Improving Fire Department Turnout Times: Training v. Sanctions in a High Public Service Motivation Environment

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ABSTRACT

Fire departments are comprised of individuals known to have high levels of public service motivation (PSM). One of the most important measures of fire personnel performance, turnout time, may be affected by managerial strategies. Turnout time measures the time elapsed from when the emergency dispatcher informs the fire unit of an emergency and when the unit leaves the fire station. In 2015, the El Paso Fire Department required fire personnel to participate in a training module focusing on the importance of emergency response and turnout time. At the conclusion of the training period, the department began enforcing a turnout time policy of 90 seconds, with units being required to submit paperwork concerning their response if they exceeded the 90-second requirement. We find that training and policy enforcement decrease turnout times in these high PSM employees, but policy enforcement with sanctions yields the largest decrease.

INTRODUCTION

The speed that fire departments respond to emergencies is of concern to citizens and fire departments alike. The growing concern over response times throughout the fire service industry and fire departments led to increased attention on emergency response times. Easily measured with modern technology, response times and their components are crucial measures of employee performance in fire departments? How can fire managers improve emergency response among their personnel. Fire departments are composed of individuals dedicated to public service who arguably have high levels of public service motivation. Do certain human resource strategies like training and/or strict policies have an effect on fire personnel performance?

The importance of fire department response time efficiencies cannot be overstated. Research has shown that once ignited, a fire worsens at an exponential rate (Halpern,

Isherwood, and Wand 1979). Additionally, the cost of a fire increases for every minute it is allowed to burn. Fire causes $2,400 of property damage per minute (Challands 2010). These effects are only one of the reasons fire standards boards and accrediting agencies concern themselves with response times.

Aside from responding to fire related incidents, many fire departments also provide emergency medical services to their communities with certified emergency medical technicians (EMTs) and ambulance drivers. Research has shown that there is a positive correlation between response times and mortality (Pons et al. 2005). For a patient suffering from an acute myocardial infarction (heart attack), the survivability of this cardiac event decreases at a rate of 10% a minute (Health Quality Ontario 2005). While responding efficiently to cardiac emergency has always been of concern to fire departments, there is additional research that indicates response times also affect non-cardiac arrest related emergencies (Blackwell and Kaufman 2002; Wilde 2013).

From the beginning of an emergency call, until emergency units arrive on the scene, the time it takes to respond is broken into three distinct, measurable parts. The first component of the response is defined as the call processing time, which is that time between when the 911 call has been placed, up until when emergency units are notified that they have been assigned an emergency incident. The second component of the response is defined as turnout time. This is the time between when an emergency unit has been notified they are assigned an emergency incident until they begin to respond to the emergency incident scene. The final component is defined as travel time. That is, the time between when the emergency unit is notified and when it begins to respond (wheels rolling on the apparatus and leaving the fire station).

For the purpose of this study, we focus exclusively on the turnout time component. It is the predominant element of total response time for which fire managers and supervisors can attempt to improve through training and/or personnel policies without influence from a number of extraneous factors. Managers cannot control the call processing or dispatch time, as they have no jurisdiction over dispatchers. Managers can attempt to decrease the travel time component of response time, but it is predicated on so many other confounding factors that are difficult to observe and/or measure. Construction, traffic accidents, road quality, weather, and traffic flow are just a few of the impediments to fast travel time (Subramaniam, Ali, and Shamsudin 2012). While construction and road quality, and to some extent weather, can be anticipated, other travel and traffic conditions change abruptly. Turnout times are directly observable and often recorded using modern technology. The factors that affect travel time do not affect turnout time, which is a function of a unit's weakest link (turnout time calculations stop once all personnel are in the emergency apparatus and are outbound to an emergency). Therefore, various managerial techniques and strategies may affect turnout times, and evaluation of these techniques does not suffer from as many confounding factors that may bias the results as in an analysis of travel time and/or total response time.

The purpose of the research is twofold: first, to determine what organizational strategies (training v. policy enforcement with sanctions) improve initial fire department response times (turnout times), and second, to better understand how these strategies work inside a high public service motivation (PSM) setting. We worked with the El Paso Fire Department (EPFD) in implementing their training modules and their sanction policy. Ideally, we would have engaged in an experimental design, randomly assigning some fire

stations to receive the training, and others to not receive the training. However, given that emergency response deals with life and death along with property damages, it would not have been ethical to subject some personnel (and the potential beneficiaries of their services) to training that could have a positive effect on life and/or property, while other personnel were omitted. We took advantage of the EPFD agreeing to limit personnel changes across stations and shifts and ensuring training consistency during the study period. Similar ethical considerations occur with the personnel sanctioning policy. Nevertheless, our data is immense and informative, and allows for the testing of the hypotheses related to training and sanctions.

THEORETICAL LENS: PUBLIC SERVICE MOTIVATION (PSM) FRAMEWORK

One lens through which to view our study is through the public service motivation (PSM) framework. In their seminal article, Perry and Wise (1990) present PSM as a definitive concept and define it "as an individual's predisposition to respond to motives grounded primarily or uniquely in public institutions and organizations" (p. 368). Individuals with high levels of PSM value serving the public interest and are thought to be more likely to pursue activities and careers that promote societal well-being. Perry and Wise (1990) argue that high PSM individuals will be more likely to pursue employment in public service organizations. In the public sector, they predict those individuals committed to public service to outperform coworkers with low levels of PSM.

