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International Fire Service Journal of Leadership and Management

The *International Fire Service Journal of Leadership and Management (IFSJLM)* is composed of peer-reviewed articles related to fire leadership and management. To our knowledge, it is the only academic journal with this focus in the world. *IFSJLM* is published by Fire Protection Publications (FPP) at Oklahoma State University (OSU). FPP is part of the College of Engineering, Architecture, and Technology at OSU and is the leading publisher in the world of fire-related education and training materials. *IFSJLM* would not be possible without the financial support of the Dean of the College of Engineering, Architecture, and Technology and Fire Protection Publications. Their support represents a commitment to the continued professionalization of the American fire service.

Fire Protection Publications

Dr. John Granito Award for Excellence in Fire Leadership and Management Research

The Dr. Granito Award

Fire Protection Publications (FPP) and the *International Fire Service Journal of Leadership and Management (IFSJLM)* head-quartered on the campus of Oklahoma State University (OSU) are proud to announce the creation of the **Dr. John Granito Award for Excellence in Fire Leadership and Management Research (the Dr. Granito Award)**. The award will be presented at the *IFSJLM* Research Symposium that supports the Journal held annually in July at the IFSTA Validation Conference. The award honors Dr. John Granito. John is one of the premier fire and public safety consultants in the United States. Just a few of his many Fire, Rescue, and Emergency Services research projects include: Oklahoma State University-Fire Protection Publications Line of Duty Death Reduction project (3 years); Centaur National Study (3 years); Research Triangle Institute/National Fire Protection Association/International City/County Management Association project (4 years); Fire Department Analysis Project (FireDAP) of the Urban Fire Forum (13 years); *Combination Department Leadership* project, University of Maryland, Maryland Fire & Rescue Institute (4 years); Worcester Polytechnic/International Association of Fire Fighters/International Association of Fire Chiefs/ National Institute for Occupational Safety and Health *Fire Ground Performance Study* (current). He has participated in more than 400 fire department studies. John also has strong ties to academia. He served in a number of academic positions for almost 30 years, including 16 years at the State University of New York at Binghamton. He is Professor Emeritus and Retired Vice President for Public Service and External Affairs at SUNY Binghamton, which is consistently ranked in the top public universities by *U.S. News and World Report*. John has published numerous articles, chapters, and technical papers, served as co-editor of the 2002 book published by the International City/County Management Association entitled, *Managing Fire and Rescue Service*, and is a Section Editor of the NFPA® 2008 *Fire Protection Handbook.* Dr. Granito will be the first recipient of the award that honors him and his service to the fire service and to academia. Each year the recipient of the Dr. Granito Award will present the Keynote Address at the annual *IFSJLM* Research Symposium.

Nomination Form

Fire Protection Publications (FPP) and the *International Fire Service Journal of Leadership and Management (IFSJLM)* headquartered on the campus of Oklahoma State University (OSU) are accepting nominations for the **Dr. John Granito Award for Excellence in Fire Leadership and Management Research (the Dr. Granito Award).** The award is presented at the Research Symposium that supports the *International Fire Service Journal of Leadership and Management (IFSJLM)* held annually in July at the IFSTA Validation Conference.

The nominee should have made a significant contribution to the advancement of fire leadership and management through his/her scholarly/academic writing. The Dr. Granito Award is not necessarily a life-time achievement award, although such individuals certainly should be in a prominent position to be nominated. The nominee can be a person who, although early in their career as a practitioner/scholar or academic, has made a seminal contribution to the fire leadership and management literature.

To nominate an individual for the Dr. Granito Award, please submit by 15 January of the symposium year: (1) this form (or a copy of it), (2) no more than a one-page single-spaced letter explaining why you believe the person is deserving of the award, and (3) a copy of the nominee's resume or curriculum vitae. Send the materials to: Dr. Granito Award, Dr. Bob England, Editor, *International Fire Service Journal of Leadership and Management*, Department of Political Science, 237 Murray Hall, Oklahoma State University, Stillwater, Oklahoma 74078.

I nominate _____ for the **Dr. John Granito Award for Excellence in Fire Leadership and Management Research.** To support the nomination, I have included a letter of recommendation and a resume or curriculum vitae (CV) of the nominee. (A nomination is not accepted without the supporting letter and resume/CV.)

Nominator Name: _____

Address: _____

_____

Zip/Postcode: _____

Contact Information:

Telephone: _____

Email: _____

Message from Dr. Robert England

Editor, *International Fire Service Journal of Leadership and Management (IFSJLM)* and Professor of Political Science at Oklahoma State University

Welcome to Volume 5 of *IFSJLM*. This issue marks the transition from a biannual to an annual issue of the "Red Journal." By moving to one issue yearly instead of two, we are able to provide readers with more content at one time and lower journal production costs.

The first article in this issue, as is the tradition now, is a presentation delivered by Dr. Lori Moore-Merrell at the annual *IFSJLM* Research Symposium held in July 2010 in Oklahoma City. Dr. Moore-Merrell was the 2010 recipient of the Dr. John Granito Award for Excellence in Fire Leadership and Management Research. We extend our thanks to Dr. Moore-Merrell for her excellent keynote address and her many scholarly contributions to fire leadership and management.

We urge our readers to nominate others for the award that honors those who advance the **science of fire leadership and management**. A nomination form is found at the bottom of the previous page of this issue of *IFSJLM*.

Keynote Address

Jason D. Averill, National Institute of Science and Technology
Dr. Lori Moore-Merrell, International Association of Fire Fighters
Adam Barowy, National Institute of Science and Technology
Robert Santos, Urban Institute
Richard Peacock, National Institute of Science and Technology
Dr. Kathy A. Notarianni, Worchester Polytechnic Institute
Doug Wissoker, Urban Institute

Report on Residential Fireground Field Experiments

Abstract

Service expectations placed on the fire service, including Emergency Medical Services (EMS), response to natural disasters, hazardous materials incidents, and acts of terrorism have steadily increased. However, local decision-makers are challenged to balance these community-service expectations with finite resources without a solid technical foundation for evaluating the impact of staffing and deployment decisions on the safety of the public and firefighters.

For the first time, this study investigates the effect of varying crew size, first-apparatus arrival time, and response time on firefighter safety, overall task completion, and interior residential tenability using realistic residential fires. This study is also unique because of the array of stakeholders and the caliber of technical experts involved. Additionally, the structure used in the field experiments included customized instrumentation; all related industry standards were followed, and robust research methods were used. The results and conclusions will directly inform the National Fire Protection Association® (NFPA®) 1710 Technical Committee, who is responsible for developing consensus industry-deployment standards.

This report presents the results of more than 60 laboratory and residential fireground experiments designed to quantify the effects of various fire department deployment configurations on the most common type of fire — a low-hazard residential structure fire. For the fireground experiments, a 2,000 ft² (186 m²), two-story residential structure was designed and built at the Montgomery County Public Safety Training Academy in Rockville, Maryland. Fire crews from Montgomery County, Maryland, and Fairfax County, Virginia, were deployed in response to live fires within this facility. In addition to systematically controlling for the arrival times of the first and subsequent fire apparatus, crew size was varied to consider two-, three-, four-, and five-person staffing. Each deployment performed a series of 22 tasks that were timed, while the thermal and toxic environment inside the structure was measured. Additional experiments with larger fuel loads as well as fire modeling produced additional insight. Report results quantify the effectiveness of crew size, first-due engine arrival time, and apparatus-arrival stagger on the duration and time to completion of the key 22 fireground tasks and the effect on occupant and firefighter safety.

Background

The fire service in the United States has a deservedly proud tradition of service to community and country dating back hundreds of years. As technology advances and the scope of service grows (e.g., more Emergency Medical Services [EMS] obligations and growing response to natural disasters, hazardous materials incidents, and acts of terrorism), the fire service remains committed to a core mission of protecting lives and property from the effects of fire.

Fire fighting is a dangerous business with substantial financial implications. In 2007, U.S. municipal fire departments responded to an estimated 1,557,500 fires. These fires killed 3,430 civilians (nonfirefighters) and contributed to 17,675 reported civilian fire injuries. Direct property damage was estimated at $14.6 billion dollars (Karter, 2008). In spite of the vigorous nationwide efforts to promote firefighter safety, the number of firefighter deaths has consistently remained tragically high.

In both 2007 and 2008, the U.S. Fire Administration (USFA) reported 118 firefighter fatalities (USFA, 2008).

Although not all firefighter deaths occur on the fireground — accidents in vehicles and training fatalities add to the numbers — every statistical analysis of the fire problem in the United States identifies residential structure fires as a key component in firefighter and civilian deaths as well as direct property loss. Consequently, community planners and decision-makers need tools for optimally aligning resources with the service commitments needed for adequate protection of citizens.

Despite the magnitude of the fire problem in the United States, there are no scientifically based tools available to community and fire service leaders to assess the effects of prevention, fixed sprinkler systems, fire-fighting equipment, or deployment and staffing decisions. Presently, community and fire service leaders have a qualitative understanding of the effect of certain resource allocation decisions. For example, a decision to double the number of firehouses, apparatus, and firefighters would likely result in a decrease in community fire losses, while cutting the number of firehouses, apparatus, and firefighters would likely yield an increase in the community fire losses, both human and property. However, decision-makers lack a sound basis for quantifying the total impact of enhanced fire resources on the number of firefighter and civilian lives saved and injuries prevented.

Studies on adequate deployment of resources are needed to enable fire departments, cities, counties, and fire districts to design an acceptable level of resource deployment based upon community risks and service-provision commitment. These studies will assist with strategic planning and municipal and state budget processes. Additionally, as resource studies refine data-collection methods and measures, both subsequent research and improvements to resource-deployment models will have a sound scientific basis.

Project Overview

This project systematically studies deployment of fire-fighting resources and the subsequent effect on both firefighter safety and the ability to protect civilians and their property. It is intended to enable fire departments and city/county managers to make sound decisions regarding optimal resource allocation to meet service commitments using the results of scientifically based research. Specifically, the residential fireground experiments provide quantitative data on the effect of crew size, first-due engine arrival time, and subsequent apparatus stagger on time-to-task for critical steps in response and fire fighting.

The first phase of the multiphase project was an extensive survey of more than 400 career and combination fire departments in the United States with the objective of optimizing a fire service leader's capability to deploy resources to prevent or mitigate adverse events that occur in risk- and hazard-filled environments. The

results of this survey are not documented in this report, which is limited to the experimental phase of the project, but they will constitute significant input into future applications of the data presented in this document.

This report describes the second phase of the project, divided into the following four parts:

- **Part 1** — Laboratory experiments to design the appropriate fuel packages to be used in the burn facility specially constructed for the research project

- **Part 2** — Field tests for critical time-to-task completion of key tasks in fire suppression

- **Part 3** — Field tests with real furniture (room and contents experiments)

- **Part 4** — Fire modeling to apply data gathered to slow-, medium-, and fast-growth-rate fires

The scope of this study is limited to understanding the relative influence of deployment variables on low-hazard, residential structure fires, similar in magnitude to the hazards described in National Fire Protection Association® (NFPA®) 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*. The standard uses as a typical residential structure a 2,000 ft^2 (186 m^2) two-story, single-family dwelling with no basement and no exposures (nearby buildings or hazards such as stacked flammable materials).

The limitations of the study, such as firefighters' advance knowledge of the facility constructed for this experiment, invariable number of apparatus, and lack of experiments in extreme temperatures or at night, will be discussed in a later section of this report. It should be noted that the applicability of the conclusions from this report to commercial structure fires, high-rise fires, outside fires, and response to hazardous material incidents, acts of terrorism, and natural disasters, or other technical responses has not been assessed and should not be extrapolated from this report.

Literature Review

Research to date has documented a consistent relationship between resources deployed and firefighter and civilian safety. Studies documenting engine- and ladder-crew performance in diverse simulated environments as well as actual responses show a basic relationship between apparatus staffing levels and a range of important performance variables and outcome measurements such as mean on-scene time, time-to-task completion, incidence of injury among fire service personnel, and costs incurred as a result of on-scene injuries (Cushman, 1982; McManis Associates & John T. O'Hagan and Associates, 1984; Morrison, 1990; Phoenix [AZ] Fire Department, 1991).

Reports by fire service officials and consulting associates reviewing fire suppression and emergency response by fire crews in U.S. cities were the first publications to describe the relationship between adequate staffing levels and response time, time to completion of various fireground tasks, overall effectiveness of fire suppression, and estimated value of property loss for a wide range of real and simulated environments. In 1980, the Columbus (OH) Fire Division's report on firefighter effectiveness showed that for a predetermined number of personnel initially deployed to the scene of a fire, the proportion of incidents in which property loss exceeded $5,000 and horizontal fire spread of more than 25 ft^2 (2.3 m^2) was significantly greater for crews whose numbers fell below the set thresholds of 15 total fireground personnel at residential fires and 23 at large-risk fires (Backoff,1980). The following year, repeated live experiments at a one-family residential site using modern apparatus and equipment demonstrated that larger units performed tasks and accomplished knockdown more quickly, ultimately resulting in a lower percentage of loss attributable to factors controlled by the fire department. The authors of this article highlighted that the fire company is the fire department's basic working unit and further emphasized the importance of establishing accurate and up-to-date performance measurements to help collect data and develop conclusive strategies to improve staffing and equipment utilization (Gerard & Jacobsen, 1981).

Subsequent reports from the USFA and several consulting firms continued to provide evidence for the effects of staffing on fire crews' ability to complete tasks involved in fire suppression efficiently and effectively. Citing a series of tests conducted in 1977 by the Dallas (TX) Fire Department that measured the time it took three-, four-, and five-person teams to advance a line and put water on a simulated fire at the rear of the third floor of an old school, officials from the USFA underscored that time-to-task completion and final level of physical exhaustion for crews markedly improved not after any one threshold, but with the addition of each new team member. This report went on to outline the manner in which simulated tests exemplify a clear-cut means to record and analyze the resources initially deployed and finally utilized at fire scenes (National Fire Academy [NFA], 1981). A later publication detailing more Dallas (TX) Fire Department simulations — 91 runs each for a private residential fire, high-rise office fire, and apartment house fire — showed again that increased staffing levels greatly enhanced the coordination and effectiveness of crews' fire-suppression efforts during a finite time span (McManis Associates & John T. O'Hagan and Associates, 1984). Numerous studies of local departments have supported this conclusion using a diverse collection of data, including a report by the National Fire Academy (NFA) on fire department staffing in smaller communities, which showed that a company crew staffed with four firefighters could perform rescue of potential victims approximately 80 percent faster than a crew staffed with three firefighters (Morrison, 1990).

During the same time period that the impact of staffing levels on fire operations was gaining attention, investigators began to question whether staffing levels could also be associated with the risk of firefighter injuries and the cost incurred as a result of such injuries at the fire scene. Initial results from the Columbus (OH) Fire Division showed that "firefighter injuries occurred more often when the total number of personnel on the fireground was less than 15 at residential fires and 23 at large-risk fires" (Backoff, 1980). Mounting evidence has indicated that staffing levels are a fundamental health and safety issue for firefighters in addition to being a key determinant of immediate response capacity. One early analysis by the Seattle (WA) Fire Department for that city's Executive Board reviewed the average severity of injuries suffered by three-, four-, and five-person engine companies, with the finding that "the rate of firefighter injuries expressed as total hours of disability per hours of fireground exposure were 54 percent greater for engine companies staffed with three personnel when compared to those staffed with four firefighters, while companies staffed with five personnel had an injury rate that was only one-third that associated with four-person companies" (Cushman, 1982). A joint report from the International Association of Fire Fighters (IAFF) and Johns Hopkins University (JHU) concluded, after a comprehensive analysis of the minimum staffing levels and firefighter injury rates in U.S. cities with populations of 150,000 or more, that jurisdictions operating with crews of less than four firefighters had injury rates nearly twice the percentage of jurisdictions operating with crews of four-person crews or more (IAFF & JHU, 1991).

More recent studies have continued to support the finding that staffing per piece of apparatus integrally affects the efficacy and safety of fire department personnel during emergency response and fire suppression. Two studies in particular demonstrate the consistency of these conclusions and the increasing level of detail and accuracy present in the most recent literature by looking closely at the discrete tasks that could be safely and effectively performed by three- and four-person fire companies. After testing drills comprised of a series of common fireground tasks at several fire-simulation sites, investigators from the Austin (TX) Fire Department assessed the physiological impact and injury rates among the variably staffed fire crews. In these simulations, an increase from a three- to four-person crew resulted in marked improvements in time-to-task completion or efficiency for the two-story residential fire drill, aerial-ladder evolution, and high-rise fire drill, leading the researchers to conclude that loss of life and property increases when a sufficient number of personnel are not available to conduct the required tasks efficiently, independent of firefighter experience, preparation, or training. Reviews of injury reports by

the Austin (TX) Fire Department furthermore revealed that the injury rate for three-person companies in the 4 years preceding the study was nearly one-and-a-half that of crews staffed with four or more personnel. In a sequence of similar tests, the Office of the Fire Marshal of Ontario, Canada, likewise found that three-person fire companies were unable to safely perform deployment of backup protection lines, interior suppression or rescue operations, ventilation operations that required access to the roof of the involved structure, use of large hand-held hoselines, or establishment of a water supply from a static source without additional assistance and within the time limits of the study. Following these data, Fire Marshal officials noted that three-person crews were also at increased risk for exhaustion due to insufficient relief at fire scenes and made recommendations for the minimum staffing levels per apparatus necessary for suppression and rescue related tasks (Office of the Fire Marshal of Ontario, 1993).

The most comprehensive contemporary studies on the implications of fire-crew staffing now include much more accurate performance measures for tasks at the fireground in addition to the basic metric of response time. They include environmental measures of performance, such as total water supply, which expand the potential for assessing the cost-effectiveness of staffing not only in terms of fireground personnel injury rates but also comparative resource expenditures required for fire suppression. Several examples from the early 1990s show investigators and independent fire departments beginning to gather the kind of specific, comprehensive data on staffing and fireground tasks such as those suggested and outlined in concurrent local government publications that dealt with management of fire services (Coleman, 1988). A report by the Phoenix (AZ) Fire Department laid out clear protocols for responding to structure fires and response evaluation in terms of staffing, objectives, task breakdowns, and times in addition to outlining the responsibilities of responding fire department members and the order in which they should be accomplished for a full-scale simulation activity (Phoenix [AZ] Fire Department, 1991). One attempt to devise a prediction model for the effectiveness of manual fire suppression similarly reached beyond response-time benchmarks to describe fire operations and the step-by-step actions of firefighters at incident scenes by delineating the time-to-task breakdowns for size-up, water supply, equipment selection, entry, locating the fire, and advancing hoselines, while also comparing the predicted time-to-task values with the actual times and total resources (Menker, 1994). Two separate studies of local fire department performance, one from Taoyuan County in Taiwan and another from the London Fire Brigade, have drawn ties between fire crews' staffing levels and total water demand as the consequence of both response time and fire severity. Field data from Taoyuan County for cases of fire in commercial, business, hospital, and educational properties showed that the type of land use as well as response time had a significant impact on the water volume necessary for fire suppression, with the notable quantitative finding that the water supply required on-scene doubled when the fire department response increased by 10 minutes (Chang & Huang, 2005).

