional Analysis. Police Quarterly, 15(2), 157–176. https://doi.org/10.1177/1098611112442809

Kaba, M. (2020, June 12). Yes, we mean literally abolish the police. The New York Times. https://www.nytimes.com/2020/06/12/opinion/sunday/floyd-abolish-defund-police.html

Kovandzic, T. V., & Sloan, J. J. (2002). Police levels and crime rates revisited: A county-level analysis from Florida (1980–1998). Journal of Criminal Justice, 30, 65–76.

Levitt, S. D. (1997). Using electoral cycles in police hiring to estimate the effect of police on crime. American Economic Review, 87, 270–290.

MacDonald, H. (2016). The war on cops: How the new attack on law and order makes everyone less safe. Encounter Books.

MacLean, C. E. (2020). Improving African American confidence in law enforcement: Recruit to optimize procedural justice, not racial quotas. International Journal of Police Science & Management, 146135572097469. https://doi.org/10.1177/1461355720974698

Maguire, E. R., Nix, J., & Campbell, B. A. (2017). A war on cops?: The effects of Ferguson on the number of U.S. police officers murdered in the line of duty. Justice Quarterly, 34(5), 739–758.

Main, F., & Spielman, F. (2021, January 15). Police retirements grow in Chicago, New York, Minneapolis amid anti-police backlash. Chicago Sun-Times. https://chicago.suntimes.com/2021/1/15/22229584/police-retirements-backlash-chicago-new-york-minneapolis-john-catanzara-fop-michael-lappe

Marier, C. J., & Moule, R. K. (2019). Feeling blue: Officer perceptions of public antipathy predict police occupational norms. American Journal of Criminal Justice, 44(5), 836–857. https://doi.org/10.1007/s12103-018-9459-1

Marvell, T. B., & Moody, C. E. (1996). Specification problems, police levels, and crime rates. Criminology, 34, 609–646.

McLaughlin, E. C., & Vera, A. (2020, August 24). Wisconsin police shoot Black man as children watch from a vehicle, attorney says. CNN. https://www.cnn.com/2020/08/24/us/kenosha-police-shooting-jacob-blake/index.html

Mello, S. (2019). More COPS, less crime. Journal of Public Economics, 172, 174–200. https://doi.org/10.1016/j.jpubeco.2018.12.003

Moon, B., & Hwang, E. (2004). The reasons for choosing a career in policing among South Korean cadets. Journal of Criminal Justice, 32, 223–229.

Moon, B., & Zager, L. J. (2007). Police officers' attitudes toward citizen support: Focus on individual, organizational and neighborhood characteristic factors. Policing: An International Journal of Police Stategies & Management, 30, 484–497. https://doi.org/10.1108/13639510710778859

Morrow, W. J., Vickovic, S. G., Dario, L. M., & Shjarback, J. A. (2019). Examining a Ferguson Effect on college students' motivation to become police officers. Journal of Criminal Justice Education, 30(4), 585–605. https://doi.org/10.1080/10511253.2019.1619793

Morrow, W. J., Vickovic, S. G., & Shjarback, J. A. (2020). Motivation to enter the police profession in the post-Ferguson era: An exploratory analysis of procedural justice. Criminal Justice Studies, 1–21. https://doi.org/10.1080/1478601X.2020.1802591

Mourtgos, S. M., & Adams, I. T. (2019a). The effect of prosecutorial actions on deterrence: A county-level analysis. Criminal Justice Policy Review. https://doi.org/10.1177/0887403419829201

Mourtgos, S. M., & Adams, I. T. (2019b). The rhetoric of de-policing: Evaluating open-ended survey responses from police officers with machine learning-based structural topic modeling. Journal of Criminal Justice. https://doi.org/10.1016/j.jcrimjus.2019.101627

Mourtgos, S. M., & Adams, I. T. (2020). Assessing public perceptions of police use-of-force: Legal reasonableness and community standards. Justice Quarterly, 37(5), 869–899. https://doi.org/10.1080/07418825.2019.1679864

Mourtgos, S. M., Mayer, R. C., Wise, R. A., & O'Rourke, H. (2020). The Overlooked Perspective of Police Trust in the Public: Measurement and Effects on Police Job Behaviors. Criminal Justice Policy Review, 31(5), 639–672. https://doi.org/10.1177/0887403419851850

Muir, W. K. (1977). Police: Streetcorner politicians. University of Chicago Press.

Myhill, A., & Bradford, B. (2013). Overcoming cop culture? Organizational justice and police officers' attitudes toward the public. Policing: An International Journal of Police Strategies & Management, 36(2), 338–356. https://doi.org/10.1108/13639511311329732

Niederhoffer, A. (1967). Behind the shield: The police in urban society. Doubleday.