PSM and Employee Motivation in the Public and Private Sectors

Perry and Wise (1990) predict that an individual's propensity to work in or seek employment in the public sector is a function of the level of PSM. Empirical research largely confirms their predictions. Research indicates that preference for working in the

government is a function of increasing levels of PSM (Clerkin and Coggburn 2012; Lewis and Frank 2002; Pedersen 2013; Vandenabeele 2008). In one study, indivduals with the highest levels of PSM, 29% indicated that they preferred working in the public sector; 24% indicated that they preferred working in the private sector (Frank and Lewis 2002). Even though this difference may appear modest, individuals employed in government positions had higher levels of PSM than private sector employees. Clerkin and Coggburn (2012) are one of the first scholars to include the public, private, *and* non-profit sectors in their analysis. Disaggretating PSM into its dimensions, they find that the self-sacrifice dimension of PSM leads men to seek employment in the non-profit sector and both men and women to seek employment in the government. Extending the PSM literature beyond the U.S. context, Steijn (2008) studies Dutch federal workers, confirming the expectations of Perry and Wise (1990). PSM levels are greater in government employees compared to private sector employees. Other international scholars find similar results between the dimensions of PSM and likelihood of seeking employment in the public sector (Hui, Hu, Yang, and Yu 2011; Vandenabeele 2008).

Research stemming from Perry and Wise's (1990) article concentrates on the differences in reward motivations between public sector and private sector employees and job seekers (Bozeman and Su 2015; Pandey and Stazyk 2008). Intrinsic rewards like feelings of accomplishments and purpose, along with having interesting work, are seen as more important motivations for public sector employees than for private sector employees (Crewson 1997; Frank and Lewis 2004; Karl and Sutton 1998; Perry 1997; Perry and Porter 1982; Perry and Wise 1990; Rainey 1982; Wittmer 1991). Serving the public interest and a desire to help fellow citizens, as opposed to monetary inducements, tends to

emerge as the central reward motivation for individuals working in the public sector (Crewson 1997; Frank and Lewis 2004; Houston 2000; Karl and Sutton 1998; Lewis and Frank 2002; Pandey and Stazyk 2008; Rainey 1982; Rainey and Steinbauer 1999; Wittmer 1991).

Certain public sector professions appear to be composed of individuals with higher levels of PSM. Perry (1997) describes the legal and medical professions as fields noted for employing individuals with high levels of commitment to public service. Organizations vary in their level of access and service to the general public. High-publicness organizations are those agencies that provide welfare, educational, and cultural services to the public (Antonsen and Jorgensen 1997; Vandenabeele 2008). Individuals with high levels of PSM tend to be most attracted to positions in high-publicness organizations (Vandenabeele 2008).

The emergency response field is another setting in which high PSM individuals may be attracted. Firefighters face a multifaceted job description, having to respond to a variety of public service calls ranging from fires to medical emergencies. In a study of 9-11 responders to the September 11th Attacks, Lee and Olshfski (2002) describe the noble and selfless acts of New York City firefighters. They argue that commitment to the job, and not PSM, per se, led many NYFD employees to risk their lives during the terrorist attacks. Brewer (2008) however, appears to see PSM and commitment to a job as synonymous, especially in the firefighting profession, where commitment to the job is serving the public. Through the examination of fire personnel, we are able to better understand what managerial strategies may work in high PSM environments.

Employee Productivity and Performance

Worker productivity is also postulated to increase when individual employee service goals align with their organization's mission (Perry and Wise 1990; Rainey and Steinbauer 1999; Wright 2007). In terms of managerial strategies and employee motivation, Perry and Wise (1990) argue that public sector employees' productivity and performance increases as employee PSM increases. Numerous empirical survey research indicates a positive relationship between employee PSM and employee reports of working harder (Lewis and Frank 2002), individual employee performance (Alonso and Lewis 2001; Kim 2006; Leisink and Steijn 2009; Naff and Crum 1999; Park and Rainey 2008; Vandenabeele 2009; Van Loon 2016) [1], employee efficiency (Ritz 2009), and overall organizational performance (Brewer and Selden 2000; Kim 2005; van Loon 2016). Most of these studies rely on employee self reports in surveys, but the relationship between PSM and employee performance remains with supervisor ratings of their employees (van Loon 2016; van Loon, Vandenabeele, and Leisink 2015).

Naff and Crum's (1999) significant empirical study examining the relationship between PSM and employee performance ushered in a critical review of the research methods involved, with some criticism aimed at potential endogeneity issues. Skeptics of PSM's effect on performance cite the cross-sectional and survey-based nature of extant research (Brewer 2008; Wright 2008; Ritz, Brewer, and Neumann 2016; Wright and Grant 2010) and the endogeneity issue of whether or not high levels of PSM increase the likelihood of working in the public sector, or if working in the public sector increases PSM (Pedersen 2013; Ward 2014; Wright and Grant 2010).[2] PSM scholars have called for the use of experimental and quasi-experimental methodologies to address the endogeneity and

causal effects issues inherent in the extant literature (Bozeman and Su 2015; Perry and Vandenabeele 2015; Wright and Grant 2010).