Response time as a predictor of residential fire outcomes has received less study than the effect of crew size. A Rand Institute study demonstrated a relationship between the distance the responding companies traveled and the physical property damage. This study showed that the fire severity increased with response distance, and therefore the magnitude of loss increased proportionally (Rand Institute, 1978). Using records from 307 fires in nonresidential buildings over a 3-year period, investigators in the United Kingdom correspondingly found response time to have a significant impact on final fire area, which in turn was proportional to total water demand (Sardqvist, 2000).

Recent government and professional literature continue to demonstrate the need for more data that would quantify in depth and illustrate the required tasks, event sequences, and necessary response times for effective fire suppression in order to determine with accuracy the full effects of either a reduction or increase in fire-company staffing (Karter, 2008). A report prepared for National Institute of Standards and Technology (NIST) stressed the ongoing need to elucidate the relationship between staffing and personnel injury rates, stating that "a scientific study on the relationship between the number of firefighters per engine and the incidence of injuries would resolve a long-standing question concerning staffing and safety" (TriData Corporation, 2005). While not addressing staffing levels as a central focus, an annual review of fire department calls and false alarms by the NFPA® exemplified the need to capture not only the number of personnel per apparatus for effective fire suppression but also to clarify the demands on individual fire departments with resolution at the station level (NFPA®, 2008).

In light of the existing literature, there remain unanswered questions about the relationships between fire service resource deployment levels and associated risks. For the first time, this study investigates the effect of varying crew size, first-apparatus arrival time, and response time on firefighter safety, overall task completion, and interior residential tenability using realistic residential fires. This study is also unique because of the array of stakeholders and the caliber of technical advisors involved. Additionally, the structure used in the field experiments included customized instrumentation for the experiments; all related industry standards were followed; robust research methods were used; and the results and conclusions will directly inform the NFPA® 1710 Technical Committee as well as public officials and fire chiefs.[1]

Discussion

Both the increasing demands on the fire service — such as the growing number of EMS responses, challenges from natural disasters, hazardous materials incidents, and acts of terrorism — and previous research point to the need for scientifically based studies of the effect of different crew sizes and firefighter-arrival times on the effectiveness of the fire service to protect lives and property. To meet this need, a research partnership of the Commission on Fire Accreditation International (CFAI), International Association of Fire Chiefs (IAFC), IAFF, NIST, and Worcester Polytechnic Institute (WPI) was formed to conduct a multiphase study of the deployment of resources as it affects firefighter and occupant safety. Starting in FY 2005, funding was provided through the U.S. Department of Homeland Security/ Federal Emergency Management Agency (DHS/FEMA) Grant Program Directorate for Assistance to Firefighters Grant Program — Fire Prevention and Safety Grants. In addition to the low-hazard residential fireground experiments described in this report, the multiple phases of the overall research effort include development of a conceptual model for community risk assessment and deployment of resources, implementation of a generalizable department incident survey, and delivery of a software tool to quantify the effects of deployment decisions on resultant firefighter and civilian injuries and on property losses.

The first phase of the project was an extensive survey of more than 400 career and combination (both career and volunteer) fire departments in the United States with the objective of optimizing a fire service leader's capability to deploy resources to prevent or mitigate adverse events that occur in risk- and hazard-filled environments. The results of this survey are not documented in this report, which is limited to the experimental phase of the project. The survey results will constitute significant input into the development of a future software tool to quantify the effects of community risks and associated deployment decisions on resultant firefighter and civilian injuries and property losses.

The following research questions guided the experimental design of the low-hazard residential fireground experiments documented in this report:

1. How do crew size and stagger affect overall start-to-completion response timing?

2. How do crew size and stagger affect the timings of task initiation, task duration, and task completion for each of the 22 critical fireground tasks?

3. How does crew size affect elapsed times to achieve the following three critical events that are known to change fire behavior or tenability within the structure?

   a. Entry into structure

   b. Water on fire

   c. Ventilation through windows (three upstairs and one back downstairs window and the burn-room window)

4. How does the elapsed time to achieve the national standard of assembling 15 firefighters at the scene vary between crew sizes of four and five?

In order to address the primary research questions, the research was divided into the following four distinct, yet interconnected parts:

- **Part 1** — Laboratory experiments to design appropriate fuel load

- **Part 2** — Experiments to measure the time for various crew sizes and apparatus stagger (interval between arrival of various apparatus) to accomplish key tasks in rescuing occupants, extinguishing a fire, and protecting property

- **Part 3** — Additional experiments with enhanced fuel load that prohibited firefighter entry into the burn prop — a building constructed for the fire experiments

- **Part 4** — Fire modeling to correlate time-to-task completion by crew size and stagger to the increase in toxicity of the atmosphere in the burn prop for a range of fire-growth rates

The experiments were conducted in a burn prop designed to simulate a low-hazard fire in a residential structure described as typical in NFPA® 1710. NFPA® 1710 is the consensus standard for career firefighter deployment, including requirements for fire department arrival time, staffing levels, and fireground responsibilities.

Limitations of the study include firefighters' advance knowledge of the burn prop, invariable number of apparatus, and lack of experiments in elevated outdoor temperatures or at night. Further, the applicability of the conclusions from this report to commercial structure fires, high-rise fires, outside fires, terrorism/natural disaster response, hazardous materials, or other technical responses has not been assessed and should not be extrapolated from this report.

Primary Findings

Of the 22 fireground tasks measured during the experiments, results indicated that the following factors had the most significant impact on the success of fire-fighting operations. All differential outcomes described in the following sections are statistically significant at the 95-percent confidence level or better.

Overall Scene Time

The four-person crews operating on a low-hazard structure fire completed all the tasks on the fireground (on average) 7 minutes faster — nearly 30 percent — than the two-person crews. The four-person crews completed the same number of fireground tasks (on average) 5.1 minutes faster — nearly 25 percent — than the three-person crews. On the low-hazard residential structure fire, adding a fifth person to the crews did not decrease overall fireground task times. However, it should be noted that the benefit of five-person crews has been documented in other evaluations to be significant for medium- and high-hazard structures, particularly in urban settings, and is recognized in industry standards.[2]

Time to Water on Fire

There was a 10-percent difference in the *water on fire* time between the two- and three-person crews. There was an additional 6-percent difference in the water on fire time between the three- and four-person crews. (i.e., four-person crews put water on the fire 16 percent faster than two-person crews). There was an additional 6 percent difference in the water on fire time between the four- and five-person crews (i.e., five-person crews put water on the fire 22 percent faster than two-person crews).

Ground Ladders and Ventilation

The four-person crews operating on a low-hazard structure fire completed laddering and ventilation (for life safety and rescue) 30 percent faster than the two-person crews and 25 percent faster than the three-person crews.

Primary Search

The three-person crews started and completed a primary search and rescue 25 percent faster than the two-person crews. The four- and five-person crews started and completed a primary search 6 percent faster than the three-person crews and 30 percent faster than the two-person crew. A 10-percent difference was equivalent to just over 1 minute.

Hose Stretch Time

In comparing four-and five-person crews to two-and three-person crews collectively, the time difference to stretch a line was 76 seconds. In conducting more specific analysis comparing all crew sizes to the two-person crews, the differences are more distinct. Two-person crews took 57 seconds longer than three-person crews to stretch a line. Two-person crews took 87 seconds longer than four-person crews to complete the same tasks. Finally, the most notable comparison was between two-person crews and five-person crews — more than 2 minutes (122 seconds) difference in task completion time.

Industry Standard Achieved

As defined by NFPA® 1710, the *industry standard achieved* time started from the first-engine arrival at the hydrant and ended when 15 firefighters were assembled on scene.[3] An effective response force was assembled by the five-person crews 3 minutes faster than the four-person crews. Based on the study protocols modeled after a typical fire department apparatus deployment strategy, the total number of firefighters on scene in the two- and three-person crew scenarios never equaled 15; and therefore the two- and three-person crews were unable to assemble enough personnel to meet this standard.

Occupant Rescue

Three different standard fires were simulated using the Fire Dynamics Simulator (FDS) model. Characterized in the *Handbook of the Society of Fire Protection Engineers* as slow-, medium-, and fast-growth rate,[4] the fires grew exponentially with time. The rescue scenario was based on a nonambulatory occupant in an upstairs bedroom with the bedroom door open.

Independent of fire size, there was a significant difference between the toxicity, expressed as fractional effective dose (FED), for occupants at the time of rescue, depending on arrival times for all crew sizes. Occupants rescued by early-arriving crews had less exposure to combustion products than occupants rescued by late-arriving crews. The fire modeling showed clearly that two-person crews cannot complete essential fireground tasks in time to rescue occupants without subjecting them to an increasingly toxic atmosphere.

For a slow-growth-rate fire with two-person crews, the FED was approaching the level at which sensitive populations such as children and the elderly are threatened. For a medium-growth-rate fire with two-person crews, the FED was far above that threshold and approached the level affecting the general population. For a fast-growth-rate fire with two-person crews, the FED was well above the median level at which 50 percent of the general population would be incapacitated.

Larger crews responding to slow-growth-rate fires can rescue most occupants prior to incapacitation along with early-arriving larger crews responding to medium-growth-rate fires. The result for late-arriving (2 minutes later than early-arriving) larger crews may result in a threat to sensitive populations for medium-growth-rate fires. Statistical averages should not, however, mask the fact that there is no FED level so low that every occupant in every situation is safe.

Conclusion

More than 60 full-scale fire experiments were conducted to determine the impact of crew size, first-due engine arrival time, and subsequent apparatus arrival times on firefighter safety and effectiveness at a low-hazard residential structure fire. This report quantifies

the effects of changes to staffing and arrival times for residential fire-fighting operations. While resource deployment is addressed in the context of a single structure type and risk level, it is recognized that public policy decisions regarding the cost-benefit of specific deployment decisions are a function of many other factors, including geography, local risks and hazards, and available resources as well as community expectations. This report does not specifically address these other factors.

The results of these field experiments contribute significant knowledge to the fire service industry. First, the results provide a quantitative basis for the effectiveness of four-person crews for low-hazard response in NFPA® 1710. The results also provide valid measures of total effective response-force assembly on scene for fireground operations as well as the expected performance time-to-critical-task measures for low-hazard structure fires. Additionally, the results provide tenability measures associated with a range of modeled fires. Future research should extend the findings of this report in order to quantify the effects of crew size and apparatus arrival times for moderate- and high-hazard events such as fires in high-rise buildings, commercial properties, certain factories, or warehouse facilities and responses to large-scale nonfire incidents or technical-rescue operations.

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Endnotes

[1] NFPA® is a registered trademark of the National Fire Protection Association®, Quincy, Massachusetts. NFPA® 1710 defines minimum requirements relating to the organization and deployment of fire suppression operations, emergency medical operations, and special operations to the public by substantially all career fire departments. The requirements address functions and objectives of fire department emergency services delivery, response capabilities, and resources. The purpose of this standard is to specify the minimum criteria addressing the effectiveness and efficiency of the career fire department fire suppression operations, emergency medical services, and special operations delivery in protecting the citizens of the jurisdiction and the occupational safety and health of fire department employees. At the time of this experiment, the 2004 edition of NFPA® 1710 was the current edition.

[2] NFPA® 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*: Section 5.2.1 Fire Suppression Capability and Section 5.2.2 Staffing.

[3] As defined in the *Handbook of the Society of Fire Protection Engineers*, a fast fire grows exponentially to 1 MW in 150 seconds. A medium fire grows exponentially to 1 MW in 300 seconds. A slow fire grows exponentially to 1MW in 600 seconds. A 1 MW fire can be thought of as a typical upholstered chair burning at its peak. A large sofa might be 2 to 3 MW.

[4] As defined in the *Handbook of the Society of Fire Protection Engineers*, a fast fire grows exponentially to 1 MW in 150 seconds. A medium fire grows exponentially to 1 MW in 300 seconds. A slow fire grows exponentially to 1 MW in 600 seconds. A 1 MW fire can be thought of as a typical upholstered chair burning at its peak. A large sofa might be 2 to 3 MW.

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Under Fire: Firefighters' Coping with Aggression and Violence

Abstract

The issue of aggression and violence towards emergency workers, and particularly firefighters, has become a high-profile issue within the United Kingdom (UK). Aggressive acts range from verbal abuse to physical attacks, either directed at the fire appliance or aimed directly at the firefighters themselves. Government and trade unions dispute the size of the problem, with unions claiming official statistics vastly underestimate both the scale of the problem and its effects. Whilst the physical effects of violence are obvious, the psychological effects are more subtle as are the psychological strategies employed by firefighters to prepare and protect themselves against these effects. This paper reports two linked studies, both of which used Interpretative Phenomenological Analysis (IPA) to explore the impact of attacks and the ways in which firefighters make sense of their experiences. Study 1 explored participants' experience of being attacked and their resultant reactions. In the analysis control *emerged as the superordinate theme and the key issue of importance for participants. Within this analysis, three subthemes emerged:* attacks are "normal," loss of control, *and* the need to explain*. These subthemes suggest that participants were actively employing psychological strategies to make sense of and protect themselves from their encounters. Study 2 focused directly on the protective coping strategies used by firefighters that allow them to regain some control. Three superordinate themes emerged from the analysis:* normalising the abnormal, the professional firefighter, *and* a supportive watch*. Research reported here lends support to claims that acts of aggression can be underreported through the normalised acceptance of such acts. Further, they indicate a need for real-world interventions to promote the unacceptability of such attacks, to decrease the levels of normalisation, and to allow the use of more effective coping methods.*

Introduction

Over recent years, there has in the United Kingdom (UK) been an increasing public awareness of and media interest in the issue of violence towards fire crews whilst they are conducting their occupational duties. How this increasing interest is justified in terms of incident rates is difficult to determine. The UK Government does not publish or publicise the data they collect on attacks on firefighters, despite requiring the formal reporting of all such events. However, when questioned on incident rates, it claims that attacks fell from 1,300 in 2005/2006 to 400 in 2006/2007 (Labour Research Department, 2008); and it states that its intention is to see rates fall further by 2018 (Communities and Local Government [CLG], 2008). However, the Fire Brigades Union has long been critical of official statistics on this topic (Labour Research Department, 2005); and research it commissioned suggested, during the same timescale that CLG had reported on, that there had actually been an increase in attacks. The Fire Brigades Union instead suggested that figures as high as 2,030 in 2005/2006 and rising to 2,098 in 2006/2007 more accurately reflected incident rates and contended that

attacks occur around 40 times a week and six times a day (Labour Research Department, 2008). This suggestion of high incidence is lent support by an analysis of British Crime Survey data that suggests that employees working in protective service occupations, such as the Fire and Rescue Services (FRS) and the Police, are the most at risk of experiencing violence at work (Webster, Patterson, Hoare, & O'Loughlin, 2007).

The UK Government has responded to the growing awareness of this phenomenon by introducing legislation addressing this issue, both in the Fire and Rescue Services Act (2004) and more directly in the Emergency Workers Obstruction Act (2006) that makes it a criminal offence to obstruct or hinder emergency workers who are responding to an emergency situation. This legislation is aimed at deterring attackers, but whether it will actually have this impact is still open to question. It will certainly be used to criminalise and punish attackers, but not enough time has yet passed to determine the effect that this will have on incident rates or whether this legislation could actually be counterproductive, which some firefighters are concerned may be the case (Brunsden, 2007a).

The concerns about the accuracy of official statistics and whether there is an underreporting of aggressive incidents is complicated further when aggression is considered in its wider form, i.e., that attacks may not just be physical but can also be verbal or psychological. Brunsden (2007a, 2007b) details three distinct types of aggressive acts against firefighters: physical attacks from a distance, close-up physical attacks, and verbal abuse.

Physical attacks from a distance can be perceived as an attack on the role that the firefighter is performing, against the appliance or the uniform of firefighters, rather than against the person. Close-up physical attacks include those involving bodily contact or through close use of weapons such as knives or guns. Verbal abuse affects not only firefighters but also control-room staff; and although this seems to be coped with by control, there is the potential of it causing psychological distress (Brunsden, 2007a). This form of aggression is often considered as understandable by FRS personnel when situated within the stress of an emergency situation — a rationalisation that potentially mitigates distress and acts as a buffering form of coping. Verbal abuse is also generally overlooked in terms of reporting and record keeping. A CLG guidance document published in 2006 does, however, acknowledge that verbal abuse can be just as dangerous as physical attacks through increasing anxiety and stress levels, with resultant detrimental health consequences for the individual (and significant operational and economic costs for the Fire Service). The issue of aggression towards firefighters, whether physical or verbal, matters not only for those involved but also more widely because the safety of the public can be threatened, for example, through reduced operational performance or emergency response times.

Walsh (2008) alerts us to the notion that the figures can only provide a partial view of what is really going on with this phenomenon; there is more to consider than just incidence rates and whether attacks are increasing or decreasing. Official figures reveal nothing about the impact on the individuals affected by violence or their psychological and professional reactions. Ideographic qualitative approaches can, however, get to these deeper experiential understandings. To fully understand what is happening, a different research approach is needed, not only to assist in unpacking the statistics but also, and more importantly, to understand the underlying phenomenon and its effects. Qualitative approaches emphasise the importance of understanding participants' own perspectives and can offer contextualised understandings of a phenomenon's implications for the FRS (Brunsden, 2005).

Method

Two linked studies were carried out. The focus of Study 1 was very open. It explored participants' experiences and reporting of aggressive attacks whilst on duty and the resultant impact that this had had, both personally and professionally. Study 2 expanded on the key issues emerging from Study 1 and therefore focused more narrowly on the coping strategies employed, rather than experiences and understandings *per se*.

Participants

The participants in both studies were drawn from a single UK FRS. The Service served a mixed population of both rural and urban areas. Managers' views were that the Service did not particularly suffer attacks and abuse, although acknowledging that there was a small issue in certain specific locations. Different participants took part in the following two studies:

1. **Study 1**: Five firefighters participated, all of whom had an active operational role. They were all male and were aged between 36 and 47. Their length of service ranged between 11 and 26 years.

2. **Study 2**: Seven firefighters participated, again all of whom had an active operational role. They were all male and aged from 23 to 39. Their level of service ranged between 1.5 and 12 years.

Data Collection

In both studies the participants were interviewed using semistructured interviews. The interviews provided participants the chance to talk freely whilst still allowing an opportunity for further exploration of responses. All interviews took place at the fire station whilst participants were on duty. This presented a challenge to the research team as interviews were frequently interrupted by other members of staff or by emergency calls. However, as *outsider* researchers, i.e., people who are not normally involved in FRS activities, it was important that we were able to obtain a realistic understanding of the nature of our participants' daily working lives. All interviews were recorded and transcribed verbatim with the data being de-identified and participants given pseudonyms before analysis took place.