Nix, J. (2020). On the challenges associated with the study of police use of deadly force in the United States: A response to Schwartz & Jahn. PLoS ONE, 15(7). https://doi.org/10.1371/journal.pone.0236158

Nix, J., Pickett, J. T., & Wolfe, S. E. (2020). Testing a theoretical model of perceived audience legitimacy: The neglected linkage in the dialogic model of police–community relations. Journal of Research in Crime and Delinquency, 57(2), 217–259. https://doi.org/10.1177/0022427819873957

Nix, J., & Wolfe, S. E. (2016). Sensitivity to the Ferguson Effect: The role of managerial organizational justice. Journal of Criminal Justice, 47, 12–20. https://doi.org/10.1016/j.jcrimjus.2016.06.002

Nix, J., & Wolfe, S. E. (2017). The impact of negative publicity on police self-legitimacy. Justice Quarterly, 34(1), 84–108. https://doi.org/10.1080/07418825.2015.1102954

Nix, J., & Wolfe, S. E. (2020, June 18). Defunding or disbanding the police is a dangerous idea if done hastily. Washington Post. https://www.washingtonpost.com/crime-law/2020/06/18/guest-post-defunding-or-disbanding-police-is-dangerous-idea-if-done-hastily/

Oliveira, T. R., Jackson, J., Murphy, K., & Bradford, B. (2020). Are Trustworthiness and Legitimacy 'Hard to Win, Easy to Lose'? A Longitudinal Test of the Asymmetry Thesis of Police-Citizen Contact. Journal of Quantitative Criminology. https://doi.org/10.1007/s10940-020-09478-2

Orrick, D. (2008). Recruitment, retention, and turnover of police personnel: Reliable, practical, and effective solutions. Charles C. Thomas Publisher, Ltd.

Paoline, E. A. (2003). Taking stock: Toward a richer understanding of police culture. Journal of Criminal Justice, 31(3), 199–214. https://doi.org/10.1016/S0047-2352(03)00002-3

Paoline, E. A., & Gau, J. M. (2020). An Empirical Assessment of the Sources of Police Job Satisfaction. Police Quarterly, 23(1), 55–81. https://doi.org/10.1177/1098611119875117

Paoline, E. A., & Terrill, W. (2007). Police education, experience, and the use of force. Criminal Justice and Behavior, 34(2), 179–196.

PERF. (2019). The workforce crisis, and what police agencies are doing about it. Police Executive Research Foundation. https://www.policeforum.org/assets/WorkforceCrisis.pdf

Peyton, K., Sierra-Arévalo, M., & Rand, D. G. (2019). A field experiment on community policing and police legitimacy. Proceedings of the National Academy of Sciences, 116(40), 19894–19898. https://doi.org/10.1073/pnas.1910157116

Piza, E. L., & Chillar, V. F. (2020). The effect of police layoffs on crime: A natural experiment involving New Jersey's two largest cities. Justice Evaluation Journal, 1–19. https://doi.org/10.1080/24751979.2020.1858697

President's Task Force on 21st Century Policing. (2015). Final Report of the President's Task Force on 21st Century Policing.

Rantz, J. (2020, December 28). Rantz: Seattle Police on pace to lose nearly 200 officers in mass exodus this year. MyNorthwest.Com. https://mynorthwest.com/2392075/rantz-seattle-police-lose-nearly-200-officers-

mass-exodus-2020/?

Ren, L., Cao, L., Lovrich, N., & Gaffney, M. (2005). Linking confidence in the police with the performance of the police: Community policing can make a difference. Journal of Criminal Justice, 33(1), 55–66. https://doi.org/10.1016/j.jcrimjus.2004.10.003

Rhodes, T. N., & Tyler, D. H. (2019). Is It cool to be a cop? Exploring the differential impact of Ferguson on police applicants. Policing: A Journal of Policy and Practice. https://doi.org/10.1093/police/paz013

Rosenfeld, R., & Lopez, E. (2020). Pandemic, social unrest, and crime in U.S. cities.

Sanders, B. A. (2008). Using personality traits to predict police officer performance. Policing: An International Journal of Police Strategies & Management, 31(1), 129–147. https://doi.org/10.1108/13639510810852611

Saunders, J., Kotzias, V., & Ramchand, R. (2019). Contemporary police stress: The impact of the evolving socio-political context. Criminology, Criminal Justice, Law & Society, 20(1), 35–52.

Schott, C., & Ritz, A. (2018). The dark sides of public service motivation: A multi-level theoretical framework. Perspectives on Public Management and Governance, 1(1), 29–42. https://doi.org/10.1093/ppmgov/gvx011

Schuck, A. M., & Rabe-Hemp, C. E. (2018). Investing in people: Salary and turnover in policing. Policing: An International Journal, 41(1), 113–128. https://doi.org/10.1108/PIJPSM-09-2016-0137

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). Quasi-experiments: Interrupted time-series designs. Experimental and quasi-experimental designs for generalized causal inference.