Experimental research on PSM and employee performance centers on how to activate or foster PSM in individuals and then measuring their output. A few notable studies (Grant 2008; Pedersen 2015) utilize university students to better understand the causal linkage between PSM and employee performance. The experimental design helps overcome the temporal and endogneity issues connecting PSM with performance. Pedersen (2015) studies how long subjects report they are willing to spend on filling out a survey. He uses low-intensity PSM activation cues to determine if even small efforts at PSM activation and promotion elicit positive outcomes. Compared to the control group, students that were told their participation in the survey would a) help society, or b) help fellow citizens, reported that they would participate longer in they survey. Pedersen's (2015) main contribution is providing firm evidence that PSM can be activated if the motivation is shrouded in promoting societal or citizen benefits. His results corroborate the findings of Grant (2008) and Bellé (2013a, 2013b). These particular studies not only focus on activation of PSM and the resulting effect on performance, but whether or not employee contact with beneficiaries of public service activates PSM and increases performance. Bellé's (2013a) randomized experiment with Italian nurses and Grant's (2008) natural experiment on university employees soliciting pledges from donors provide convincing evidence that employee contact with beneficiaries of services increases output and improves employee performance. Employees also appear to respond positively to managers utilizing transformational leadership strategies and contact with beneficiaries in an interactive effect (Bellé 2013b).

Our study touches on these concepts, as firefighters interact with the beneficiaries of their services in nearly every response to an emergency dispatch. Additionally, we test whether or not training or strict policy enforcement is more likely to increase employee performance in terms of initial response time. In a symposium in the *Public Administration Review* on PSM research, Paarlberg and Lavigna (2010) discuss the need for PSM research to offer public managers options for increasing employee productivity. Perry and Hondeghem (2008) also argue the need for studies on PSM in different public sector settings. At its core, our study attempts to determine how to increase the performance of employees with high levels of PSM in terms of training versus stricter policy enforcement. We also address the call by Ritz, Brewer, and Neumann (2014) for integration of PSM with human resource management. They lament the lack of recommendations in the extant literature applicable to practitioners. Practitioners can learn potentially valuable lessons from the findings and implications of our current study.

Training

Training is an integral component in the performance management and human resource management subfields of public administration. It allows managers to introduce or reemphasize the mission and goals of the organization to improve employee and overall organizational performance (Ingraham, Joyce and Donahue 2003; Van Wart 1998). Strategic human resource management strategies including, but not limited to training, can promote organizational performance on their own, or increase PSM (Giauque, Anderfuhren-Biget, and Varone 2013). Widely studied in the private sector, training leads to immediate and significant impacts on employee productivity (see for example, Bartel 1994; Delaney and Huselid 1996; Huselid 1995; Ichniowski, Shaw, and Prennushi 1997;

MacDuffie 1995; and Youndt et al. 1996). Despite its importance, training is understudied in public management (Kroll and Moynihan 2015), which may be a function of the difficulty in studying the direct effects of training on employee performance (Owens 2006). The few studies on public sector training reiterate its importance in improving employee and organizational performance. Training has been shown to have a positive impact on organizational commitment, which translates to organizational performance (Bozeman and Perrwé 2001; Gould-Williams and Gatenby 2010; Grunberg, Anderson-Connolly, and Greenberg 2000; Owens 2006).

Effective training enhances other antecedents for public employee and organizational performance like improved teamwork (Gould-Williams and Gatenby 2010); increased knowledge of employee role definitions (Henstra 2010); and the development and growth of employee knowledge, skills, and abilities (Ford and Schmidt 2000; Jacobson, Rubin, and Selden 2002; Sullivan et al. 2009). Studies on training and performance tend to rely on employee or supervisor self-reports of performance, which may create an understandable bias in favor of training. Daley and Vasu (2005) are one of the few public administration scholars to study strategic human resource strategies on measurable performance goals and standards. They determine that formal training for public welfare workers increased the likelihood that clients obtained a job. Sullivan et al. (2009) use social workers' pre and post training knowledge of specific public welfare policies and procedures relevant to their daily work. Social worker self-reports of their own performance correlate strongly with participation in the training modules. Gould-Williams and Gatenby (2010) report the significant impact of training availability for UK local public servants and their perceived level of performance.

Thorough training regarding policies and procedures are especially important in public sector emergency response organizations where efficiency and effectiveness are crucial for saving lives and property. Such training is important not only for routine day-to-day emergencies, but as well in generalized emergency preparedness for first responders potentially facing more large scale disasters and emergency situations (Perry and Lindell 2003), and this macro-level analysis predominates in the fledgling emergency management literature. Henstra (2010) sees training as paramount in instilling role definitions and a sense of public service commitment in emergency responders. Ford and Schmidt (2000) argue that training leads to an increase in overall emergency preparedness by creating automaticity of emergency response knowledge, skills, and abilities. In their view, continual and essential emergency response training leads to responder expertise and a clear ability to respond to any type of large disaster. A dearth of research extends these ideas to the micro-level, day-to-day operations of emergency responders, and no studies, to our knowledge, examine training and emergency response times for fire departments. A clear need exists for improved responses to emergencies in fire departments given their increased workload and variety of services provided beyond putting out fires (medical calls, service calls, car accidents, etc.).

PREVIOUS FINDINGS RELATED TO FIRE DEPARTMENT EMERGENCY RESPONSE

Most of the research, to date, on fire department response times has centered on external factors. Only one study, to our knowledge, specifically examines turnout times, and no studies examine managerial strategies for improving turnout times. Common factors do emerge in the extant research concerning variables that affect overall response. Upson and Notarianni (2010) studied fire and EMS incident types, along with daytime v.

nighttime incidents and station design. They found that fire and nighttime incidents took the longest for response (Upson and Notarianni 2010). Pendleton (1999) found that nighttime responses had the longest response times. Station design configuration also has an impact on turnout times (Reglen and Scheller 2016) and response times (Kitterman 2008). In another study, Dell'Orfano (2006) concluded that station design, call type, time of day, and call volume all affect turnout times, but he does not present his findings with any indications of statistical significance.