Analytic Process

In both studies the data were subjected to an Interpretative Phenomenological Analysis (IPA) (Smith & Osborn, 2003, 2004). This involved the following approach being taken: Initially, each individual transcript was analysed in isolation from the other transcripts. This process began with the transcript being read and re-read in order to obtain a holistic overview of the participant's account. During this re-reading, unfocused research notes were made relating to anything within the transcript that appeared to be significant. Following this initial encounter, the transcript was then subjected to a closer examination, which identified conceptual themes that were felt to depict the essence of the participant's account. The emergent themes from each single account were then listed alongside data extracts that exemplified and illustrated the specific themes.

Following this initial stage, analysis *across* participants' accounts began. Connective themes were sought across accounts, with related themes from individual accounts being clustered together and organised under superordinate conceptual headings.

Throughout this process of data organisation, the original transcripts were continually referred to in order to ensure that themes remained representative of the participants' original accounts and intentions. The final emergent themes from an IPA should reflect the most salient meanings contained within the participants' own narratives (Bramley & Eatough, 2005). The resultant structure of themes was then used to facilitate the creation of the written analysis, which again involved a continuous reflection on the thematic framework and a return to the original transcripts to ensure a representative account. In addition, one member of the research team was not involved in these primary analyses. Instead he or she acted as an auditor for the validity of the analysis to check that the interpretations were justified against the data.

Analysis: Study 1

The broad exploration of participants' experiences of aggressive incidence led to a single super-ordinate theme emerging; specifically that of *control*. This super-ordinate theme was comprised of three sub-ordinate themes: *attacks are "normal," loss of control*, and *the need to explain*.

Attacks Are Normal

All participants regarded encountering abuse and violence as a normal and expected part of their daily occupational role. All participants depicted aggression and abuse as something to be expected. Paul's statement that it is:

> *"... just one of those things" (Paul)*

was typical of the participants' position regarding attacks.

The frequency of attacks in some areas appeared to feed into this expectation; not only would attacks occur, but they were inevitable and so necessarily accepted. As George states here:

> *"It's just so normal ... it becomes the norm." (George)*

This expectation of aggression and imposition of *normal* onto what should be an abnormal event was seen throughout all of the participants' accounts. This was accompanied by a trivialisation of the impact of aggressive attacks. Bob's statement that it is:

> *"Water off a duck's back" (Bob)*

portrays attacks as ineffectual and leaving no imprint, physically or otherwise on the crews.

This minimising of the impact of aggressive attacks was particularly the case when no injury or harm had resulted; in such cases, reporting was regarded as a waste of time. Similarly, verbal abuse was not seen as an attack at all but just accepted as part of their role. This suggests that the definitions of *attacks* being employed by firefighters are not necessarily the same as those in use by others (for example, FRS management, CLG, or even their own Fire Brigades Union).

However, despite all of the participants minimising the impact of attacks, there was still some evidence that attacks were something to be endured and did have an effect on those who experienced them. John's statement that:

> *"... you just have to grin and bear it" (John)*

suggests that there is a detrimental effect of attacks, which has to be borne, albeit borne with a brave face. Digging deeper into their acceptance of attacks, it became clear that this decision to *grin and bear it* emerged from a sense of powerlessness and an inability to do anything else other than accept it. Attacks were accepted and tolerated because this offered the only way of seeming to have any control at all over the situation.

Loss of Control

At the same time, there was still clear evidence that participants were aware that this construction of normality offered only an illusion of control and that they were aware of the limitations of this tactic. During aggressive encounters, it was clear that participants experienced feelings of helplessness as to what action they could take in response to attacks and abuse. Their acceptance of the attacks was seen to be the only course of action open to them as:

> *"... you can't really do anything about it." (John)*

This inaction was not through choice; however, instead participants felt that any action on their part could have greater negative consequences for them than just accepting the attacks. Despite the normalising of attacks, participants clearly felt frustrated by their inability to act against attackers. As Paul says:

> *"... You'd like to do more things but we'd be strung up if we did." (Paul)*

Throughout participants' responses, there was clear evidence of a fear that they would be judged as having behaved inappropriately in these encounters if they challenged their attackers in any active ways. Participants articulated their concerns that they might lay themselves open to prosecution or disciplinary action as George's statement here suggests:

> *"... and more than likely it will be us that loses our job if we overreacted." (George)*

This concern for job security, and of management reprisals for any action, makes it clear why inaction against the attackers has become the chosen behavioural response. Participants loved their jobs despite the incidence of attacks and were anxious that any reprisals against attackers could threaten these as John suggests here:

"... you wouldn't be in the job for much longer." (John)

There were, however, behavioural strategies being used in order to prevent attacks arising in the first place. Participants explained that they needed to be continually vigilant at the same time as trying to perform their occupational duties. They reported being continually on the lookout for the next attack:

"Gone are the days where you go to a job and you just do the job, it's now you've got to watch your backs."(Bob)

Participants also reported using strategies such as sending two fire appliances when only one is needed, so that one crew can watch for the other crew's safety, or reversing appliances into cul-de-sacs in order to provide a quick escape if necessary.

The lack of control, and the accompanying powerlessness that participants felt, would act as a severe stressor in and of itself. The resultant stress would need to be dealt with in some way and choosing to impose normality on the attacks serves to reduce the stress, effectively making the stressor disappear. Normalising gives control *back* in that it renders the attacks invisible, meaning that there is no longer anything needing to be controlled. A further way that participants re-established control was by re-contextualising the attacks through attempting to understand the attackers' motivations.

The Need to Explain

The need for participants to explain and understand the attacks was clearly expressed throughout the data. The ways in which attacks were explained differed across participants, however, with various attributions being made about the motivations of attackers. The role that the uniform plays was seen as crucial, as George's statement articulates:

"... Uniform, blue lights, easy target."(George)

George attributed aggression as being a generalised attack against any emergency service uniform. Uniforms as a representation of authority and the notion that attacks can therefore be seen as a rebellion against authority was clearly articulated throughout the data. Firefighters thus become reduced to a symbolic representation of a generic authority figure as Paul suggests:

"... same as the Police ... some kind of authority." (Paul)

The linkage to the police that Paul begins to make was made far more explicit by other participants. There was a clear suggestion that firefighters were receiving aggression actually intended for the police; either as a softer replacement target less likely to respond effectively or as a genuine error on the part of attackers as Mike suggests:

"... they think we're part of the Police sometimes with the uniform."(Mike)

Certainly this notion of a lack of distinctiveness across the services has led some UK FRS to change their uniforms of recent years, changing from the dark blue used by the police to colours such as burgundy or gold. The attribution of intention as being against the uniform, rather than the individual suffering the aggression, serves to displace the attack from something personal to something organisational. This removes personal stress because it reduces the attack to the level of an occupational hazard rather than an incident of targeted interpersonal violence against the self. This notion of attacks being against authority, with the uniform the representation of that authority, was clearly the dominant attribution made regarding motivation. However, linked to this belief was a secondary attribution regarding the state of mind of the attacking youths. Where authority attacks could be seen as purposeful and making a statement, this secondary attribution was far less intentional:

"... we're just another target for them because they're bored."(Bob)

The notion of a bored indifferent youth culture was clear in the data. Although this attribution of bored youth could be seen as heavily intertwined with the attribution of firefighters as *authority*, in that bored youth can hit out at authority, there is also a distinctiveness about these attributions. Attacking authority could at least be seen as a natural developmental stage (albeit not usually expressed in such antisocial ways) and was therefore understandable to participants. However, violence as a fun leisure activity to stave off boredom generated more confusion in and less understanding from participants.

Summary: Study 1

There was indeed underreporting based largely on the normalising of attacks, which rendered attacks less meaningful and therefore less psychologically visible even to the firefighters themselves. Underreporting was thus not an active strategy but an omission because of a trivialising of incidents. Despite this tendency, there was still a strong need to explain attackers' actions, partly as a way of restoring some sense of understanding and control to a situation in which firefighters felt out of control and which would otherwise have become a major stressor. All of the activities were a way of coping — a way of restoring meaning to acts that appear incomprehensible. Given the need of firefighters to cope, it was felt appropriate to explore the issue of coping more directly — the focus of the second study.

Analysis: Study 2

The exploration of coping strategies revealed three distinct means of coping: *normalising the abnormal, the professional firefighter*, and *a supportive watch*.

Normalising the Abnormal

Throughout all of the interviews and echoing the findings of the first study, there was again a constant normalising of violence and abuse. As firefighters routinely deal with events that the rest of society would find unusual or *abnormal* in some way (for example, fire fighting itself), it is perhaps unsurprising that they are also able to normalise antisocial behaviour alongside everything else they face.

As Robert notes, aggression has become an occupational inevitability in the same way as attending road traffic collisions or fire fighting. It is just another unpleasant aspect of the work that needs to be accepted and dealt with:

> *"... I've just come to realise now that when I go out it could be part of my job that I get abused or get things thrown at us and, it just kind of … you just gel all the job together." (Robert)*

Again throughout this data, the participants depicted the violence they experienced as something that is to be normally expected, something that is routine. However these participants went further in their attributions of normality in that they also depicted the behaviours themselves as normal in terms of child development. Participants frequently related to their own childhoods in the attempt to explain aggressive behaviours, reflecting particularly on adolescence. James thus excused the aggressive behaviours he faced as normal during adolescence:

> *"... it's just, like I say, part of growing up." (James)*

By doing this James is justifying what he has to face, strengthening the need for him to have to accept such behaviours as inevitable. The identification of aggressive acts as normal childhood development takes responsibility away from the aggressors at the same time as allowing a more sympathetic interpretation to be applied to them.

Whilst effective in the short term, coping strategies that normalize the abnormal in this way have the potential over time to become detrimental. When discussing coping with Nick, his response flagged up an example of the dangers of such normalization:

> *"... I don't tend to get stressed out about some of the things that stress other people out but in the same instance I get stressed out about the most trivial things so it's an unusual paradox … but I think the times when people expect me to be fussed I'm not and I think that comes from work..." (Nick)*

Nick appears to cope with the large issues he faces, but emotional release is still needed and instead gets diverted into overreactions about more trivial things. This diversion allows him to ignore the psychological effects of what he is experiencing from one day to the next, resulting in him never having to face his true emotions about these more serious issues. This also denies him the opportunity for full reflection on how he feels. The normalising of violence leading to a neglect of personal considerations was apparent across all of the participants' data.

The Professional Firefighter

Throughout all participants' data, the passion and commitment that they had regarding their occupational identity of firefighter was evident, despite the frequent interactions with antisocial and aggressive behaviour. The responsibilities of and passion for their work was not to be interfered with, even if it put their personal physical and psychological safety at risk. This focus on the occupational role can become a form of coping in and of itself:

> *"I won't let antisocial behaviour from a very small minority spoil my ... professionalism." (Robert)*

Despite his frustrations, Robert uses his professionalism to provide a reason as to why he should be unaffected by these acts. Professionalism thus becomes a buffer against the abuse.

Similarly, Adam draws upon his love for his job and the struggles he had to achieve the role as a defence against being affected by aggressive behaviours:

> *"No, no, like I say I love my job, I've always wanted to do it … I've worked hard to get here so I'm not going to give it up for some scrapes that want to torch cars and be antisocial … no." (Adam)*

Adam draws upon his professional commitment and work satisfaction to mitigate against the effects of aggressive encounters. In this way, the aggressive attacks could be viewed as actually increasing, rather than reducing, occupational commitment and the determination to perform the job well. This reliance on the role as a defence against the effects of attack could occur as a *post hoc* coping strategy following encounters but could also be implemented *during* the encounters.

> *"... I tend to try and go away from it, just not participate in it and not stand there arguing with them or just anything, just pretty much turn your back on it and go away if you can and it's pretty much seemed to work." (Gary)*

Gary notes that an avoidant non-confrontational strategy that focuses only on the occupational role can also act as a pragmatic solution to aggression, essentially stopping the behaviour. However, it is important to note here that whilst this might work for abuse, it would

be inappropriate and dangerous to take this approach if violent or physical attacks are occurring.

This form of coping is highly dependent on high job satisfaction and occupational commitment. However, this reliance on the professional role could only buffer a certain amount of the stress, and other forms of support were also needed.

A Supportive Watch

There was a clear focus on relationships and support across all participants' data. Every participant repeatedly drew attention to the importance and necessity of developing bonds within the Service and on the watch in particular as the key source of support. As Robert simply states:

> "... you rely on each other." (Robert)

The intimate bonding between a watch was felt to provide essential support and gave confidence across all aspects of the job, particularly when facing aggressive and abusive behaviours. This finding of the importance of the watch has been noted countless times elsewhere in the stress research literature pertaining to the FRS. The need for the comforting barrier that their social bonds provide, and the importance of unity to tackle any negative behaviours, was evident throughout this data. There was a confidence that support would always be forthcoming as Gary articulates here:

> "If you was suffering antisocial behaviour, you wouldn't be left to suffer it on your own, you always know that your work colleagues, if it does get hard, and ... they're always there and vice versa." (Gary)

The importance of such peer support from the watch outweighed even that of personal family support, although family support was still evident as an element of coping.

Adam justified the emphasis on support from the watch and from others who shared the operational role:

> "... if I go to headquarters or talk to anyone up there, they're not operational; they don't see what we see.... They can sit and read from a manual and give some psychological profiles ... it's different to actually be there and they don't know what it smells like, they don't know what the atmosphere's like, they don't know what they have to do whereas with the team we can talk about it ... we dealt with it much better than talking to someone in an office or a clinic ... it's a lot better to get it out amongst ourselves." (Adam)

The shared experience validates any supportive comments that peers make, whereas those offered by others are stripped of importance and rendered meaningless in terms of providing support.

Summary: Study 2

As in Study 1, the normalising of aggressive attacks emerged as a central issue; however, here this was being used explicitly as an active coping strategy rather than just an unconscious acceptance that participants were unaware of. Participants were also aware of their active reliance on their own occupational role and their reliance on their professional identity as a means of buffering both the impact of and their own engagement with abusive behaviours. However, when the psychological impact of abuse was actually felt by participants, they then turned to their watch and operational peers in order to access social support.

Discussion

Experiencing aggressive behaviours, although initially dismissed as not affecting those firefighters interviewed, clearly does have both a personal and professional impact. Both studies demonstrate the complex ways in which coping strategies are developed, highlighting that these can be both positive and negative and can differ in their utility over time.

The normalisation and acceptance of what should be unacceptable behaviours result in a lack of consideration for personal psychological safety. Such a lack of focus on one's own psychological state can very effectively reduce the stress resulting from aggressive encounters in the short term. However, this form of coping, which is essentially a form of avoidance, will be less effective for issues that are ongoing and persistent. Failing to appropriately acknowledge personal distress can mask issues until they become severe; and the use of avoidance as a coping strategy by firefighters has been found to predict increased psychological distress (Brown, Mulhern, & Joseph, 2002). Avoidance can cause serious problems when used as a long-term coping strategy (Seiffge-Krenke & Klessinger, 2000; Nowack, 1989). Brown et al. (2002) put forward a case that emergency service personnel could benefit from undergoing coping-skills training to assist in the development and use of healthier coping strategies than avoidance. Coping-skills training could also enable firefighters to make healthier attributions regarding causation, redefining attacks from inevitable to preventable.

Firefighters should therefore be encouraged to consider their own emotional reactions and seek help rather than divert their feelings elsewhere. However, help seeking has often been found to be more difficult for men (Galdas, Cheater, & Marshall, 2005; Möller-Leimkühler, 2002; Whitaker, 1987), and men dominate the occupation of fire fighting. This male reluctance to seek help has particularly been found to be the case within *macho* cultures, which the FRS can arguably be described as being (Munding, 2008; Thurnell-Read & Parker, 2008). The expressed preference for support from operational peers found in the current research has been seen elsewhere (Durkin, 2007). This prefer-

ence can act as a block to accessing professional help (e.g., see Hill & Brunsden, 2009); firefighters have been found to show resistance to interventions from outside therapists (Precin, 2004). The preference for peer support and the reliance on their own professional roles as a coping strategy can be seen as intertwined. There is a widespread recognition in the literature that firefighters have a very strong occupational identity (e.g., see Brunsden & Hill, 2009; McCammon, Durham, Allison, & Williamson, 1988) and have high levels of job satisfaction (North et al., 2002). This strong identity is likely to feed a preference for support from peers who share and understand that same identity. Interventions can be designed in ways that utilise this preference for peer support and which incorporate the operational identity.

Lawrence and Barber (2004) set out a trauma-support model, in place at Tyne and Wear Fire and Rescue Service, that integrates appropriate professional training for volunteer peer supporters. Such a model could easily be used to support victims of less obviously traumatic incidents such as abusive encounters. Extending this trained peer support from traumatic to other stressors, which would not necessarily come under that definition, could assist in helping firefighters to recognise the actual impact of aggressive encounters and render these more immediately psychological visible.

The finding that firefighters were nervous about taking any form of direct action because of a fear of repercussions is a concern. This is likely to increase the implicit stress levels resulting from antisocial encounters. There was a clear misunderstanding that direct actions were necessarily negative and aggressive in retaliation. However, there are more positive forms of interaction that could be deployed. One form of training that may prove useful here is conflict resolution training. This suggestion has been previously endorsed by the Fire Brigades Union (Labour Research Department, 2008). However, it should be acknowledged that this is only likely to be useful in face-to-face interactions; whereas, most physical attacks are long distance (Brunsden, 2007a). It is therefore most likely to be effective in those instances where firefighters receive verbal abuse and lower-level face-to-face behaviours (for example, spitting or pushing), particularly in terms of preventing the escalation of these behaviours into worse aggression.

In addition to the training implications arising from this research, a number of operational issues emerged from the analysis. The strategies currently being employed to prepare for and defend against attacks have the potential to impair operational performance. In the UK a crew is likely to consist of four individuals. However, if one or two of these are guarding equipment or scanning the horizon for potential attackers, the crew can effectively be *self-downsized* to just two, with negative implications for operational effectiveness. Similarly, the strategy of sending two appliances where only one is justified by the incident is likely to detrimentally impact on response times. There is also likely to be an

impact on reporting behaviours from the normalising of aggressive acts, because this renders these invisible and so less likely to be perceived as worthy of report.

The issue of emergency service abuse has gained a much higher profile in recent years and this carries a risk. As noted in this research, once something is normalised, it becomes internalised and accepted. The raised profile of attacks could therefore contribute to a belief that such attacks are inevitable. However, effective campaigning and responsible reporting, which promoted the *unacceptability* of these behaviours, could, if internalised, conversely assist in reducing occurrence. It is therefore imperative that the leadership of the FRS actively engage with the media on this issue. This needs to occur both at the national level through Government action (for example, funding promotional campaigns) and at local levels through the actions of individual Services (for example, through the careful framing of press releases about particular incidents and through direct engagement with the media).