Shjarback, J. A., & Maguire, E. R. (2021). Extending research on the "war on cops": The effects of Ferguson on nonfatal assaults against U.S. police officers. Crime & Delinquency, 67(1), 3–26. https://doi.org/10.1177/0011128719890266

Sierra-Arévalo, M., & Nix, J. (2020). Gun victimization in the line of duty: Fatal and non-fatal firearm assaults on police officers in the United States, 2014-2019. Criminology & Public Policy. https://jnix.netlify.app/files/pdfs/cpp_gva_assaults.pdf

Steers, R. M., Mowday, R. T., & Shapiro, D. L. (2004). The future of work motivation theory. The Academy of Management Review, 29(3), 379–387. https://doi.org/10.2307/20159049

Tankebe, J. (2014). Rightful authority: Exploring the structure of police self-legitimacy. In Crime, justice and social order: Essays in honour of A. E. Bottoms (pp. 1–30). Oxford University Press.

Terrill, W., Paoline, E. A., & Manning, P. K. (2003). Police culture and coercion. Criminology, 41(4), 1003–1034. https://doi.org/10.1111/j.1745-9125.2003.tb01012.x

Thibaut, J. W., & Kelley, H. H. (1959). The social psychology of groups. John Wiley & Sons, Inc.

Tiesman, H. M., Gwilliam, M., Konda, S., Rojek, J., & Marsh, S. (2018). Nonfatal injuries to law enforcement officers: A rise in assaults. American Journal of Preventive Medicine, 54(4), 503–509. https://doi.org/10.1016/j.amepre.2017.12.005

Todak, N. (2017). The decision to become a police officer in a legitimacy crisis. Women & Criminal Justice, 27(4), 250–270. https://doi.org/10.1080/08974454.2016.1256804

Trinkner, R., Tyler, T. R., & Goff, P. A. (2016). Justice from within: The relations between a procedurally just organizational climate and police organizational efficiency, endorsement of democratic policing, and officer well-being. Psychology, Public Policy, and Law, 22(2), 158–172. https://doi.org/10.1037/law0000085

Vitale, A. S. (2017). The end of policing. Verso Books.

Wallace, D. (2020, December 23). Portland cops resigning at "unprecedented" level midcareer to take low-paying jobs elsewhere: Report [Text.Article]. Fox News; Fox News. https://www.foxnews.com/us/portland-police-officers-resign-unprecedented-level-defund-police

Washington Post. (2021). Fatal force: Police shootings database. Fatal Force. https://www.washingtonpost

.com/graphics/investigations/police-shootings-database/

Weichselbaum, S., & Lewis, N. (2020, June 9). Support for defunding the police department is growing. Here's why it's not a silver bullet. The Marshall Project. https://www.themarshallproject.org/2020/06/09/support-for-defunding-the-police-department-is-growing-here-s-why-it-s-not-a-silver-bullet

White, M. D., Cooper, J. A., Saunders, J., & Raganella, A. J. (2010). Motivations for becoming a police officer: Re-assessing officer attitudes and job satisfaction after six years on the street. Journal of Criminal Justice, 38(4), 520–530. https://doi.org/10.1016/j.jcrimjus.2010.04.022

Wilson, J. M. (2012). Articulating the dynamic police staffing challenge: An examination of supply and demand. Policing: An International Journal of Police Strategies & Management, 35(2), 327–355. https://doi.org/10.1108/13639511211230084

Wilson, J. M., Dalton, E., Scheer, C., & Grammich, C. A. (2010). Police recruitment and retention for the new millennium (p. 150). RAND Corporation.

Winsor, M., Brady, E., & Wash, S. (2021, January 14). ABC News exclusive: Jacob Blake speaks out for 1st time since being shot by police. ABC News. https://abcnews.go.com/US/abc-news-exclusive-jacob-blake-speaks-1st-time/story?id=75244637

Wolfe, S. E., & Lawson, S. G. (2020). The organizational justice effect among criminal justice employees: A meta-analysis. Criminology, 58(4), 619–644. https://doi.org/10.1111/1745-9125.12251

Wolfe, S. E., & Nix, J. (2016). The alleged "Ferguson Effect" and police willingness to engage in community partnership. Law and Human Behavior, 40(1), 1–10. https://doi.org/10.1037/lhb0000164

Wolfe, S. E., Nix, J., & Campbell, B. A. (2018). Police managers' self-control and support for organizational justice. Law & Human Behavior, 42(1), 71–82.

Wu, Y., Sun, I. Y., Chang, C. K.-M., & Hsu, K. K.-L. (2017). Procedural justice received and given: Supervisory treatment, emotional states, and behavioral compliance among Taiwanese police officers. Criminal Justice and Behavior, 44(7), 963–982. https://doi.org/10.1177/0093854817702407

Wulfsohn, J. (2021, January 5). Washington Post slammed for claiming Jacob Blake was "unarmed" during altercation with Kenosha police [Text.Article]. Fox News; Fox News. https://www.foxnews.com/media/washington-post-jacob-blake-unarmed-kenosha

Yim, Y., & Schafer, B. D. (2009). Police and their perceived image: How community influence officers' job satisfaction. Police Practice and Research, 10, 17–29. https://doi.org/10.1080/15614260802128658