The fire service industry standard for this turnout time is universally accepted at 60 seconds (Mueller 2010; National Fire Protection Agency 2010). However, the fire service literature indicates that numerous fire departments are experiencing turnout times in excess of the 60 second benchmark (Araujo 2012; Humphries 2012; Tridata 2007). This challenge is not unrecognized. Subramaniam, Ali, and Shamshudin discuss the importance of fire station design on turnout times for Malaysian fire departments. Reglen and Scheller (2016) use a large dataset to extend the case and variables considered to the United States.

We seek to build off of these studies by integrating managerial techniques employed by a fire department in a large U.S. city. While it is recognized that understanding those factors that influence fire department turnout time is important to the fire service, we contend that identifying ways to influence the behavioral components of emergency response is of more importance. Therefore, based upon the theoretical and empirical literature, we hypothesize:

H1: Turnout times will decrease after implementation of a training module that discusses the importance of turnout times.

H2: Compared to training, a policy enforcing a turnout time standard with a sanction will have the he greatest reduction in fire department turnout times.

RESEARCH DESIGN AND DATA

Study Context

The EPFD, through a coordinated effort to change the human behavior element of turnout times, set out in March 2015 to re-engage its employees in the rapidity required for effective emergency responses. The fire department began to hold classes that explained, at a very basic level, why it is that fire departments around the United States are becoming more focused on effective emergency responses. Aside from the seriousness of emergency response, taxpayers are more frequently asking their local governments to maintain very lean operations, and fire departments are subsequently held to tight budgetary constraints. These training sessions were concluded in early June 2015, marking a definitive point in time where the effect of these training sessions could be measured.

In addition to the training sessions, the EPFD also formulated a policy that would be strictly enforced, beginning on September 1, 2015, for those individual units that had turnout times in excess of 90 seconds. The policy required that incident commanders, those individuals who have ultimate responsibility for all aspects of the on scene activities and post incident documentation, include in their incident report any perceived causes for the delay in unit turnout. The documentation requirement policy was not implemented in an effort to have specific justifications outlined in the incident report for delayed responses, but rather in an effort to document those non-human response delays identified by those that actually experienced the cause of the delay.

While both the training sessions and the policy enforcement should make perfect sense to the reader, formulating a strategy for reducing emergency response times was approached as a collective action problem. The training sessions were developed to

provide those individuals who actually contribute to the effort of improved turnout times, the pervasive communication needed to overcome collective action problems. Furthermore, the required documentation policy was developed in an effort to impose non-threatening sanctions on those individual units, believed to purposefully shirk their responsibility toward the collective effort, that were unable to complete the unit turnout in under 90 seconds. The documentation requirement served a twofold purpose where incident commanders could highlight non-human errors in the processes but also served as a self-policing mechanism and ultimately an inconvenience to the incident commander when it was concluded that the cause of non-performance was primarily the result of human behavior or lack of urgency.

Data

The EPFD tracks turnout times using advanced technology. They record, down to the second, the time when an emergency dispatcher notifies fire personnel of an emergency. Once all individuals in a unit have entered their apparatus and are en route to the emergency, an individual pushes a button on a receiver in the apparatus to indicate that they are en route. This indication ends the turnout time component of total response time, entering the travel time component.

The dataset for our study includes every emergency dispatch to the EPFD from January 1, 2015 through October 20, 2015. There are thirty-four fire stations in the city of El Paso, and our data cover all three standard work shifts for each station. During an emergency dispatch, multiple units from a station are sometimes dispatched at the same time. For example, a car accident may require not only a fire engine, but also an ambulance from the same station. The station has a personnel unit that mans the engine and a

different personnel unit that responds in the ambulance. Both units receive the dispatch at the same time, but their specific unit is unlikely to leave at exactly the same (a large fire engine requires more personnel than an ambulance). The EPFD records the turnout times for all units dispatched. This organizational setup presents a complicated statistical issue. Ideally, the dataset would be organized in panel form, with emergency responses organized by station and time of day. However, the manner in which the EPFD collects data for emergencies with multiple units from the same responding station leads to repeated panels. To illustrate, an emergency dispatch at 09:00 requiring a fire engine and an ambulance from Fire Station 1 is recorded as two separate observations, or two separate turnouts for Fire Station 1 at time 09:00. Analysis of panel data becomes complicated, if not impossible, given multiple unit observations at the same time. One could average the turnout times for all units involved per emergency, but this method would essentially throw away valuable data. Additionally, there is no guarantee that personnel stay within a specific unit for each emergency over the study period even in the same fire station. For one emergency, a specific employee may operate in the unit commanding a fire engine, while later that day, he/she is part of a unit operating a pumper. Given these issues and that thousands of the emergency dispatches in our dataset involve multiple units from the same station, averaging the turnout times per event would introduce bias. Instead of further manipulating the data, we keep the data in the same format as the EPFD, and treat each unit dispatch as a unique observation.

The dataset required some additional cleaning prior to analysis. One issue with the EPFD recording every emergency unit dispatch is that the personnel may not be in the station once they receive a dispatch. For example, if they are returning to the station from

a previous emergency, they do not first go back to the station, and then travel to the emergency; they immediately travel to the emergency. The EPFD records turnouts for these emergencies, which have minimal turnout time since all personnel are in the apparatus. An individual simply has to push the receiver button to indicate that they are en route to the emergency. Fortunately, the EPFD tracks the location of emergency apparatuses when they receive a dispatch using GPS technology. We drop all emergencies from the dataset where the emergency apparatus is not within 250 feet of its respective fire station's GPS coordinates. This method allows us to be confident that the apparatus is at the station and the personnel are not already in the apparatus upon receiving the emergency dispatch.