At present this area is a troublingly under-researched topic. There is almost no academic research available on this issue with the available information instead coming from the Government and Fire Brigades Union. Their information is often contradictory, which is understandable given the subjective investment of both government and union officials regarding this issue. It is vital that this issue is researched by neutral researchers in order to offer a clearer picture of this phenomenon. Further, there is a clear need for this research to occur from a variety of perspectives (for example, effects on victims, motivations of attackers, or effectiveness of interventions) rather than merely focussing on the rise or fall of incidence rates as the key issue. Incidence rates are necessarily influenced by reporting accuracy which, as can be seen in the current research, often bears little relation to what is actually being experienced.

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Endnote

[1]Authorship order is alphabetical and does not denote authorial contribution.

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Reducing Fire Service Exposures Using a New Dispatch Protocol

Abstract

In the era of global influenza pandemics and limited resources, fire services struggle with how best to protect their members from exposures. Although PPE (personal protective equipment) is routinely available, oftentimes firefighters have insufficient warning or information when they arrive on the scene of a medical call, rescue, or fire and become unduly exposed. Using a retrospective observational design, we investigated the effectiveness of Tucson (AZ) Fire Department's (TFD) implementation of Code 90 *in which calls were identified as having the potential for infectious disease or other unwanted exposures. The firefighters were given this information and the need for PPE in* advance of their arrival at the scene. This report measured the effectiveness of that intervention by evaluating exposure data pre- and post-implementation of Code 90 over a nine-year span.*

We classified exposure agents as one of the following: known infectious disease, infectious agent, chemical agent, animal bite/sting, or other. Descriptions of the call types, location, and individuals exposed were analyzed, in addition to a relative ranking of exposure agents most frequently experienced by TFD employees. Over 90 percent of exposure events occurred on medical calls, and 61 percent of all events were due to respiratory exposures. In the second year of Code 90, the incidence of exposures was 12.78 percent exposures/year, a trend in the percentage of decline. In the first year (2007) of the new dispatch protocol, there were 112 exposure reports stemming from 48 separate events. Compared to an annual average of 85.7 exposures during the prior six-year period (2001 through 2006), this increase could be explained by heightened awareness of and increased attention to potential exposures. However, in the second year of the code 90 protocol, there were only 93 reported exposures from 37 events. This represents a 17 percent decrease in frequency between the two years and a 19 percent decline in the incidence per 100 employees.

Fire service leaders could use this information to guide their own practice to decrease exposures.

Primary Objective

Occupational and community exposures increase the risk of disease transmission to fire personnel and also promote indirect transmission to the home and patient environments (Lejeune & Berkowitz, 2000). The objective of this assessment was to evaluate the effectiveness of a new protocol implemented by the Tucson (AZ) Fire Department (TFD), called *Code 90*, whose aim was to reduce the frequency of events and number of employees unduly exposed to potentially infectious or harmful agents.

Study Population

The employees evaluated in this study include firefighters, paramedics, engineers, captains, and chiefs. TFD consists of 22 individual fire stations and 770 uniformed employees, serving a growing community of approximately 540,000 citizens.

Background

The occupational hazards and risk-laden environments of firefighters are diverse and dynamic. As an integral part of the first responder's network, firefighters and others (e.g., police and emergency medical services) are at great risk for exposure to numerous potentially harmful agents. Firefighters accept the level of risk that they must face, and in many ways acknowledge illnesses, injuries, and even fatalities to be part of the job. With today's increasing awareness of health and safety, and with advances in technology and information gathering/sharing, the philosophy that these risks are the norm need no longer be relevant.

Exposure Ranking

Ranking exposures on a severity or risk scale is inherently multifactorial as well as situational. Any attempt at ranking exposures cannot be considered absolute and will vary depending on individual event characteristics. A typical exposure pathway will consist of a point source, route, receptor population, and dose. As noted previously, potential exposures to this population of firefighters included both chemical and biological agents and were, therefore, considered separately. There exist differences between chemical and biological agents

when evaluating potential exposure routes. For biologics, the three most common routes of exposure are (1) airborne, (2) direct contact, and (3) indirect contact, while chemical exposure routes are usually due to (1) inhalation, (2) contact, or (3) ingestion.

Code 90

The Code 90 protocol was implemented in December of 2006 to better track potential exposures to TFD personnel because consistency in identifying and describing these events was less than ideal. In addition, the need for such a protocol came in response to the growing publicity and concern associated with Methicillin-Resistant *Staphylococcus Aureus* or MRSA (Enright, Robinson, & Randle, 2002) and pandemic influenza H1N1 in the allied health fields.

The TFD initiated a series of three questions, which are asked of every calling party about the patient in question (Tucson [AZ] Fire Department [TFD]), 2006):

1. Are they coughing?

2. Do they have a fever?

3. Do they have an on-going disease process?

This information was then shared via computer link with responding crews. It was expected that this advance warning would allow the firefighter officer and crew members to assure proper personal protective equipment (PPE) was utilized on that call. It was hoped that this measure would allow for early identification of harmful exposures and their subsequent reduction.

Resources and Methods

Study Design

The study was a retrospective observational trial using data prior to the Code 90 intervention as an historical control. Because firefighters typically remain in their occupation for 25 to 30 years, few subjects dropped out of the study population. This study was designed to determine whether giving firefighters advance warning about potential exposures before they arrived on the scene had any impact.

Study Procedure

The Code 90 dispatch was initiated by department order, and became part of TFD's standard operating procedures (SOPs) in December, 2006. Dispatchers in the TFD communications department and TFD firefighters received instructions and training on the new dispatch code and its purpose to decrease exposures to firefighter personnel. No other updates on the use of PPE were provided to the members of TFD during the study period.

End Points

The primary end point of the study was whether an exposure occurred. Secondary end points included whether the Code 90 instructions actually led to the use of PPE in the field.

What Was Measured

The annual injury and illness surveillance data were used to describe the extent of exposures before the Code 90 dispatch instructions were initiated in December, 2006, compared to subsequent years. Data analyses were performed using Stata v10.1.

For purposes of this study, *exposure* takes on a broader definition than what is customarily reported. For this population and over the years of 2001 through 2008, exposure agents were classified under the following categories (**Table 1** catalogs the composition of each category):

- *Infectious disease* — As reported by the annual injury and illness surveillance databases (note that not all reports were confirmed with a medical diagnosis)

- *Infectious agent* — From a known biological agent with potential to cause disease or adverse reaction

- *Chemical agent* — Having the potential to cause adverse toxic, irritation, or anaphylactic events

- *Animal* — As in the result of a bite or sting

- *Other/unknown*

All events reported as a potential exposure (i.e., noninjury) were recorded, regardless of confirmation by clinical diagnosis. An *event* was identified as having resulted in the exposure to one or multiple individuals. For each event type, a review of the reported data was performed to assess whether certain activities were associated with changes in the potential for having been exposed.

For animal bites, general health threats to humans include anaphylactic reactions, rabies, West Nile virus, secondary infections, sepsis, damage to the musculoskeletal system, and even death. Stings or bites from regional arthropods (e.g., spiders, scorpions) and reptiles (e.g., snakes and poisonous lizards such as Gila Monsters) may inflict various degrees of toxicity from venom.

Results

In the first year (2007) of the new dispatch protocol, there were 112 exposure reports stemming from 48 separate events. Compared to an annual average of 85.7 exposures during the prior six-year period (2001 through 2006), this uptick could be explained by height-

Table 1: Components of Exposure Categories

Infectious Disease	Infectious Agent	Chemical Agent	Animal	Other
Coccidioidomycosis	Amniotic fluid	Asbestos	Bee sting	Unknown
Hepatitis A	Blood	Carbon monoxide	Bug bite	
Hepatitis C	Feces	Hazardous materials	Cat bite	
HIV*	Respiratory	Intravenous solution	Dog bite	
Influenza	Saliva	Smoke	Scorpion sting	
Lice	Urine		Spider bite	
Measles	Vomit		Snake bite	
Meningitis	Water		Lizard bite	
MRSA†				
Pertussis				
Scabies				
Staphylococcus				
Tuberculosis				
VRE‡				

* Human Immunodeficiency Virus
† Methicillin-Resistant *Staphylococcus Aureus*
‡ Vancomycin-Resistant Enterococcus

ened awareness of and increased attention to potential exposures. However, in the second year of the Code 90 protocol, there were only 93 reported exposures from 37 events. This represents a 17-percent decrease in frequency between the two years and a 19-percent decline in the incidence per 100 employees.

By ranking the infectious diseases and agents of this study and those most prevalent to TFD, we specifi-

cally categorized between potential airborne exposures (measles, tuberculosis, meningitis, pertussis, coccidioidomycosis, and contact exposures [MRSA, meningitis, staphylococcus, lice, scabies, and Vancomycin-Resistant Enterococcus (VRE)]).

Exposures consisted of known infectious diseases, potential infectious agents, chemical agents, animal bites/stings, and unknown sources. **Figures 1 and 2**

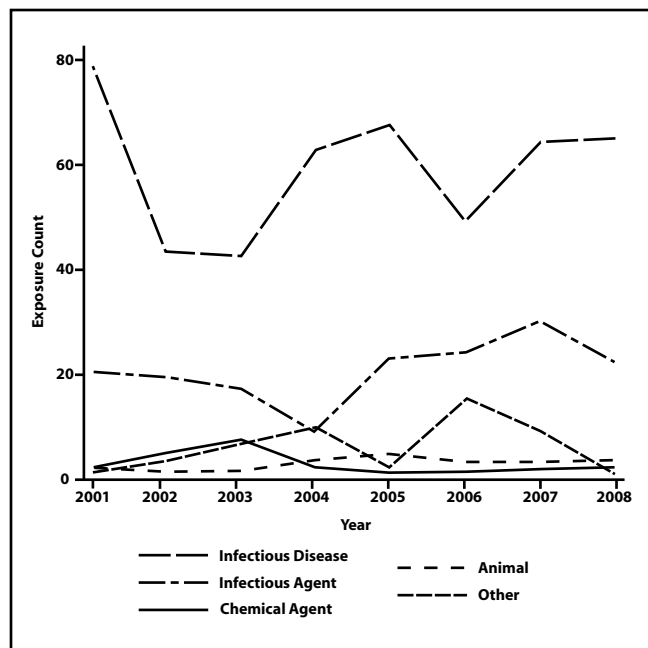**Figure 1: Exposure Count by Category, 2001–2008**
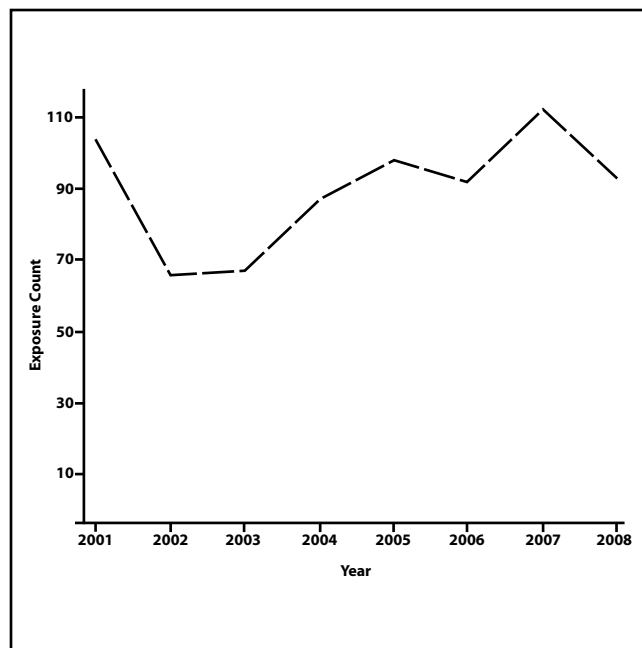

Figure 2: Total Number of Exposures, 2001–2008

Table 2: Recorded Exposure Events for TFD, 2001–2008, Code 90 Implemented in December 2006

Number Exposed at Single Event	Year								Total Events	Total Exposed
	2001	2002	2003	2004	2005	2006	2007	2008		
1	28	22	11	14	20	37	28	22	182	182
2	6	3	7	5	3	1	5	4	34	68
3	1	2	0	1	2	3	1	1	11	33
4	4	1	2	2	3	2	4	3	21	84
5	1	2	2	0	0	2	5	0	12	60
6	4	3	4	7	9	3	5	6	41	246
7	1	0	0	0	0	0	0	0	1	7
8	0	0	0	0	0	1	0	0	1	8
9	1	0	0	0	0	0	0	0	1	9
10	0	0	0	1	0	0	0	0	1	10
12	0	0	0	0	0	0	0	1	1	12
Total Events	46	33	26	30	37	49	48	37	306	
Total Exposed	104	66	67	87	98	92	112	93		719

display the frequencies of each exposure category and the total number of exposures for each year of the study period.

Beginning in December, 2006, the Code 90 protocol was incorporated into the dispatch protocols. Recorded exposure events for TFD are noted in **Table 2**.

For all reported events resulting in either injury or exposure during the study period (2001 through 2008), the hours between 8 a.m. and 2 p.m. have the highest frequency of injury occurrence, whereas the majority of

Figure 3: Event Time of Day
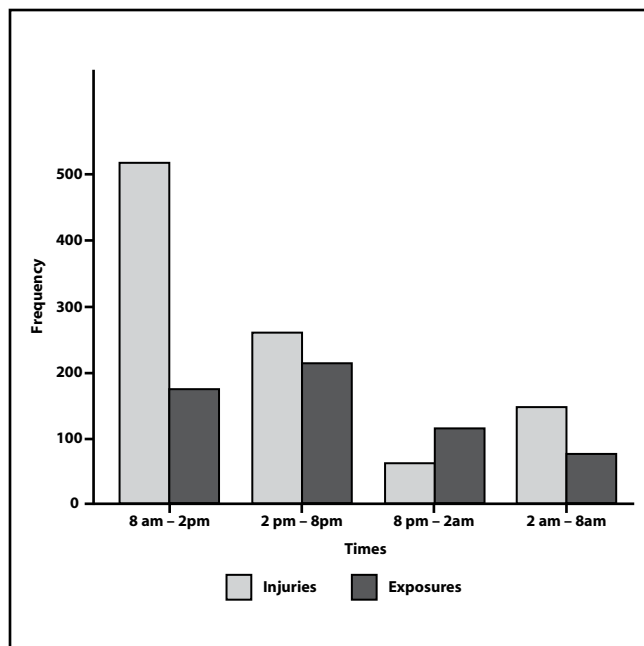
exposures occurred during the hours from 2 p.m. to 8 p.m. (see **Figure 3**). No obvious trend was found with the number of reported exposures throughout the days of the week (see **Figure 4**).

There was a difference in the type and proportion of agents involved between events that resulted in exposure to a single individual and events that led to exposures to multiple individuals. Of the 306 events, approximately 60 percent (N = 182) were single-person exposures. The most frequent exposure agent involved was blood (N = 54), followed by respiratory secretions (N = 42), unknown agents (N = 18), MRSA (N = 14), hepatitis C (N = 7), and tuberculosis (N = 5). No needle sticks occurred during the study period.

During the eight-year study period, 124 of the 306 events involved two or more employees exposed during the same incident to the same source agent. Further review of these events showed that agents most often involved in these multiple employee exposures were tuberculosis (N = 38), meningitis (N = 24), and MRSA (N = 12) (see **Table 3**).

There was no discernable time trend in the frequency of these events. However, the most frequently occurring agents involved in multiple exposure events, in general, have a known greater risk in terms of infectivity than the most frequently occurring events of single exposure events. Also, events that result in multiple individuals being exposed more often specifically identified the infectious disease (e.g., tuberculosis, MRSA); whereas, events exposing just one individual tended to simply identify the potentially infectious substance (e.g., blood, respiratory secretions).

Table 3: Identified or Suspected Agent of Exposure to 2+ Individuals, 2001–2008

Exposure Agent	Frequency	2001	2002	2003	2004	2005	2006	2007	2008
Tuberculosis	38	13	3	3	7	1	1	6	4
Meningitis	24	0	3	2	2	6	6	2	3
MRSA	12	1	2	0	0	5	0	4	0
Blood	14	1	0	2	0	1	3	5	2
Pertussis	5	1	1	1	1	0	1	0	0
Measles*	4	0	0	0	0	0	0	0	4
Lice	3	1	0	0	1	1	0	0	0
Feces	2	0	0	1	0	1	0	0	0
Respiratory	2	1	0	0	0	1	0	0	0
Saliva	2	0	1	0	1	0	0	0	0
Staphylococcus	2	0	0	2	0	0	0	0	0
Unknown	4	0	0	0	1	0	1	1	1
HIV	1	0	0	1	0	0	0	0	0
Hazardous Materials	2	0	0	0	1	0	0	0	1
VRE	1	0	0	0	0	1	0	0	0
Amniotic Fluid	1	0	0	1	0	0	0	0	0
Coccidioidomycosis	1	0	0	0	1	0	0	0	0
Scabies	1	0	0	0	1	0	0	0	0
Smoke	1	0	0	1	0	0	0	0	0
Vomit	3	0	1	0	0	0	0	2	0
Water	1	0	0	1	0	0	0	0	0
Total	**124**	**18**	**11**	**15**	**16**	**17**	**12**	**20**	**15**

* All measles cases were recorded during an outbreak of measles (most notably with school-aged children) during the first half of 2008.

Of the total 719 individuals exposed, approximately 71 percent were either firefighters or paramedics (see **Table 4**); and an overwhelming majority (93 percent) of exposures occurred while responding to a medical emergency (see **Table 5**). Sixty-one percent of the events entailed a respiratory exposure, followed by exposures to the skin (12 percent), head/face (11 percent), upper extremity (10 percent), and other parts of the body (2.5 percent) (see **Table 6**).

When restricted to multiple exposed events, medical responses accounted for 97 percent of cases, and only two exposures occurred during a fire response. As the number of people exposed to a single event increased, the potential for exposure to what had been deemed an agent of greater impact to this population did not change. Tuberculosis and meningitis occurred most frequently and were distributed ubiquitously among the job ranks. A considerably large proportion of the events were exposures in six individuals (N = 41, see Table 2);

however, there did not appear to be anything unique about these types of event exposures. One event that resulted in 10 exposed people was due to the recovery of a human body in a wash for which the specific type of exposure was unknown. Another large number event was when 12 employees were exposed to a single patient infected with measles.

The annual number of exposure events and number of exposed individuals per 10,000 calls are shown in **Figure 5**. In general, approximately 10 to15 employees were reported to have an exposure for every 10,000 response calls from 2001 through 2008.