Finally, five shifts across separate stations were not able to undergo training due to unforeseen events in the EPFD. To reduce bias, we omit from consideration all turnout times from these specific shifts at their respective station. The resulting dataset is still large, and these dropped observations unlikely introduce bias into the results.

Variables of Interest

We list the variables of our study and their coding in Table 1. The dependent variable is **Log Turnout**. Turnout times are measured in seconds, and vary throughout our dataset. The original turnout time variable is positively skewed, and therefore, not normally distributed. We eliminate turnout times in the bottom 2.5% and top 2.5% of times. This omission means that turnout times of less than 8 seconds and more than 167 seconds are eliminated from analysis. Turnout times of less than 8 seconds are likely unfeasible, and may be due to personnel "gaming the system" by indicating that they are en route to an emergency, when in actuality, they have not left the station. Extreme turnout

times are probably a function of the personnel forgetting to indicate the moment they leave the station, and then remembering to indicate their status well on their way to an emergency. Even when omitting outliers, the turnout time variable is not normally distributed. Therefore, we take the logarithm of turnout time as our dependent variable. The resulting dataset contains 69,835 observations.

The main variables of interest in our study are the training and policy enforcement variables (**Training Completed** and **Policy Enforcement**). The training variable is coded 1 if the emergency occurred after a stations' responding personnel completed the turnout time training, and 0 if the personnel had not completed training. We expect the training to drastically reduce turnout times for emergencies. **Days Trained** measures the number of days since the unit responding to the emergency participated in the training module (including the day of training). We multiply this variable with **Training Completed** to create an interaction term **(Training Completed X Days Trained)** to help measure any decay effect of the training. If this interaction term is significant, it could indicate that the marginal effect of the training changes as the number of days since training increases.

The policy enforcement variable **(Policy Enforcement)** helps to determine the effect of administrative enforcement and sanctions on turnout times. It is coded 1 if the emergency occurred during the policy enforcement period, and 0 otherwise. We expect the policy enforcement to decrease turnout times since personnel will not want to face reprimand from their superiors.

Station Variables

As noted in our review of the literature, the design of fire stations, along with other characteristics, may affect turnout times. We test whether or not the dormitory type in

each station affects turnout times, with the belief that remote dormitories, or those dormitories in a separate building from the apparatus garage, will have the largest negative effect on turnout times, compared to above-the-garage and adjacent dormitories. We set the reference category for this series of dummy variables as **Adjacent** (1 if the dormitory is connected to the apparatus garage; 0 otherwise). Therefore, the variables in the model are **Above** (1 if the dormitory is above the apparatus garage; 0 otherwise) and **Remote** (dormitory is in separate building from the apparatus garage). Remote dormitories require more steps to reach the garage, and therefore, likely cause an increase in turnout times.

Some fire stations have a battalion chief located at the station. His or her presence may naturally compel personnel to move more quickly to the apparatus in an emergency. Therefore, the variable **Chief Station** controls for this possibility. It is a dummy variable coded 1 if the personnel responding to the emergency come from a station with a battalion chief, and 0 otherwise.

The final two station specific variables help to account for the size of the fire station. **Multi Unit Station** is a dummy variable coded 1 if the fire station has multiple units and 0 otherwise. Additionally, we include the square footage of the fire station in the analysis.

Control Variables

A series of dummy variables code the time of day the emergency occurred, with the **Daytime** (12:00 – 17:59:59) variable as the reference category. We name the dummy variables **Morning** (06:00 – 11:59:59), **Evening** (18:00 – 23:59:59), and **Graveyard** (00:00 – 05:59:59). The time of the emergency likely affects turnout times, with the daytime having the lowest times since personnel are alert and awake.

We also control for the type of emergency. **Fire** is a dummy variable coded 1 if the emergency is fire-related, and 0 otherwise. **Medical** is coded 1 if the emergency is medical-related, and 0 otherwise. The reference category is **Other Incident**. The expectation is that fire and medical emergencies should take less time to mobilize, since other incidents are usually non-emergencies. Additionally, we control for whether or not the unit dispatched was the primary unit or a secondary unit. The dispatching of a secondary unit occurs when the primary unit is already occupied and dispatch must send the next closest unit to the emergency. This variable, **Primary Unit**, is measured 1 if the unit dispatched was the primary unit and 0 otherwise.

A series of dummy variables control for the type of emergency apparatus deployed for the incident since apparatus type affects emergency response times (Kolesar 1975). The reference category is **Ambulance**, and the other variables compared to it are **Engine**, **Aerial**, **Quint**, and **Other Apparatus**. All of these variables are coded 1 if they fall into the respective apparatus category, and 0 otherwise. The categories are all mutually exclusive.[3]

<<<Table 1 Here>>>

Statistical Model

We separate our analyses into two distinct time periods. To first examine the effect of the training module on turnout time, we analyze data from January 1, 2015 through August 31, 2015. During this time period, various stations and shifts participated in the training module. The policy enforcement period with sanctions began on September 1, 2015. Therefore, to understand the independent effect of the training module on turnout times, we eliminate observations occurring on or after September 1, 2015. Our second

analysis includes all observations during the study period to determine the effect of the policy enforcement with sanctions.

We measure our independent variable, turnout time, in seconds and then take the logarithm. Therefore, an Ordinary Least Squares (OLS) regression is an appropriate statistical test. The interpretation of the coefficients changes from a standard OLS regression in that a one-unit change in the independent variables leads to a beta (converted to percentage) percent change in the dependent variable. We cluster the standard errors by fire station to account for any station specific characteristics that we do not model, but that affect turnout times.

RESULTS

For greater clarity, we first present the t-test for the effect of the training module in Table 2. All observations during the policy enforcement period are excluded so that the observations include emergency responses by units before and after the training period, but before the policy enforcement period. The average turnout time for emergency responses involving untrained units is 74.23 seconds, while the average turnout time for emergency responses involving trained personnel is 65.05 seconds. This approximately 9-second difference is statistically significant at the 99% confidence level using a standard t-test. Naturally, the same statistically significant relationship exists when logging the turnout time variable, as seen in the third column of Table 2. These t-tests provide initial support for our first hypothesis, and illustrate the average difference in turnout times for post-training and pre-training emergency responses. The OLS regression results help illustrate the independent effect of the training while controlling for other relevant variables.

<<<Table 2 Here>>>

Table 3 depicts the results of the OLS regression. Model 1 includes all relevant independent variables, but omits the interaction term (Training Completed X Days Trained). Model 2 includes the interaction term. Standard errors are clustered by station to help account for any unmeasured station specific variables. Since the dependent variable is measured as the logarithm of turnout time, multiplying the beta coefficient of an independent variable by 100 gives a decent approximation of the percent change in turnout time for a one-unit increase in the respective independent variable. A more exact measure is to use the following expression to convert the beta coefficients into an average percent change:

$$(e^{\beta} - 1) * 100$$

Next to the results for Model 1 and Model 2, we include columns that convert the beta coefficients into their respective average percent change in turnout time for a one-unit increase in the respective independent variable. Both models display similar results in terms of the signs and significance of the betas. The interaction term in Model 2 is not statistically significant, which suggests that there is no interactive effect and that Model 1 is a better specification. Therefore, we only consider the results in Model 1. Confirming the first hypothesis, units responding that had gone through the training module experienced turnout times 15.72% shorter than units that had not undergone training. This result is statistically significant at the 99% confidence level. A 15.72% decrease in turnout times stemming from training may appear miniscule; however, in the emergency response field, where seconds matter for life and property, it represents a substantively significant decrease. For example, if a fire unit had been averaging turnout times of 70 seconds (10

seconds above the 60-second industry standard), and they decreased their average turnout times by 15.72%, they would be averaging turnout times of 59 seconds. The main implication is that the training modules decreased turnout times.

Other variables, as reported in previous literature, are also statistically significant. The time of the emergency naturally affects turnout times. The longest turnout times occur during the graveyard shift, with turnout times 61.77% longer than the reference category of daytime emergencies. This finding comports with Reglen and Scheller (2016) who logically note that personnel are often asleep during the graveyard shift. Also in line with their research is that above-the-garage dormitories increase turnout times by 9.31%. These living quarters require personnel to navigate stairs or the traditional fire pole into the apparatus garage, which requires more skill and dexterity than working in a station with a dormitory adjacent to or in a separate building from the apparatus garage.

Interestingly, the type of emergency apparatus has no effect on turnout times. Medical emergencies have slightly longer turnout times than the reference category of other types of incidents, but the difference is only 2.12%. Even more perplexing for management scholars is that having a battalion chief at the station does not lead to a statistically significant decrease in turnout times. The coefficient is in the expected direction, but far from significant. Having a high-ranking supervisor present does not appear to increase performance in this setting. Finally, the size of the fire station and whether or not is a multi-unit station has no effect on turnout times. Substantively, the crucial factors affecting turnout times is the time of the emergency and whether or not the personnel had participated in the training module.

<<<Table 3 Here>>>

We use the full dataset to test the second hypothesis that the greatest reduction in turnout times will occur during the policy enforcement period. The average turnout time for emergencies prior to the policy enforcement period is 69.32 seconds. For emergencies during the policy enforcement period, turnout times average 42.89 seconds. A t-test (not depicted) of the difference of means for these times and the logged turnout times is statistically significant at the 99% level. One problem with relying on just the t-test to evaluate the second hypothesis is that the dataset includes observations for turnout times before the policy enforcement period, and it includes responses by trained and untrained units. Therefore, the average turnout time prior to the policy enforcement period is skewed downward due to the positive effect of the training module during this time period. With OLS regression, we control for pre-policy enforcement period responses with trained personnel by included the **Training Completed** dummy variable. Including this variable allows us to better understand the independent effect of the policy enforcement.

Table 4 depicts the OLS regression results for analysis of the policy enforcement with sanctions for turnout times in excess of 90 seconds. Model 3 displays the regression coefficients and the column next to it converts the coefficients into the average percent change in turnout time for each one-unit increase in the respective independent variable.[4] The results largely mirror the results from Model 1 in Table 3. As in Model 1, turnout times are the longest during the graveyard shift, and are 68.88% longer during this shift than the reference category of the daytime shift. The same relationship also applies to above-the-garage dormitories. Personnel in stations with these living quarters experienced 12.08% longer turnout times. Medical emergencies appear to take slightly longer to turnout than

other incidents, and turnout times for personnel responding on fire engines, compared to other apparatuses declined by 7.6%.