Discussion of Results

The finding that the majority of exposures occurred mid-afternoon to early evening (2 p.m. to 8 p.m.) may be attributed to the higher number of medically-related response calls that occurred during that time. The number of reported exposures increases from

Table 4: Job Classification of those Reporting Exposure

Job rank	Frequency	Percent
Paramedic	246	36.7
Firefighter	247	34.4
Engineer	102	14.2
Captain	98	13.6
Inspector	3	0.5
Recruit	2	0.3
Civilian	1	0.1
Fire Chief	1	0.1
Other	1	0.1

Table 5: Location of Exposure Event

Location	Frequency	Percent
Medical	671	93.3
Station	23	3.2
Fire	9	1.3
Training	7	1.0
Other	6	0.8
Office	3	0.4

Table 6: Body Area Contacted by Exposure

Body Part Affected	Frequency	Percent
Respiratory	367	61.1
Head/Face	74	12.3
Upper Extremity	64	10.6
Skin	51	8.5
Other	24	4.0
Lower Extremity	15	2.5
Torso	6	1.0

December through June, followed by a steady decline between July and November (see **Figure 6**). This finding is consistent with the usual pattern of seasonal influenza that typically peaks in January and tapers off through May in the United States, although the H1N1 global influenza pandemic has been present year round (Centers for Disease Control and Prevention [CDC], 2009).

Is Code 90 Effective?

The initial increase in incidence after implementation of Code 90 may be related to an enhanced aware-

Figure 4: Cumulative Number of Exposed by Day of the Week
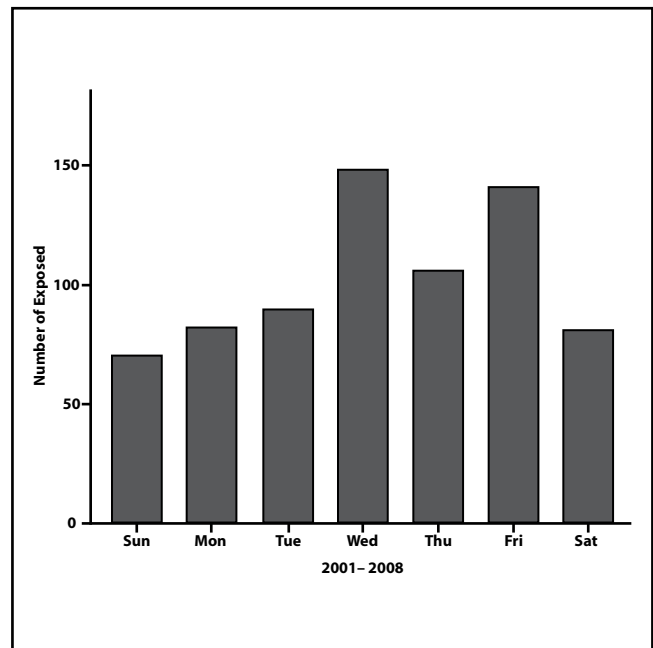
ness and focus on infectious diseases, most notably the national attention on MRSA. In the second year after Code 90 implementation, there were 93 exposure reports from 37 events. This represents a 17 percent decrease in frequency of exposures/events that occurred between the two years (see **Table 7**) along with a 19 percent drop in incidence per 100 employees (P = 0.1038).

In a study by Nicas and colleagues (Nicas, Nazaroff, & Hubbard, 2005), the risk of secondary airborne exposure to an infectious agent (e.g., tuberculosis) was quantified in controlled settings. Factors considered when calculating the expected number of pathogens deposited into a hospital visitor's alveolar region included characteristics of the pathogen, infected patient, and the susceptible individual as outlined in **Table 8**.

The viability of the pathogen will depend on ambient temperature, ventilation, degree of pathogen settling on surfaces, pathogen viability, and disinfection by air, among other factors. Together, these variables can help determine the risk of infection for the susceptible person and can be manipulated for both a *one-hit* pathogen — instances in which only one pathogen is believed to be required to cause disease (e.g., tuberculosis) — and a *multiple-hit* pathogen, which requires a higher dose of pathogens to cause disease such as MRSA (CDC, 2007).

In an older published work, the potential severities of selected infectious agents were ranked on individual scales by degree of infectivity, pathogenicity, and virulence (see **Table 9**) (Fox, Hall, & Elveback, 1970). While this particular publication may be considered outdated because it does not account for the extensive antibiotic-resistant diseases faced today, the provided table is useful in understanding general concerns.

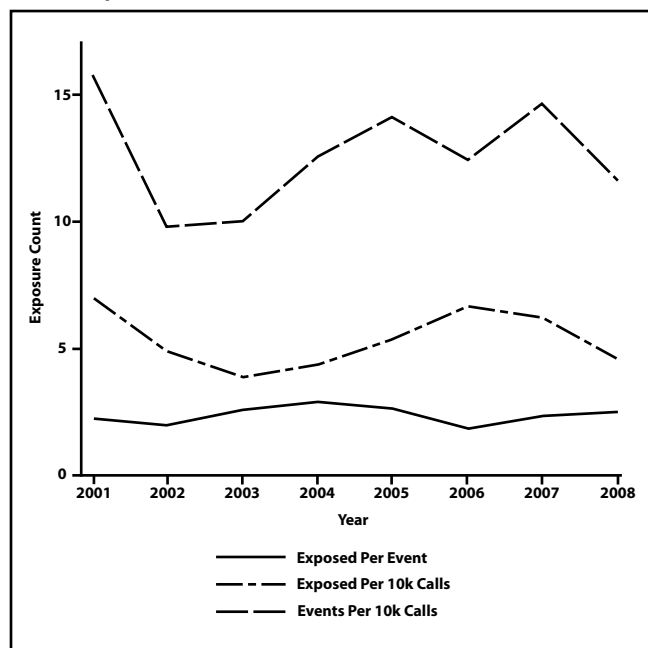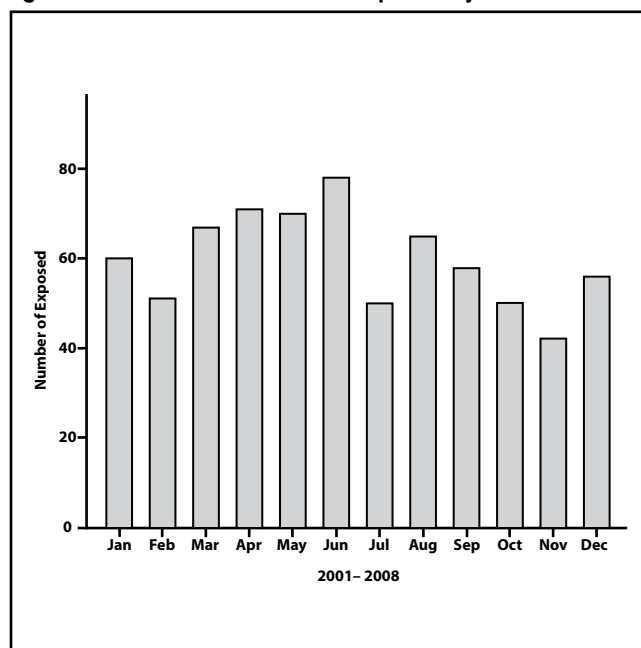**Figure 5: Number of Events and Exposed Employees per 10,000 Calls, 2001-2008**

Figure 6: Cumulative Number of Exposed by Month

Prediction of Risk

While models of infectivity do not predict disease, they can be useful in determining one's risk, which can then help put in place specific preventative measures or protective barriers such as PPE. Exposures found in this study were predominantly infectious. Chemical exposures were generally related to smoke and hazardous materials and were most frequently encountered at fire and medical scenes or at the station.

The exposure agents in this study were ranked according to their primary mode of transmission and relative infectivity. Airborne agents are given a higher ranking in terms of their mode of transmission, while organisms with higher resistance or that occur with regular frequency were given a greater risk ranking in terms of disease potential.

All individual exposures to measles (N = 23) came during an outbreak of the virus in the Tucson area between February and July of 2008. In general, native measles cases are not prevalent in the Tucson popula-

tion but the original point source for these cases was a Swiss tourist (Daniels, 2008). Measles is one of the more highly communicable infectious diseases known, and its spread occurs primarily through airborne droplet transmission. However, because its prevalence is relatively uncommon in the region, it is not considered a persistent exposure risk for this report.

Tuberculosis and meningitis cases occur at approximately twice the frequency of the next exposure agent. Tuberculosis is well-documented as having a high infectivity rate and, as such, is given a higher priority among the airborne agents; however, other infectious agents should not be ignored. For contact-related exposures, MRSA was determined to be the main concern, with meningitis as the second-highest priority. In addition, MRSA cases were most frequent in the latter years of this study period, perhaps as a result of the growing trend in its surveillance. H1N1 influenza was not yet an agent of concern during the years of analysis.

Table 7: TFD Call Counts and Exposure Incidence 2001–2008

Year	Commissioned Employees	Call Counts	Exposure Events	Exposed Employees	Incidence (per 100)
2001	573	65,779	46	104	18.15
2002	556	67,464	33	66	11.87
2003	566	66,915	26	67	11.84
2004	592	69,180	30	87	14.70
2005	633	69,488	37	98	15.48
2006	694	73,753	49	92	13.26
2007	710	76,552	48	112	15.77
2008	728	79,940	37	93	12.78

Table 8: Risk of Secondary Airborne Exposure

Pathogen	Infected Patient	Susceptible Person
Water content	Emission rate (number of coughs per hour)	Breathing rate
Water loss (once airborne)	Viable pathogens	Exposure duration Co-infections

From Nicas et al., 2005

Limitations

Due to data-cleaning processes and labeling of variables that may be different from standard TFD reports, the frequency numbers and values accounted for in this report differ slightly from TFD's annual reports or queries. From 2001 through 2008, there were 306 recordable exposure events, resulting in 719 TFD employees exposed to one or more potentially harmful agents (see **Table 2**).

A principal limiting factor was the data itself. Details describing individual activities at the time of exposure (e.g., was the paramedic in the process of intubation of a person when that individual coughed in his/her face) were not obvious in the data available. Additional limitations existed in specific exposure types. Differentiating between meningococcal bacterial, other bacterial, and viral meningitis was often not clear, nor was community- versus hospital-acquired MRSA delineated. It was also uncertain as to whether or not these exposures led to disease and/or treatment — both topics for a proposed second arm of the study.

Conclusions and Recommendations

As the number of people exposed to a single event increases, the potential for exposure to a more severe agent did not change. Infectious agents were the predominant source of exposure, and one may consider tuberculosis to be of greater concern than meningitis or MRSA. Among other allied health-related professions, MRSA has been receiving more focused attention; and given the greater frequency of potential MRSA exposure events in the last two years of this study, continued evaluation of focused intervention strategies would be prudent. Above all else, it can be concluded that infectious agents as described in this report are the greatest potential risk for any exposure event. A detailed reference guide is found in the *Control of Communicable Diseases Manual* (Heymann, 2008).

When evaluating the most frequently occurring aspects of an exposure event, we see that exposures have most often occurred to firefighters and paramedics during a medical response and most often as a consequence of a respiratory disease or agent. Over 90 percent of exposure events occurred on medical calls, and 61 percent of all events were due to respiratory exposures. Focused strategies on simple solutions to reduce potential hazards, such as wearing proper PPE during medical calls and re-emphasizing basic hygiene, can aid in their reductions.

There should be added caution in the sharing of equipment and personal gear, improved frequency and quality of personal hygiene (i.e., washing of hands) after all patient contacts, and better awareness and limiting of hand-to-face contact in addition to the proper disinfecting of equipment and rigs. Furthermore, given the high preponderance of respiratory exposures, an increase in the use of simple respiratory barriers (i.e., masks) may be of considerable benefit.

Any future intervention strategies will benefit from standardizing the data collection and management. Systematic coding rules of what determines an exposure (or other event, e.g., injury); what percentage of

Table 9: Ranking of Infection by Infectivity, Pathogenicity, and Virulence

Severity*	Infectivity (Secondary Attack Rate = Ill/ Number Exposed)	Pathogenicity (Illness Rate = Ill/Number Infected)	Virulence (Severe Cases/ Total Cases)
High	Smallpox Measles Chicken Pox	Smallpox Rabies Measles Chicken Pox Common Cold	Rabies Smallpox Tuberculosis Leprosy
Intermediate	Rubella Mumps Common Cold	Rubella Mumps	Poliomyelitis Measles
Low	Tuberculosis	Poliomyelitis Tuberculosis	Measles Chicken Pox
Very Low	Leprosy	Leprosy	Rubella Common Cold

* The *severity* of an infection varies by how it is being measured.
Source: Fox J. P., Hall C., Elveback L. R. (1970). *Epidemiology: Man and Disease*. New York: Macmillan Publishing.

exposures led to disease, time off, or treatment; and improved detail on the personal activities that may lead to a hazardous exposure or injury can also improve report analysis. Any further evaluation will be enhanced with periodic passive observing and/or surveying of employee activities and handling of potential exposures during response calls given a Code 90 designation. Code 90 holds promise as a low-cost, potentially effective method to alert members of the fire service about potential exposures in advance of contact and how fire service leaders can generalize this information into their own practice.

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Firesetting Firefighters: Reconsidering a Persistent Problem

Abstract

This article reconsiders the historical problem of firesetting firefighters. The research draws upon an original dataset of firefighters arrested (n = 1,213) for arson dating back to the early nineteenth century. The quantitative analysis provides an empirical foundation upon which I base a theoretical argument that questions traditional understandings of the problem. In particular, I challenge the literature that suggests that firefighter arsonists exhibit a deviant and distinctive hero complex. I argue that the most striking feature of this problem is the fine line that separates enthusiastic young members who are always the first to help out from those who attempt to prove their meddle by creating opportunities to evidence their dedication and firefighting prowess.

Introduction

The remarkable superiority in firefighting displayed by Volunteer Company 2 of Beverly, to the chagrin of its rival, Company 1 there, went up in thin smoke today....

It all started as a result of the usual friendly rivalry between "vamps." It was on that basis for a time, but fires ordinarily being scarce in Beverly, Company 2 became impatient and ill content to play checkers in the firehouse when there were honors to be won through "smoke-eating."

Then fires began breaking out with regularity. Each time, no sooner did the alarm sound than the members of Company 2 were trundling their chemical engine to the street, and with that love of thunderous noise peculiar to the fire-fighter, were making their way to the scene whooping like cowboys. (New York Times [NYT], 1931, March18)

A quick glance at any of the major newswire services under the term *firefighter* is sure to bring up innumerable articles about lives saved and livelihoods ruined. It is also likely to bring up a seemingly growing list of articles about firefighters charged with setting the very fires they were intended to fight. The apparent escalation of firesetting firefighters has forced the fire service not only in the United States but also across the world to acknowledge the problem and develop policies and strategies to address this concern. Despite (or perhaps because of) this attention, the number of firefighters arrested annually has apparently continued to climb northward.[1] This article addresses the problem of firefighter arson by drawing particular attention to the underlying suppositions that inform the traditional understanding of the phenomenon of firesetting firefighters. More importantly, this article questions whether the traditional understanding of why some firefighters

set fires inadvertently limits the utility of our mitigation strategies. By taking a step back and reconsidering our well-entrenched beliefs about what animates firefighter arsonists, it is hoped that we can begin to develop a more concerted and coherent response to the problem.

Pressed to explain and contextualize the problem of firefighter arsonists, social commentators and fire service personnel alike tend to pull from every conceivable explanation. Some have speculated that it is tied to the atomization of local communities; others peg it to the boredom of rural life, the success of fire-prevention efforts, the moral hazard of financial remuneration, and especially the compulsion of psychological pathology (Lewis & Yarnell, 1951; United Press International [UPI], 1983; Marks, 1993; Huff, 1994; Dvorchak, 1995; Cabe, 1996; Arbuckle, 2001a; Arbuckle, 2001b; Columbia Broadcasting System [CBS], 2003; Chulov, 2004; Australian Institute of Criminology [AIC], 2005a). While each of these explanations begins to unravel the complexity of the firefighter arson problem, each explanation fails to offer a coherent theory to account for the historical persistence of firesetting within the fire service. Moreover, most of these explanations are predicated upon the belief that this is, in fact, a new or at least a growing phenomenon. The argument advanced here requires an honest assessment of the nature of the fire service, which encourages us to avoid looking at firefighter arson simply as a problem of individual pathology but also one unintentionally conditioned by the fundamental paradoxes of the fire service.

In this article I offer an alternative understanding that reconsiders the contemporary thinking about firefighter arsonists that tends to portray them as demonstrably different or even psychologically dysfunctional and by extension easily identifiable and excludable. To develop this argument, I pull from a wide cross section of literature as well as a purpose-built dataset of 1,213 firefighters who have been arrested for setting fires dating back to the early 1800s.[2] It is important to note that this is

as much a theoretical work as a quantitative analysis. As such, the emphasis and distribution of this article is weighted towards the theoretical development and consequently delves deeper into the history and context of arson research, particularly as it relates to the study of firefighter arsonists. Accordingly, the literature review ends with an elaboration of my argument on the nature of arson within the fire service.

The second section concerns the empirical findings of this research. I briefly touch upon the methodological concerns of this type of archival research before turning to the analytical portion of this research, which integrates the data presentation with the data analysis/discussion. Given the problems of generalizing the sample available through the media archives to the unknown population of firefighter arsonist, I limit my analysis to descriptive statistics in this article. The third and final section of the article concludes with a discussion of the analytical and practical policy implications of such a perspective. In keeping with the tenor of the article, I discuss how the argument advanced here forces us to reconsider our traditional one-size-fits-all policy suggestions regularly advocated. The article concludes with an assessment of the future nature of the firefighter arson problem and possible directions for future research.

Previous Literature

The study of firesetting amongst the very ones charged with protecting society from the scourge of fire has long captivated scholars and lay observers alike. Arsonists, whether firefighters or not, have historically posed a considerable threat to social life. As society developed at breakneck speed, it was precariously positioned one errant flame away from almost certain ruin. Consequently, arsonists were spared little mercy at the hands of the sovereign and the citizens alike. In the shadow of this strong public sentiment, the related disciplines of psychology and psychiatry were among the first to take up the issue of arson so as to both protect society from the threat of an arsonist and the arsonist from the vengeance of society (Lewis & Yarnell, 1951).

As psychologists began to probe the troubled psyches of arsonists, many seemed to defy logical explanation. Pyromania soon filled the void and quickly became the catchall category lacking a much-needed measure of specificity (Geller, McDermeit, & Brown, 1997; Doley, 2003a). Thus, pyromania was presumably the psychological motivation behind firesetting; and the fact that they set fires was often adequate evidence that they were pyromaniacs (Huff, Gary, & Icove, 2001). This logical circularity allowed researchers to find pyromaniacs in all walks of life: among prepubescent female servants (Lewis & Yarnell, 1951), epileptics (Meshede's work, 1873, as cited in Lewis & Yarnell, 1951), and even those actively engaged in the fire-suppression effort (de Montyel's work, 1885, as cited in Lewis & Yarnell, 1951). As will become important later, these early studies confused description for explanation and consequently drew considerable attention on the idiosyncratic empirical minutiae of the particular small sample of arsonists they happened to study rather than making generalizable arguments about the nature of firesetting.

Spurred by the revolutionary writings of Sigmund Freud, the study of arsonists took on a new sense of urgency. What previous scholarship had lacked in theoretical rigor, the work of Freud and his contemporaries made up for in complex theoretical suppositions. Following this tradition, setting fires became but one example of the impulses that lay just beyond the reach of conscious thought — impulses everyone is (or could be) subject to. It followed that if left unchecked, anyone, not simply the so-called mentally disturbed, could fall foul of socially acceptable norms and consequently legal prohibitions. With respect to setting fires, Freud (1930) suggested that the fires were part of a more complex process whereby the arsonists attempted to exercise some control over their lives by symbolically urinating upon the flames. Thus, the emphasis was placed upon the extinguishment of fires as opposed to their ignition. While Freud did not use this perspective to explain firesetting firefighters, Schmid's work, 1914, as cited in Lewis & Yarnell (1951, p. 196) and Stekel's work, 1924, as cited in Lewis & Yarnell (1951, p. 196) did; noting among other things the high rates of enuresis (bed-wetting) among those who wanted to be *firemen*.

Where Freudian psychoanalysis was long on rich theoretical suppositions, it was often short on solid empirical evidence. As a consequence, the backlash that followed sought to ground psychological research with observable and generalizable findings. Large-scale studies, like that of Lewis and Yarnell (1951), attempted to strike a balance. Employing various sources ranging from psychiatric case histories to newspaper accounts, Lewis and Yarnell paint a picture of arsonists as cold, dysfunctional, and ineffectual people. In contrast to *powerful* people who have various means to secure their social position and to affect revenge, they suggest that these *weak* people find themselves without the means or capabilities to keep up and are presumably more likely to resort to the instrumental and affective capacities of arson to retaliate. The theme of power has consequently served as a powerful moralizing trope because it sought to place sole responsibility back squarely on the shoulders of the *deviant* arsonists themselves. As such, it also served to distance the normal *us* from the abnormal *them*.

This polemic intention was particularly noticeable when Lewis and Yarnell turned their attention to firefighters and *fire buffs* arrested for setting fires or calling in false alarms. With poetic disdain, Lewis and Yarnell (1951) write: "A craving to be the center of the stage and the recipient of public acclaim, even for once, is within the soul of every person — the smaller the man, the more he secretly wishes such type of recognition" (p. 193). Nowhere, they argue, is this more salient than

with "volunteer firemen [*sic*] who set fires." (p. 193). In a passage worth repeating in full, they continue:

> Probably, many of these men who become regular firemen, were indirectly influenced in making this vocational choice by a childish desire to become a fireman, who could put out fires and be praised for saving lives and property; or because they were fundamentally not aggressive and did not like to force their way in competition; they preferred the security and routine of an organization such as offered by the fire department, with its indirect identification with power and fame.

> It is in the volunteer fire departments, organized by "public-minded" citizens for the mutual protection of their own property, that this factor assumes importance. (p. 193)

While it is less clear whether their distain is directed at firefighters in general or the arsonists that occasionally populate their ranks, what is clear is that they share the view of F. R. Morgaridge that "the same reason that prompts a man to join a volunteer fire department sometimes leads him to set fires" (*National Fire Protection Quarterly* [*NFPQ*], 1927, p. 217).[3] Here again choosing to simply pass the political hot potato only serves to further cloud the issue. The strong moralizing tendency is understandable given the considerable sense of betrayal many analysts likely harbor, though getting mired in pedantic political and intellectual jousts does little to address the issue at hand — preventing further occurrences.

The questions of power and pyromania began to take a backseat to the question of motive, which presumed to offer more meaningful guidance to those actually engaged in the business of catching and prosecuting arsonists. Inciardi (1970), for instance, offered a six-pronged typology to classify the motivations for committing arson — revenge, excitement, institutionalized, insurance-claim, vandalism, and to cover up another crime. This effort to classify motives gained considerable momentum, particularly as the incidents of arson appeared to reach epidemic proportions in the early 1980s (see Doley, 2003b, for a review). Much of this momentum can be traced to the work of Federal Bureau of Investigation (FBI) Special Agent Anthony Rider (1980a, 1980b, 1980c) who used a study of arsonists to develop an argument for the utility of psychological profiles, a point I will return to shortly.

In the early 1990s under the auspices of the National Center for the Analysis of Violent Crime (NCAVC), Rider's contemporaries attempted to match crime-scene behaviors to classificatory motivational schemata (Douglas, Bugress, Burgess, & Ressler, 2006). With regards to arson, Douglas et al. (2006) drew upon Inciardi's (1970) typology, offering a revised six-pronged typology, which has by now become *the* de facto standard employed by academics and practitioners alike: vandalism, excitement, revenge, crime conceal-

ment, profit, and extremism. The extensive research agenda that followed was thus intended to validate and elaborate the suggested links between the catalogued motivations and the behavioral minutiae (Icove & Estepp, 1987; Sapp 1994; Sapp & Huff, 1994; Sapp, Huff, & Gary, 1994). While these studies seemed to distance themselves from the fuzzy empiricism of the psychoanalysts, they simply obscured their shared interest in power within their behavioral typologies and psychological *profiles*.

The notion of psychological profiling, or more accurately Criminal Investigative Analysis, advanced by the NCAVC is problematic for the study of arsonists and firefighter arsonists in particular. The problem rests in part with the linguistic fluidity surrounding the related terms — *profiles* and *profiling*, which owes much to the wildly imaginary portrayal of the latter in the popular culture. The problem becomes particularly apparent when one confuses a *profile* — a composite portrait of the likely characteristics of a statistically average person — with the practice of *profiling* — hypothesizing the characteristics of an unknown individual from a mix of investigative information and intuition. The problem lies in the clever rhetorical trick employed by Douglas et al. (2006), whereby simple phrases like *tend* or *generally* transform the flat empiricism of quantitative datasets into the seductive imagery of offender profiles derived by *profiling*. That is where discrete statistical findings give way to questionable poetic license:

> The typical excitement arsonist is a juvenile or young adult male with ten or more years of formal education. This offender is generally unemployed, single and living with one or both parents. His family tends to be from the middle-class or lower-middle-class bracket. *In general, this offender is socially inadequate, particularly in heterosexual relationships.* (Douglas et al., 2006, p. 268, emphasis added)

Besides failing to offer any measure of comparison between this subset of arsonists and the wider population, they manage, by referring to this type of analysis as a *profile*, to wrap traditional empirical findings in the emotive language of deviancy and thus they paint offenders as aberrant, abnormal, or simply different.[4]

The concern about the casual use of terms like *profiles* is driven home when we look at the firefighter arson research conducted by Timothy Huff (1994) and Ken Cabe (1996), who both drew upon this trend of offering composite profiles of likely offenders. Huff's and Cabe's analyses, which only really differed noticeably in terms of whether the arsonist worked alone or in a group, reminds us of the impact of inadvertent sampling biases, which further complicates the utility of profiles.[5] More importantly, the profiles they developed suggested that the firesetting firefighters appear to be anything but qualitatively distinct from their non-firesetting colleagues. Cabe (1996) argues that firefighter arsonists tend to be: "White males, age 17–26, … have poor

relationships with their father, and over protective mothers, … are *fascinated with the fire service and its trappings*," and so on (pp. 7–10, emphasis added). Cabe's profile only serves to distract from his more salient observations that offer a more robust explanation for the firesetting:

> Most of those arrested have less than 2 years with the Fire Service, and most are associated with a department that has few fire calls. They've completed a home study course plus 96 hours of formal instruction. They are excited, eager, and motivated. And the alarm doesn't sound nearly enough. (pp. 7–10)

The accuracy of the profiles is not the issue here. The issue is that by drawing upon the fuzzy rhetoric of profiles, there is a tendency to lose the forest for the trees.

More recently, writing about the firefighter arson problem has become something of a cottage industry that has sustained considerable academic (Doley, 1998, 2003c; Doley & Fineman [in press]; Smith, 2003; Kinney, 2003; Lindroth, 2003), fire service (Arbuckle, 2001a; Arbuckle, 2001b; Aurnhammer, 2002, 2006; United States Fire Administration [USFA], 2003; AIC, 2005a, 2005b, 2005c; Murphy, J. K. & Murphy, 2010; Cumberland Valley Volunteer Fireman's Association [CVVFA], 2010), and journalistic interest (Dvorchak, 1995; Lee, 2002; CBS, 2003; Ansley, 2004; Warne-Smith, 2004; Chulov, 2004; Gazarik & Peirce, 2005; Holden, 2010; Ring, 2011). Now that the concern has begun to gain traction, many fire services around the world have rolled out various initiatives to thwart the problem. Though despite this growing interest, little has changed. If anything the number of incidents reported in the media has continued to grow — a point I will return to shortly.

Theoretical Perspective

So what are we to make of the firefighter arson problem? Once we begin to look beyond the limiting discourse of abnormality, we see another strand running throughout the literature on firefighter arsonists. That is, we begin to see a pragmatic perspective that acknowledges that the root of this deviance may well be unfortunately woven within the very fabric of the fire service. We see a perspective that suggests that overzealous firefighters take their effort to be *model firefighters* well beyond the bounds of legal or acceptable behavior. If we return to the work of Lewis and Yarnell (1951), for instance, we see another whole side of their analysis. We see 91 (generally young) men who, whether working in groups ($n = 40$) or alone ($n = 51$), "have strong communal strivings, align themselves with fraternal organizations, crave the thrills and alleged heroic activities of the firefighters and enjoy the ceremonies and the decorations allowed them for such work" (p. 205). Whether these characteristics were the cause or effect of their firesetting though remains to be seen. What we

can take from this more circumspect perspective is that there might be a more grounded reason for the firesetting after all.

The great emphasis placed upon one's commitment to the fire service may create the very conditions whereby young members, in particular, take it just that one step too far. Thus, Terryville (NY) Fire Chief Robert Herold answers his own rhetorical question: "He was devoted, dedicated, and dependable, there was no indication whatsoever he had a problem" (UPI, 1983). Paradoxically, his devotion, dedication, and dependability may have been part and parcel of the problem. Now this is not to suggest that being dedicated causes firesetting or that all dedicated and devoted members have a propensity for setting fires, for that would be absurd. What is being argued is that the desire to be accepted and respected by one's peers and mentors may lead some firefighters to search for alternative means to demonstrate their proficiency. This is exactly what Paul Reichenbach of the Office of the Pennsylvania Fire Commissioner notes:

> They're generally younger, in their teens or early 20s. They entered the fire service expecting a lot of excitement and that's typically not the case. They say, "We haven't fought a fire in six months. Let's go start one"… They think they have to prove themselves to somebody. (Finley, 2008)

Here we draw together two important and related themes: the desire for excitement and acceptance.

While they do not take up the topic of firefighter arson themselves, John Benoit and Ken Perkins (1997) (Perkins & Benoit, 2004) lend credibility to this explanation for the preponderance of young male firefighters in the dishonor rolls of firefighter arsonists. Benoit and Perkins (1997) suggest that when confronted with the unspoken, "boring reality of firefighting"— long periods of inactivity occasionally punctuated by fleeting moments of intense activity — new recruits either embrace the service aspects of the fire service, whereby firefighting becomes "serious leisure," or they leave the fire service in search of misadventure elsewhere (p. 24). If we reconsider Benoit and Perkins' initial formulation, we might be able to argue that there exists an additional third option. This possible third option suggests that some ambitious and eager (young) firefighters may actually create a third option by setting fires to satisfy the excitement they crave as well as to provide opportunities to put their newly honed skills into practice.

From this vantage point, there is some support for the first of the two common motives offered for firefighter arson — the desire for excitement. The second common explanation — the desire to be seen as a hero, often termed *vanity* firesetting — is far more problematic. The notion of vanity firesetting like pyromania is problematic for several reasons: the first concerns the circular logic employed whereby firefighter arsonists are said to be motivated by a need to be seen as a hero, because firefighter arsonists are vanity firesetters and

vanity firesetters want to be heroes. More importantly, these "would–be-hero firesetters" (p. 228) discussed by Lewis and Yarnell (1951) and others (Hoyek, 1951; Inciardi, 1970; Orr, 1989)[6] are presumed to have a pathological drive to set fires: "These are the firesetters motivated primarily by vanity — the little men with grandiose social ambitions whose natural equipment dooms them to insignificance" (Lewis & Yarnell, 1951, p. 228). This *hero complex*, as it is occasionally termed, again wraps the firesetting in the seductive and polemic language of abnormality. This is not to suggest that some firesetters are not driven by some immature desire to be viewed positively; the problem is that it obscures the equally possible non-pathological factors — like the competitive struggle for "masculine acendency [*sic*]" (Lewis & Yarnell, 1951, p. 420).

The idea of vanity firesetting draws attention to one of the underlying reasons that we continue to think in terms of psychological dysfunction — our desire to distance ourselves from the organizational pariahs who have disgraced the profession. If we are to understand this form of firesetting, we might more accurately term it, an *atta-boy complex*.[7] The point being that the acknowledgement sought does not appear to be predominantly outwardly facing; that is, it does not appear that they seek recognition from the general public but from their colleagues and mentors (Huff, 1994; Marks, 1993). To speak of heroism, then, is to confuse the situation by employing a term that firefighters, or other emergency or armed services for that matter, themselves are unlikely to use. For firefighters rarely, if ever, refer to their own actions or those of their colleagues (except perhaps as part of a posthumous recognition or in the context of a joke) in such terms; rather, firefighters are more apt to acknowledge the good work of their colleagues with a firm pat on the back and gruff "good work out there." This understated masculine acknowledgement is miles away from the soft admiration characteristic of talk of heroism.

The *atta-boy complex* I discuss here as an alternative to the *lie of heroism* (Desmond, 2008) encourages us to reconsider how the firefighter arsonist(s) may attempt to downplay the firesetting with the belief that risks are manageable and act perhaps even *justified and necessary*. This provocative assertion stands conventional logic on its head, suggesting that the fires may be the product of a warped, if somewhat plausible, effort to *do right* by their colleagues and community. A case in Brooklyn, Illinois, in 2001 illustrated this point clearly. As was the case there, firefighter arsonists may, in fact, believe they are doing the community a considerable service by eliminating dilapidated and even crime-ridden properties.[8] The same logic could be applied in relation to the forests where there exists considerable debate about whether United States Forest Service (USFS) policies limiting logging and aggressive fire extinguishment have allowed the forests to fill with explosive levels of fuel (Desmond, 2007). Thus the fires may, in fact, be thought a justified or even *righteous*

effort to remove a social blight from the local community and provide an opportunity for the arsonist and their colleagues to brush up on their skills. See Katz (1988) for a theoretical elaboration of this inverted conception of morality.

It is important to note that setting fires to get rid of potential hazards or social blights is not without precedence. In fact, this practice is well-established within both the structural and wildland fire services where training fires set in *acquired* (condemned) *structures* and *prescribed fires* are recognized ways to provide training opportunities as well as eliminating or reducing potentially hazardous environments.[9] Thus, setting an unapproved (and illegal) fire may be rationalized by firefighter arsonists as a good end even if the means are questionable at best. This warped morality was the basis of the blockbuster film *Backdraft* (1991), which portrayed a firefighter turned arsonist who attempts to make a moral political statement about the dangers of reducing firefighter staffing by setting a series of explosive fires to *prove* the social value of firefighters.[10]

The problem may not be that firefighter arsonists are unmotivated or obstinate as the Taylorist organizational misbehavior literature might suggest. The problem is that they are overzealous in their efforts to do *what they think is right* to the point where they may be willing to take matters into their own hands and begin freelancing. Thus, we might expect that they are as likely to be the "Firefighter of the Year" type who is always going above and beyond the call of duty as the *troublemaker* type who is the source of regular scrutiny (Smith, 2003, p. 10). Rather than going through the proper bureaucratic channels to mitigate perceived problems, they take matters into their own hands. This *occupational overzealousness* is more than just the heavily lauded notions of devotion, dedication, and dependability; it is occupational socialization and commitment gone awry.

Empirical Analysis

This section begins with a brief discussion of the methods employed in constructing the dataset on which the analysis is based before moving on to the substantive analysis, which is confined to descriptive statistics.[11] This article employs a large purpose-built dataset of firefighters arrested for setting fires (n = 1,213) representing sixteen countries, though predominantly the United States (91%, n = 1,102).[12] This data was derived from a number of archival sources over the course of several years. The vast majority of cases were culled from media accounts of arrests and convictions. This included detailed searches on the LexisNexis® news archive, the *New York Times* archive, Niche News feed services (like www.firehouse.com), and other related resources. The preponderance of English-speaking countries (97.7%, n = 1,183) presumably speaks more to the use of English language newswires than this being a distinctively Anglo-American problem.

The selection of sources for this project was primarily a function of availability. The earliest case uncovered was adjudicated in1833. However, more than 80 percent of the cases occurred in the past two decades (mean = 1997, s.d. = 18.6), topping out with 104 firefighters arrested in 2008 alone (see **Figure 1**). Previous literature on the topic of firefighter arson has consistently lamented the lack of comprehensive data (Huff, 1994; Cabe, 1996; USFA, 2003; Lindroth, 2003; Kinney, 2003; Smith, 2003; Rider, 1980a).[13] The lack of consistent official data is further compounded by the similar inconsistency found in media coverage, due in no small part to the impact of media processes.[14] The concern is that artificial trends could develop that are simply a reporting artifact subject to the ebb and flow of media cycles and popular attention.[15] The historical invisibility of firefighter arson has forced researchers to derive their own data from whatever sources they had access to, which spoke as much of the methods and population sampled than to the phenomenon itself (Huff, 1994). Ultimately, the *dark figure of firefighter arson* both helps to explain the considerable growth curve captured in this data as well as poses considerable problems in terms of generalizing the findings of any firefighter arson study to the wider yet unknown population of firefighter arsonists.

The question of how to operationalize the concept of firefighter arson similarly proved more difficult than initially envisioned. At first glance, the topic seems rather self-evident. However, as I detailed elsewhere (Hinds-Aldrich, 2011), getting at what actually constitutes a *firefighter arsonist* was as much a political decision as methodological one. To thwart potential debates, I narrowly defined the term, especially as it concerns the distinction between an active member and a former firefighter.[16] I included those people tasked with extinguishing incidents of fire and ranking officials whose

primary responsibility may be more managerial than fire *fighting*. I also included auxiliary personnel such as Junior firefighters ($n = 68$), firefighters in the training academy ($n = 8$), *fire police* ($n = 4$),[17] and industrial/military firefighters ($n = 2$) whom may not be operational firefighters in the strictest sense of the word but are nonetheless intimately connected to the local fire service. Fire buffs on the other hand were excluded outright.[18]

The remaining 1,213 cases were, as expected, predominantly male (87.8%, $n = 1,065$), which is sure to grow when the cases where the subject was listed anonymously as a firefighter (10.3%, $n = 125$) are factored in. While unquestionably a minority of cases, 25 female firefighters were arrested, though over half (56%, $n = 14$) were part of a larger group of male firefighter arsonists. Determining the ethnic or racial composition of the sample conclusively was problematic because few news articles identified the race of the firefighter, though many recent news reports now include photographs. While the majority of cases (84.3%, $n = 1,023$) did not indicate the race or ethnicity of the firefighter, we might presume that the sample reflects the wider demographic composition of the fire service. The sample showed 14.2% ($n = 172$) were listed as Caucasian, 1.2% ($n = 14$) as African-American, 0.2% ($n = 3$) as Hispanic, and 0.1% ($n = 1$) as Native American.