Most importantly, the policy enforcement resulted in a dramatic decrease in turnout times after controlling for the training of the fire units. Turnout times decreased an average of 36.43% during the policy enforcement period. This finding is significant at the 99% confidence level. Even though the sanctions for a unit having a turnout time of greater than 90 seconds for an emergency involved increased paperwork, this sanction appeared to improve performance in the EPFD. Returning to a prior example, if a unit's average turnout time is 70 seconds, a 36.43% decrease would improve their average to 44.5 seconds. Enforcing a strict policy turnout time policy with sanctions appears to greatly reduce turnout times. Counter to some expectations in the academic literature, policy enforcement appears to have a stronger effect on fire personnel than training.

CONCLUSION

Our finding that the policy enforcement/sanction mechanism has a much greater effect on reducing turnout times compared to training is quite a surprise. Policy enforcement backed by sanctions (even small sanctions like paperwork), appear to have a greater effect on fire personnel. From a managerial perspective, a more heavy-handed, Theory X management style (McGregor 1960) seems to be an effective strategy with which to manage fire personnel, individuals with high levels of PSM. This finding does not necessarily call into question the value of training to increase employee performance, nor does it reveal that training or Theory Y management styles are ineffective for high PSM individuals. Conventional wisdom and previous research indicates that managerial styles focusing on training improve performance across all levels of PSM. Our study contributes

to this literature by examining a specific public sector department known to have high PSM individuals. It suggests that managerial strategies to improve performance must vary from public sector department and context to another. Firefighters are different than Department of Motor Vehicle workers, who are different from city budget analysts. In the fire service, where personnel already have a high public service ethic, training modules focusing on such ethic may have few marginal benefits. Additionally, given the rigidity of organizations like the military, police departments, and fire departments, personnel may respond better to directives and sanctions from superiors.

Future studies should examine the above command-and-control cultured departments of public service. They all engage in various forms of training to improve employee performance, but they also are sectors that tend to rely on more top-down, Theory X styles of management. Studying the effects of police response times or outputs in military units using training v. sanctions can help generalize our results to other similar fields. Additionally, examining employee performance and output in sectors that do not rely on command-and-control managerial styles after training and policy enforcement periods can help determine if training is more effective in these types of public departments.

Our study has some methodological limitations that scholars can build upon in future research. While we use OLS regression, and it is appropriate given the setup of the data, a better approach is to collect data in panel format and to observe emergency responses from the personnel unit (assuming that personnel in each unit remains fixed for the period of study). Organizing the data at the unit level for each unit's response to a

unique emergency and not having repeated time observations allows the researcher to conduct more rigorous statistical models, using panel-corrected standard errors.

Another approach would be to use difference in differences to study the effect of training and/or policy enforcement. We are not able to conduct this method with our data since the training occurred at different times instead of on one day. If a researcher can work with a fire or police department to train only a few stations on a single day and then wait at least a week to collect post-training or post-policy enforcement observations, the result would be stronger conclusions regarding the effect of the particular training or policy. The treatment group would be the stations receiving the training or policy on a particular day; the control group would be all of the other stations. Pre-treatment and post-treatment observations on performance could then be collected and correctly analyzed using a difference-in-differences approach.

Nevertheless, we believe our study makes a contribution to the public administration and PSM literatures, presenting unique results with a unique dataset. It is one of the only studies to examine training v. sanctions in a public sector department like a fire department with measurable performance output. Our study also has implications for managers in fire departments and managers in departments with high levels of PSM. At least for fire personnel, engaging in training modules may not result in increased performance compared to policy enforcement with sanctions. It seems that personnel in the fire industry are more reactive from heavy-handed approaches.

NOTES

[1] Alonso and Lewis (2001) find mixed evidence of PSM on performance.

[2] See also Kjeldsen and Jacobsen (2013), Moynihan and Pandey (2007), Pandey and Stazyk (2008), and Pedersen (2013) for studies and discussion on the endogeneity issue between PSM and public sector employment.

[3] A table of descriptive statistics appears in the Appendix.

[4] We ran the models with the interaction term (**Training Completed X Days Trained**), but the interaction term was statistically insignificant. Therefore, we only report Model 3.

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Table 1: Variables			
Variable	**Coding**	**Variable (contd.)**	**Coding**
Turnout Time	Time from receiving emergency call from dispatch until leaving station (seconds)	Aerial	1 if apparatus was an aerial; 0 otherwise
Dependent Variable: Log Turnout	Logarithm of Turnout Time	Quint	1 if apparatus used was a quint; 0 otherwise
Morning	1 if emergency occurred between 06:00 and 11:59:59; 0 otherwise	Other Apparatus	1 if apparatus used was not an engine, aerial, quint, or ambulance; 0 otherwise
Evening	1 if emergency occurred between 18:00 and 23:59:59; 0 otherwise	Ambulance (Reference Category)	1 if apparatus used was an ambulance; 0 otherwise
Graveyard	1 if emergency occurred between 00:00 and 05:59:59; 0 otherwise	Primary Unit	1 if primary unit dispatched to emergency; 0 otherwise
Daytime (Reference Category)	1 if emergency occurred between 12:00 and 17:59:59; 0 otherwise	Chief Station	1 if station has a battalion chief; 0 otherwise
Above	1 if dormitory is located above apparatus garage; 0 otherwise	Multi Unit Station	1 if station is multi-unit; 0 otherwise
Remote	1 if dormitory is located in separate building from apparatus garage; 0 otherwise	Square Feet	Fire station square footage
Adjacent (Reference Category)	1 if dormitory is connected to apparatus garage; 0 otherwise	Training Completed	1 if personnel responding completed training module; 0 otherwise
Fire	1 if emergency is fire-related; 0 otherwise	Policy Enforcement	1 if emergency occurred during the policy enforcement period; 0 otherwise
Medical	1 if emergency is medical-related; 0 otherwise	Days Trained	Number of days since initial training, including date trained.
Other Incident (Reference Category)	1 if emergency is non-fire and non-medical; 0 otherwise	Training Completed X Days Trained	Interaction term between Training Completed and Days Trained
Engine	1 if apparatus used was a fire engine; 0 otherwise		