Like women, the minimal representation of minority groups should not be overlooked for they offer an interesting vantage point on the topic. For instance, a group of young African-American volunteer firefighters in Maryland in 1989–90 illustrated exactly the dynamics at play:

Before the fire, we were just sitting around bored. We were talking about how the chief yells at us for the things we do wrong and everyone was

Figure 1: Arrest Distribution by Decade
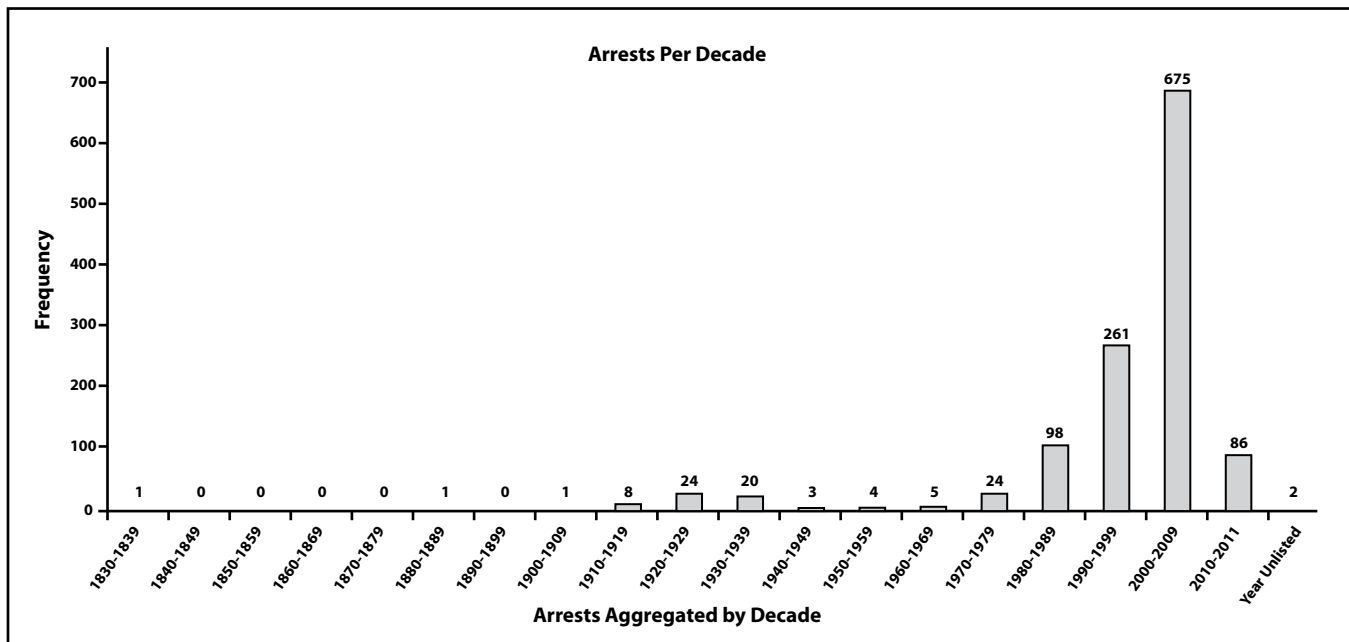
saying, "Let's wait for the next fire to come out and maybe we can do good on it." And then the words, "Set a fire" came up. (Price, 1990, p. A1)

In the end, the 11 young African-American firefighters arrested in the case(s) (actually two unrelated cases occurring in neighboring stations though uncovered simultaneously) only invited the very rebuke they had hoped to avoid. If anything, it is likely that young nontraditional members have an exaggerated desire to prove themselves to their colleagues. This *equality run amok* may lend credence to the argument advanced here that more than the lure of the fire, the arsonists sought to fit in and prove themselves to their colleagues, whether or not their colleagues would approve of their behavior.

These young men in Maryland shared another key element with many others in the sample: their youth (see **Figure 2**). While firefighter arson is not the exclusive domain of young members (with 14 firefighter arsonists that were between 50 and 64 years old when arrested), it does tend to be committed by younger members (mean 24, s.d. 7.7, mode 19). However, 18.9% (*n* = 229) of the cases did not list the age(s) of the suspect(s), which may skew the data. To get around this concern, the ages were dummy coded according to whether the suspect was listed as an adult or juvenile, using 18 years old as a cutoff. Accordingly, only 8.8% (*n* = 107) were listed as juveniles or were younger than 18 at the time of the fire(s) while 90.9% (*n* = 1,103) were listed as adults. Taken together, these two indicators suggest that while the firefighters may have crossed the legal threshold of adulthood, they may not have matured much beyond that point.

The type of fire department the arsonists were members of is similarly instructive. The sample was heavily weighted towards volunteer, retained[19] or paid-on-call firefighters (90.8%, *n* = 1,102), though Morgaridge (cited in NFPQ, 1927) and Burke (2001) would be dismayed that 4.7% (*n* = 57) of the sample were paid municipal firefighters. Wildland firefighters also represented a small subgroup (2.3%, *n* = 27), which was subdivided between career wildland firefighters (*n* = 13) and contract wildland firefighters (*n* = 14), though the distinction was not always particularly clear. The remaining cases were split between auxiliary/emergency medical services (EMS)/fire police members (*n* = 4), industrial/military firefighters (*n* = 2), and cases in which the type of department was not clear (*n* = 21).

In terms of rank, it is unsurprising, given the average age of the sample, that the majority were low-ranking members. More specifically, 78 percent were listed at the default rank of *firefighter*[20] (*n* = 946), 4.4 percent were classified as *operational probationary firefighters* (*n* = 52), 5.6 percent were listed as *nonoperational Junior firefighters or Explorers* (*n* = 68), and 0.7 percent were listed as being in the *training academy* (*n* = 8) at the time. More troublingly, a number had moved up in the rank structure to a supervisory position, though they may still have served operationally in a firefighter

Figure 2: Age Distribution
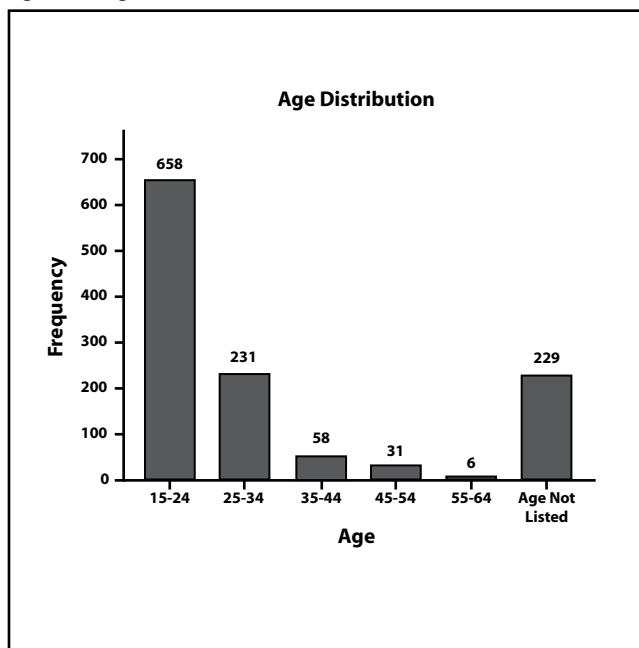
capacity as well.[21] In fact, 26 (2.1%) of the arsonists had achieved the rank of Lieutenant (or its international first-level supervisory equivalent), 29 (2.4%) were Captains, 19 (1.6%) were Battalion/Assistant/Deputy Chiefs, 27 (2.5%) were Chiefs, and 5 (0.4%) served on the Fire Department's Board of Directors in some capacity. John Orr (1989) was one of two (0.2%) fire investigators, while the remaining nine (0.9%) held other miscellaneous advanced positions in their respective departments.

The rank distribution is further explained by the tenure distribution. While the vast majority (76.8%, *n* = 932) of the cases did not make clear how long the firefighter had been a member, the remaining distribution shared a similar curve as the age distribution with just over 75 percent (*n* = 211) of the cases, in which their tenure was listed, started by a firefighter with five or less years of service. Moreover, 43.7 percent (*n* = 123) of the listed cases were set by firefighters with a year or less of service — including one young firefighter who set a fire to celebrate being voted on as a member of his fire department earlier in the evening.

Another possible explanation for the firesetting is the role of group dynamics. The sample was split relatively evenly between those who set their fire alone (48.8%, *n* = 592) and those who were part of a group of other firefighters (50.9%, *n* = 618).[22] The split was also relatively even when broken down by volunteers (alone *n* = 521, group *n* = 594). However career municipal firefighters (alone *n* = 42, group *n* = 20) disproportionally set fires by themselves, potentially suggesting differing motives for the firesetting. When broken down by age, juveniles set disproportionally more fires with others (alone *n* = 24, group *n* = 83) than do adults (alone *n* = 574, group *n* = 547). While high-ranking members

were a decided minority in the sample, their firesetting was telling. Of the 28 Fire Chiefs arrested, 64.2 percent (*n* = 18) were part of a group; similarly the 70 percent of the 20 Battalion/Assistant/Deputy Chiefs arrested (*n* = 14) were also part of a group.

If we presume the participation of such high-ranking members could be seen to make the firesetting appear acceptable to their subordinates, we should be unsurprised to find 67.6 percent of the 68 (*n* = 46) Junior firefighters were part of groups — though this is certainly not to suggest that senior members who guide Junior or Explorer programs support the firesetting. The argument here is not simply that peer pressure may contribute to the firesetting, which is obvious, but that the group nature of many of the cases supports the assertion that many firefighter arsonists are not necessarily psychologically abnormal or even necessarily seeking the visceral excitement of setting the fire but are likely attempting to evidence their prowess and dedication to their confederates and colleagues.

Another aspect that deserves further consideration is familial relationships among some of the firefighters. While the data available is very limited (unlisted cases, 94.6%, *n* = 1,148), a handful of firefighter arsonists were related to other fire service members, (5.6% had a relative listed). For instance, 36 of the arsonists had a parent in the fire service (often in a high-ranking position), 19 had a sibling, 4 had another relative (i.e., cousin or uncle), 3 had a spouse, and 2 had a child in the fire service. Others had parents or direct family members in esteemed social positions — law enforcement or local politics.

Most importantly, the number of firefighter arsonists who have family members also active in the fire service, while perhaps unsurprising given the historical tendency for multiple generations of a family to serve in the fire service, suggests that these individuals are likely well known in the local community and local fire service even before they join. As such, it suggests that background checks may be of limited utility, especially if there is an undercurrent of political pressure to accept certain members based on whom they are related to.

Taken together, these empirical findings add another layer to the substantive argument that many firefighter arsonists appear to be motivated as much by social factors within the fire service than psychological factors within their mind. Overall, the number of firefighter arsonists that set fires in conjunction with other firefighters suggests that in order to understand and uncover the root of firefighter arson cases, we should be focusing considerable attention on the social dynamics of the firehouse as much as the psychological makeup of prospective firefighters.

Policy Implication

So what if we do accept the argument that firefighter arsonists are as likely to be motivated by an interest to *prove* their dedication and competence as they are by

the excitement of extinguishing a fire or even a psychological deviance? How should we move forward so as to begin to mitigate further cases? First, we must dispatch with the idea that all firefighter arsonists have a *problem* with fire or, said another way, that they are *arsonists turned firefighters*. As was argued at length thus far in this article, the notion that at the primary root of this firesetting is some sort of psychological abnormality unintentionally blinds us to the more mundane and problematic truth that firefighter arsonists may not appear demonstrably different from their equally dedicated colleagues.

By viewing these arsonists as *bad apples* that can be plucked before they spoil the bushel, we fundamentally misunderstand the issue by implying that our best or only course of action is to carefully pick over newcomers for any sign of blemish (Marks, 1993). Unfortunately, this bad-apple approach is at the heart of the majority of policy recommendations proffered to date. In this concluding section, I critically assess the various attempts to address the problem and attempt to chart a way forward.

The traditional bad-apple perspective is particularly problematic in that it leads us to develop a *circle-the-wagons* mentality, whereby we place all our emphasis upon guarding the boundary between *us* and *them* without realizing that the seeds of this problem are just as likely to sprout from within. The primary recommendation offered by most commentators is to develop rigorous background checks (USFA, 2003; Doley, 2003b; Lindroth, 2003; Ansley, 2004; Murphy and Murphy, 2010). Background checks can take many forms, from employment histories, school records, credit reports, driving records, past fire-service references, or most commonly criminal-records checks. To this end, some states have adopted laws prohibiting convicted arsonists from serving as firefighters (Pennsylvania Voluntary Fire Service [PaVFS] Act 168, 2006; South Carolina Firefighters Employment and Registration Act [SCFERA], 2001), encouraged prosecutors and judges to include similar prohibitions as part of sentencing recommendations, or considered establishing arsonist registries (Associated Press [AP], 2009). This concern is not entirely unfounded because there have been instances where convicted firefighter arsonists have attempted to or have successfully (re)joined fire departments as a recent case from Mississippi illustrated (AP, 2011).

While it is vital that fire departments exercise due diligence in vetting prospective firefighters, they must also appreciate that background checks are necessary but not sufficient (Huff, 1994). Given the youth of many of the offenders, they are unlikely to have considerable criminal records, if any at all, and even those with criminal records may have them sealed or expunged once spent. This is not to suggest that criminal-records checks are futile or unnecessary, far from it. However, we cannot put too much faith in background checks alone — as a number of recent cases have shown. In

fact, Huff (1994) also noted that, "most of the group of-fenders appeared not to have the inclination to set any fires before joining the department. The idea occurred to them later." Focusing our attention primarily upon patrolling the border looking for deviant prospective fire-fighters, no matter how sophisticated the tools we have at our disposal, is likely to fall short because it draws our attention in the wrong direction.

Even rather novel approaches such as the Arson Screening and Prediction (ASAP) instrument devel-oped by criminologist Allen Sapp may be hamstrung by the same shortcomings. The ASAP screening tool was designed to be administered by local fire service officials without the need for a background in psychol-ogy or specific training. The instrument simply mea-sures respondent's answers against the South Carolina Forestry Commission profile of firefighter arsonists. As such, it is not intended to conclusively identify past firesetting or even future firesetting; rather, it is intended simply to identify persons whose background or inter-ests may make them worthy of further scrutiny. It is thus another tool that fire service leaders can employ to inform their decision on whether to hire or accept a pro-spective firefighter. The greatest strength of the ASAP instrument may be inadvertent. A fire department that adopts this instrument or similar training sessions for all firefighters — new and old — signals that it is watch-ing and takes a zero-tolerance approach to firesetting, which may discourage some members from going down that path.

Moreover, background checks and screening instru-ments are likely to be ineffective when they are not part of a larger concerted effort to send an honest message about the responsibilities and realities of the fire service to new recruits (Murphy & Murphy, 2010). If we accept the adapted version of Benoit and Perkins' (1997) *seri-ous leisure thesis*, we should also be more forthcoming about the potential *boring reality of the fire service* to new recruits. More provocatively, we may also want to reconsider the types of behaviors and actions that we recognize officially or unofficially such as attending the most calls, being first on scene, or acting *heroically*. While this type of award may honor valor and com-mitment, it may also serve as a perverse incentive for those only too eager for the recognition.

Fire departments and state training academies should also develop and mandate training modules, like the Hero to Zero Program developed by the Pennsyl-vania Chapter of the International Association of Arson Investigators (PA-IAAI) and the Pennsylvania State Fire Commissioner's Office. This program is designed to draw attention to the problem and the personal and departmental ramifications of setting fires. Since we cannot bank on the deterrent effect of punishment, we must also be diligent in our effort to investigate ev-ery fire in our jurisdiction (to the extent possible) and encourage members to voice concerns anonymously if they suspect firesetting among their colleagues (Huff, 1994).

This investigative diligence can pay dividends not just for discovering firesetting firefighters but other arsonists as well. Perhaps the most straightforward approach is to habitually request, listen, and trace the initial caller(s) reporting the fire. While I noted the trend too late into the data collection to accurately record the frequency, a considerable number of firefighter arson-ists also called in the fire(s) they set. In fact, some made little effort to hide their identity by either referring to dispatchers by first name or in one case leaving their pager on high volume so that the dispatcher could hear the fire tones in the background while speaking with the otherwise anonymous caller. Similarly, fire investigators should habitually record the names of the first-arriving firefighters to the scene or the fire station through radio transmissions, personal recollections, or electronic door lock records. Again this action can assist in fire investi-gations that do not necessarily involve firefighters be-cause their observations upon arrival can help establish the origin of the fire, suspicious witness behaviors, or the like.

Huff's (1994) recommendation that fire officials look for a rash of so-called *nuisance fires* (e.g., trash piles, hay bales, and brush fires) presumably holds true today. Amazingly, as Huff also hints, investigators should also be wary if the fire station itself catches fire; this unfortu-nately also holds true as 31 of the firefighter arsonists in this dataset actually set fire to their own fire station, some more than once. Often these trends become evi-dent when calls are consistently geographically plotted or categorized by day of the week or time of day. When cross-referenced with the list of first-arriving or first-due firefighters, patterns may also emerge. The challenge remains how to cast light on the problem in both the in-vestigative and academic sense without building resent-ment and casting a pale over the millions of firefighters whose image has been (and continues to be) tarnished by the actions of a small but visible minority.

While it may not seem to have much bearing on fire-fighter arson investigations, more comprehensive na-tional firefighter arson data is needed to develop more robust investigative strategies as well as the ground-work for a firefighter arson early-warning system now that computer technology and extensive digital data are readily available. Yet, in the fifteen years since Cabe voiced his concern about the lack of national data, little progress has been made. Beyond the academic interest in consistent data, Cabe (1996) noted that the gather-ing process has important knock-on effects: "Without comprehensive information, the natural tendency is to view each case as an isolated incident" (pp. 7–10). The U.S. Fire Administration (USFA) special report on firefighter arsonists (2003) also noted that none of the various national reporting systems such as the National Fire Information Reporting System (NFIRS) cataloged by the USFA and the Uniform Crime Reports (UCR) cataloged by the FBI allow for the collection of informa-tion on firefighter arsonists.

More recently the Bombing and Arson Tracking System (BATS) run by the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) has made an important first step by including a space to note whether the arsonist was a firefighter at the time of the fire(s), which will hopefully help future researchers and practitioners gain a further understanding of exactly how pervasive a problem this is. Hopefully, the other reporting systems will follow suit. Better still, hopefully they may also adopt a detailed form like UCR *Supplemental Homicide Reports (SHR)* for the reporting of more detailed information. The problem remains that given the voluntary nature of fire and arson reporting and the ambiguous jurisdictional debate between the fire and police services, reporting is sure to remain spotty at best. This data is available; we simply require intervention from our elected national officials and fire service leaders to push for the inclusion of this data — and we must support them vigorously in this effort, despite the natural tendency to conceal *dirty laundry*.