Table 2: Effects of Training Module on Turnout Time		
Training Completed?	**Mean Turnout Time (sec.)**	**Mean Log Turnout Time**
No	74.23	4.20
Yes	65.05	4.05
(N = 46,954)	**t = 30.37*** **	**t = 32.12*** **
*p<0.10; **p<0.05; ***p<0.01		

Table 3: OLS Regression Results for Training Period Dependent Variable: Log Turnout Standard errors clustered by fire station				
Variable	**Model 1**	$(e^{\beta}-1)*100$	**Model 2**	$(e^{\beta}-1)*100$
Morning	**0.101*** (0.009)**	**10.63**	**0.100*** (0.009)**	**10.52**
Evening	**0.066*** (0.006)**	**6.82**	**0.068*** (0.006)**	**7.04**
Graveyard	**0.481*** (0.013)**	**61.77**	**0.484*** (0.014)**	**62.26**
Daytime (Reference Category)	----	----	----	----
Above	**0.089* (0.045)**	**9.31**	**0.087* (0.047)**	**9.10**
Remote	-0.018 (0.030)	-1.78	-0.016 (0.031)	-1.59
Adjacent (Reference Category)	----	----	----	----
Fire	-0.001 (0.021)	-0.09	-0.010 (0.022)	-1.00
Medical	**0.021*** (0.006)**	**2.12**	**0.019*** (0.006)**	**1.92**
Other Incident (Reference Category)	----	----	----	----
Engine	-0.050 (0.039)	-4.88	-0.050 (0.039)	-4.88
Aerial	0.015 (0.053)	1.51	0.023 (0.053)	2.33
Quint	-0.035 (0.032)	-3.44	-0.030 (0.033)	-2.96
Other Apparatus	-0.042 (0.043)	-4.11	-0.035 (0.042)	-3.44
Ambulance (Reference Category)	----	----	----	----
Primary Unit	-0.010 (0.009)	-1.00	-0.010 (0.009)	-1.00
Chief Station	-0.038 (0.036)	-3.73	-0.035 (0.036)	-3.44
Multi Unit Station	-0.072 (0.054)	-6.95	-0.086 (0.062)	-8.24
Square Feet	0.0000009 (0.000002)	0.00009	0.0000009 (0.000002)	0.00009
Training Completed	**-0.171*** (0.017)**	**-15.72**	**-0.040* (0.020)**	**-3.92**
Days Trained	----	----	**-0.002*** (0.001)**	**-0.20**
Training Completed X Days Trained	----	----	-0.001 (0.001)	-0.10
Constant	**4.180*** (0.063)**	----	**4.193*** (0.071)**	----
N	46,954	46,954	46,954	46,954
R-Squared	0.1277	0.1277	0.1509	0.1509

Table 4: OLS Regression Results for Policy Enforcement Dependent Variable: Log Turnout Standard errors clustered by fire station		
Variable	**Model 3**	$(e^{\beta} - 1) * 100$
Morning	**0.106*** (0.008)**	**11.18**
Evening	**0.078*** (0.007)**	**8.11**
Graveyard	**0.524*** (0.013)**	**68.88**
Daytime (Reference Category)	----	
Above	**0.114** (0.045)**	**12.08**
Remote	0.004 (0.024)	0.40
Adjacent (Reference Category)	----	----
Fire	-0.020 (0.020)	-1.98
Medical	**0.017*** (0.006)**	**1.71**
Other Incident (Reference Category)	----	----
Engine	**-0.079** (0.032)**	**-7.60**
Aerial	-0.011 (0.050)	-1.09
Quint	-0.045 (0.032)	-4.40
Other Apparatus	-0.005 (0.038)	-0.50
Ambulance (Reference Category)	----	----
Primary Unit	-0.014 (0.009)	-1.39
Chief Station	-0.014 (0.040)	-1.39
Multi Unit Station	-0.072 (0.050)	-6.95
Square Feet	0.000002 (0.000002)	0.0002
Training Completed	**-0.183*** (0.011)**	**-16.72**
Policy Enforcement	**-0.453*** (0.015)**	**-36.43**
Constant	**4.181*** (0.058)**	----
N	69,835	69,835
R-Squared	0.2257	0.2257

Appendix: Descriptive Statistics (N = 69,835)			
Variable	**Mean**	**Median**	**% 1s**
Turnout Time	65.74	61.00	----
Dependent Variable: Log Time	4.04	4.11	----
Morning	----	----	24.43
Evening	----	----	28.53
Graveyard	----	----	16.07
Daytime	----	----	30.97
Above Dorm	----	----	10.73
Remote Dorm	----	----	20.33
Adjacent Dorm	----	----	68.94
Fire	----	----	2.29
Medical	----	----	76.08
Other Incident	----	----	21.63
Engine	----	----	45.16
Aerial	----	----	5.97
Quint	----	----	9.32
Other Apparatus	----	----	0.80
Ambulance	----	----	38.75
Primary Unit	----	----	66.61
Chief Station	----	----	22.77
Multi Unit Station	----	----	92.18
Square Feet	7632	5800	----
Training Completed	----	----	55.64
Policy Enforcement	----	----	13.53
Days Trained	46.94	17	----
Training Completed X Days Trained	46.03	13	----