Conclusions

Firefighter arson remains a contemporary problem despite the sporadic efforts over more than 100 years to draw attention on the issue. Our understanding of firesetting firefighters has historically mirrored the wider literature on arson. Each of these perspectives offers an interesting window onto the problem. However, there is not a single universal motivation for all firefighter arsonists nor is there a single theoretical lens that gives us sufficient purchase on the reasoning of every firesetting firefighter.[23] The topic of firesetting firefighters is also too multifaceted to explain every incident and offender with a single offender profile (Doley, 2003b). The theoretical lens developed here suggests that the fundamental paradoxes inherent in the fire service that reward commitment, initiative, and fireground experience may inadvertently convey the message to some firefighters that it is acceptable to set fires in certain circumstances. This theoretical lens simply offers an alternative perspective on the issue, though it too is not a panacea.

There appears to be considerable theoretical traction for the argument that many firesetting firefighters are animated by a desire to be respected by their colleagues. They appear to have convinced themselves that rather than waiting for (the increasingly rare) opportunities to demonstrate their prowess when fires occur normally, they should take matters into their own hands. The historical dataset employed here further lends weight to this position. The preponderance of young men with less than five years of service in the sample suggests that they may have reached a turning point, a point whereby they have been in their positions long enough to see the boring reality of the fire service while not long enough to have gained a sufficient foothold in the business of fire fighting to warrant

widespread respect from their colleagues and community. This is the fundamental paradox that the *atta-boy complex* attempts to explain.

The argument put forward here is by no means offered as a justification or an effort to blame the social environment while lessening the culpability of any of the firefighters who have disgraced their profession. Rather the message here is to call into question the tendency to unconsciously employ the language of psychology in an effort to paint these offenders as qualitatively different from the millions of firefighters who conscientiously uphold the distinguished image of the fire service. This tendency obscures the pragmatic straightforward explanations that are often noted but quickly brushed aside in popular accounts of particular cases.

Overall, this rather dystopian assessment of the nature of firesetting among firefighters does not paint an optimistic picture for our effort to eliminate the problem. Drawing the figurative wagons closer together and developing more robust screening mechanisms can only go so far. These programs may serve their purpose by occasionally weeding out prospective arsonists (or criminals) turned firefighters, though they do little to weed out *firefighters turned arsonists*. It is these firefighters turned arsonists that are at once the most troubling and the most interesting.

The tools of law enforcement can unfortunately do little other than deal with these acute outbreaks. If we are to get beyond dealing with the acute outbreaks, we must as a matter of urgency gain a more robust understanding of the frustratingly fine line between acceptable, committed behavior and unacceptable, overzealous behavior, particularly as a precursor to occupational deviance. This is where I depart from Huff (1994) who notes that "while grants [to study the problem in greater depth] are nice, the immediate and apparent answer to prevent firefighter arson is deceptively simple: applicant screening." Screening programs are only part of the solution.

Screening programs, which have been employed religiously in police departments for years, generally weed out only *criminals turned cops* not *cops turned criminals*. For example, if we stick with the policing analogy, screening programs are likely to flag applicants who may be corruptible, those with questionable criminal connections, those with mounting personal debt, etcetera, though it is not as likely to isolate those who might get so caught up in *making things right* or *getting their guy* that they would push procedural, legal, or ethical boundaries. What is needed is a better understanding of how *occupational overzealousness,* as I have come to term it, develops in public sector and/or public safety organizations. Only then can we begin to explain how these *Dirty Harry*-like figures (Klockars, 1980) (be they firefighters, police officers, or for that matter military personnel) could reconcile attempting to do *right* through inappropriate or illegal means, all the while carrying out their duties "whooping like cowboys" (NYT, 1931).

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Endnotes

[1] As will be discussed in greater detail later in this article, it is not possible to conclusively determine whether the number of firefighter arsonists is increasing or whether given the attention the problem has garnered, we are now catching and prosecuting more through official legal channels.

[2] Due to the methodological limitations of using archival newspaper accounts, I used the lower threshold of arrest for inclusion in the dataset. In many cases the subjects were also charged and convicted, but this information was not consistently reported. When subsequent media coverage noted that a subject was acquitted or had the charges dropped, this was noted in a *Case Disposition* variable and those cases were excluded from the analysis. Since the media did not always document the final disposition of every case, it is possible that some of the individuals included were actually acquitted, had the charges dropped in exchange for their testimony, or otherwise were not adjudicated with or without prejudice. This is always a risk of using archival newspaper data. Since the threshold for inclusion was simply arrest, I do not and cannot imply that each individual is in fact guilty of the crime(s) for which he or she was arrested or charged.

[3] Equally problematic is his suggestion that he is, "therefore, a strong adherent of the paid fire department" (1927, p. 217). A brief look at the history of firefighter arson, as I will soon illustrate, will call into question Morgaridge's suggested way forward. More importantly, while we might quickly dismiss his comments while serving as the Assistant General Manager of the National Board of Fire Underwriters as ideologically and politically motivated, we are well advised to pay heed to his fundamental concern. This argument continues to divide the fire service along political lines. In a more recent Letter to the Editor, the Assistant to the General President of the International Association of Fire Fighters (IAFF) union took " great umbrage" to a quote by a local fire service leader who off-handedly mentioned that firefighter arson is rare and "paid firefighters do this kind of thing, too" (Burke, 2001, p. 2). Therefore, Burke requested that all future articles dealing with this "unfortunate matter" refer to the accused clearly as "volunteer firefighters." Turning the political trick around, he alleged that the original quote was "not based on fact, [rather it served] to downplay the need for career firefighters in the county," which led him to off-handedly retort, "most volunteer departments will take whoever applies to be a volunteer (and often at a younger age than professionals) because they have a hard time recruiting and retaining volunteers these days" (p. 2). Political potshots aside, this line of reasoning serves no purpose other than to obfuscate the issue and encourage both sides to *pass the buck* rather than deal honestly with the issue.

[4] It is also unclear whether these composite profiles lead to a degree of tunnel vision, whereby those who

do not fit the *profile* are overlooked, thereby artificially reinforcing the profile by only flagging up those who *fit the profile*.

[5] Huff interviewed those firefighter arsonists who had passed through the various filters of the criminal justice system to receive a custodial sentence. Cabe (1996) studied all firefighter arsonists in a limited geographic area over a finite period of time. If the statistical profiles are based upon a very limited number of offenders who may not be representative of the whole population of offenders, the findings are not likely generalizable beyond the group studied.

[6] It is not particularly clear who coined the term *vanity firesetting*. Both Lewis and Yarnell (1951) and Hoyek (1951) use the term liberally, suggesting it was well established by the 1950s. Disturbingly, one of the few writers to focus exclusively on vanity firesetting was Glendale (CA) firefighter and arson investigator Captain John Orr (1989); see also Wambaugh (2002). John Orr's interest in vanity firesetters is particularly troubling given that he was later convicted for numerous fires and four murders.

[7] An *atta-boy* is a colloquial phrase that is often used to denote a commendation. It is derived from the phrase, *that's my boy* or *that'a boy*. The term is used here to capture the dynamic, whereby the fires are presumed to be set to create an opportunity for the firefighters to put their skills into practice and thereby gain the respect of their colleagues. The term is somewhat tongue-in-cheek and may not be particularly ideal for it too employs the language of abnormality — complex — though it serves its purpose as an effort to counter the rhetoric of heroism.

[8] A major case in the tiny hamlet of Arkwright, South Carolina, in 1995 also illustrated this point. Many of the 150 fires the group, which included the current and past Fire Chief and a member of the Board of Fire Commissioners, set were in vacant rundown buildings that residents had complained attracted drug users from nearby Spartanburg. Shopkeeper Chad Lister noted, "[The vacant buildings] were eyesores … If I was on the jury, I wouldn't convict them" (Breckenridge, 1995).

[9] In one of the more bizarre cases, two young firefighters in Tennessee set fire to a vacant building that had been set up for a training burn only days later. The result was the same though the two found themselves charged with arson for their impatience. Similarly, highly decorated and highly revered U.S. Forest Service (USFS) Type-1 Incident Commander (one of only 14 in the country) Van Bateman was charged with setting two fires in the Coconino National Forest in Arizona. Bateman, who had been flown by the Federal Emergency Management Agency (FEMA) to New York City to head its 9/11 response, admitted setting the fires though he argued that setting prescribed burns without official paperwork was common practice. He later pled guilty to a felony count of "setting timber afire without authorization."

[10] The film *Backdraft* (1991) pulls loosely from an actual case in Greater Boston in the early 1980s where a group comprised of a firefighter and numerous fire buffs set hundreds of fires allegedly to *show* the short-sightedness and danger of a highly contentious series of firefighter layoffs. The fires did $22 million in damage and injured 280 firefighters and civilians.

[11] A number of methodological and operationalization problems were encountered in the course of this research. Adequately covering these concerns here proved to be beyond the scope of this article. For a more detailed discussion of the problems and potential solutions, please see the research by Hinds-Aldrich (2011).

[12] The sample pulls from 48 states. Many of the cases clustered along the Eastern seaboard, the first ten in descending order: PA ($n = 182$), NY ($n = 100$), NJ ($n = 65$), NC ($n = 57$), SC ($n = 55$), TX ($n = 44$), GA ($n = 42$), VA ($n = 41$), WV ($n = 41$), MD ($n = 40$), and so on. These cases do not presumably represent all possible cases but rather the cases discovered in the process of this research. For instance, in South Carolina, Cabe (1996) reported that there were 33 arrests in 1993 and 47 in 1994. However, there were only 13 and 12 cases, respectively, recorded in this dataset for the same time period. Consequently, the number of actual cases is presumably considerably higher.

[13] This lack of data is tied in no small part to the moral hazard for fire departments when it comes to acknowledging and addressing this sort of wrongdoing. Thus, those diligent fire departments that have acknowledged the problem and have begun to address the problem may actually be penalized for their efforts by inflated figures. Meanwhile, jurisdictions that ignore the problem by handling it in-house are perversely rewarded with inaccurately low figures.

[14] Said another way, it is important to know whether cases are reported consistently throughout history and across jurisdictions, especially for long-term archival research. Similarly, it is important to consider how the growth in the number and remit of media outlets and wire services may also create reporting artifacts in long-term archival research. Official data, when it is available, is also subject to similar questions.

[15] This is particularly evident when one considers what might be most appropriately termed *topical contagion*, whereby a story in the media picks up a momentum of its own and spreads geometrically and geographically. While it is not possible or feasible in the scope of this project to control for these media affects, the sample offers a broad cross section of cases to mitigate potential threats to validity.

[16] Former firefighters ($n = 103$) and retired firefighters ($n = 5$) were excluded from this sample, even though it could be argued that they are/were intimately related to the fire service. The cases were excluded (though the case details were retained in the dataset for comparison purposes) so as not to distract from the findings

presented here. The case for excluding former fire-fighters is particularly salient when the firefighter was administratively separated from the fire service for disciplinary reasons. In those cases, a strong argument can be made that the fire service acted correctly and should not be held to account for their former members' subsequent actions as a recent case in Hawaii illustrated. More often, however, the line between former and current personnel comes down to timing. For firefighters are occasionally listed as former firefighters in press accounts when, upon a closer reading, the person was an active member at the time of the fire(s) but then resigned after questioning or was quickly purged from the department's roles as soon as their transgressions came to light. For that reason, current members were defined as members who were active in the fire service at the time of the fire, regardless of the later disposition of their membership.

The question of timing has perplexed others as well. After the recent arson arrest of a former firefighter in Pennsylvania, several local commentators rhetorically asked, when does someone lose the title *former firefighter*? By the time he destroyed the auto parts factory, which caused the company to fold and lay off its entire workforce, he had not been a firefighter for approximately a decade. Similarly, one of the most destructive infernos of the *Black Saturday* fires in Victoria, Australia, in early 2009 was allegedly lit by a man listed as a former firefighter though he had left the fire service decades earlier when mandatory background checks were instituted for all Australian firefighters in the early 1990s. Despite obvious problems, any connection to the fire service, however tenuous or dated, is presented as a direct connection.

[17] *Fire police* are non-fire-fighting personnel tasked with crowd and traffic control around fire scenes, popular in some parts of the Northeastern United States.

[18] Previous research often included *fire buffs*, civilians who have an active interest in fire fighting and its trappings though are not members of a fire-fighting organization, in addition to active firefighters; see for instance, Lewis and Yarnell (1951).

[19] The term *retained firefighter* is almost exclusively British, in that there are few true uncompensated volunteers. Retained firefighters in the United Kingdom (UK) receive an annual stipend as well as are paid for the hours they spend on calls or training.

[20] The rank of *firefighter* was used as the default value. Only news accounts that list a specific rank (i.e., Captain) or title (i.e., Training Officer or Probationary

Firefighter) were categorized according as such. It is possible that some of the firefighters listed with the default rank of firefighter may have held other positions or ranks — higher or lower. Additionally, the rank listed was the highest rank held since it was not always clear when or why they stepped down or were demoted.

[21] It is worth mentioning that some of the ranking members were not serving in that role at the time of the fire. For instance, a recent case out of Pennsylvania is illustrative. The alleged subject had previously served as an Assistant Fire Chief of the volunteer section sometime before he was hired for a paid part-time entry-level firefighter position with the same department. Thus, the highest rank achieved was recorded because it is important to note the position of responsibility held as well as being often difficult to determine whether they were demoted or stepped down in light of an arson investigation.

[22] Firefighters were only considered to be part of a group if the group included at least one other firefighter. A number of firefighters colluded with civilians; however, these cases were noted under a different variable because it was decided that collusion between firefighters was more pertinent.

[23] Ultimately, this empirical analysis cannot conclusively answer the question of motive. Previous research shows reasons for firesetting among firefighters that are more or less independent of their association with the fire service (Hinds-Aldrich, 2011). It was not feasible, however, to exclude these cases from the dataset employed in this study since it is not clear how the determination was made or how accurate that determination was.

About the Author

Matt Hinds-Aldrich is an Assistant Professor of Fire Science at Anna Maria College. He is currently a member of a national firefighter arson working group convened by the National Volunteer Fire Council. He is also currently completing a Ph.D. at the University of Kent in England that examines the concept of firefighter culture. He served as a firefighter and trained as a fire investigator prior to pursuing a doctorate. His previous writing has explored the persistent use of arson during protests as well as the politicization of arson during the American church arson epidemic and the German Reichstag fire. Matt can be contacted at: mhinds-**aldrich@annamaria.edu**

Book/Article Review

The Role of E-Government in the Fire Service: Applications Taken from Selected Literature

Articles Reviewed:

Lee, J. (2010, July). Ten-year retrospect on stage models of e-government: A qualitative meta-analysis. *Government Information Quarterly, 27*(3), 220–230.

Moon, M. J. (2002, July/August). The evolution of e-government among municipalities: Rhetoric or reality? *Public Administration Review, 62*(4), 424–433.

Silcock, R. (2001, January). What is e-government? *Parliamentary Affairs, 54*, 88–101.

Arguably one of the most important innovations to governmental customer service delivery is e-government. Simply put, the term describes information and communication technologies utilized to provide better services for citizens. It can be more narrowly defined as "the production and delivery of government services through information technology (IT) applications" (Moon, 2002, p. 425) or more broadly defined as "any way IT is used to simplify and improve transactions between governments and other actors, such as constituents, businesses, and other governmental agencies" (Sprecher, 2000, p. 21).

Since its emergence in the United States in 1993, e-government has gained popularity throughout the world in both developed and emerging nations. Surveys dated as early as 2002 have shown the widespread use and benefit of e-government in providing users with one-stop service centers and customer friendly principles in Web design (Ho, 2002). Aligning closely with the "citizen as customer," as initially purported by David Osborne and Ted Gaebler in1992 in their book *Reinventing Government*, e-government has found its place in both federal and municipal management. Customer-based government has set the bar high and prompted municipal departments to rethink and revise the way they conduct business with their corporate customers, citizens, and perhaps most important, voters. The central focus is now aimed at designing government service delivery specifically intended for those who use it. Donnelly and McGuirk (2005) offer four principles that support a government's strategy for e-government:

- Building services around citizen choice
- Making government services more accessible
- Maintaining equality between those with ready access to electronic media and those without, and
- Effective use of information (p. 29)

The major obstacle to e-government, according to Ho (2002), is "the burden of transactions costs imposed on public officials and citizens" (p. 435). Quite simply, citizen engagement is pricey. Furthermore, citizens are reluctant to participate in the decision-making processes of government (e.g., responding to surveys and submitting formal feedback). Anyone engaged with performance measurement will readily agree with this concern, especially within the fire service where citizen feedback is scarce at best.

The role of the Internet in reinventing government has been well documented. A quick search of the literature provides numerous sources outlining the role that IT plays in modern public administration. More specifically, IT neatly blends with the concept of e-government in the form of one-stop service centers. The purpose of this essay is to elucidate the nexus between e-government and the fire service. A cursory examination of fire department websites, for example, reveals opportunities for citizens to interact with fire department personnel. How deeply this interaction goes is the question at hand.

A decade ago Rachel Silcock (2001) writing in the United Kingdom for *Parliamentary Affairs*, proposed six *dynamic* stages through which governments, including the fire service, could pass electronic service to their customers. Although ten years old, the author's outline provides a firm basis from which to incorporate e-government.

The first stage is i*nformation publishing and dissemination*, in which departments and agencies establish individual websites. This step requires one-way communication that allows customers to download information from the site. The second stage Silcock titled *official two-way transactions*. Here customers can engage in transactions such as paying bills or securing permits. This stage could be critical to the efficacy of a fire department with respect to staffing issues. For example, applications can be made available as downloadable files to prospective firefighters. Third, is *multipurpose portals*. In this stage customers can, through a single point of entry, access several municipal departments — thereby saving time. In this venue, users could, for example, download building codes from the building department, electrical codes from another agency, and fire codes from the fire department through a single gateway — thus illustrating an ideal example of one-stop shopping.

Fourth, is *portal personalization*. Here, more frequent users could customize their own portals, again saving time and energy. Those who know where they want to go and what they want would benefit from this time-saving special feature.

Fifth, Silcock proscribes a *clustering of common services*. This is where a government would consolidate particular services along common lines to benefit the

user. For instance, one could secure permits from several departments such as fire, building, and electrical. Unlike the multipurpose stage, users would not have to navigate throughout different departments; rather one screen would display all relevant items and options.

The last stage is *full integration and enterprise transformation*. At this stage *old walls*, as Silcock calls them, would be broken down and bridges constructed among departments ensuring smooth navigation throughout the municipality's website.

Writing in *Public Administration Review* one year later, M. Jae Moon (2002) conceptualized a five-stage model that closely resembled Silcock's earlier work. Moon's first four stages included: *information/dissemination; two-way communication; service and financial transactions; and vertical and horizontal integration*, all of which closely parallel Silcock's model stages. Moon's fifth stage is labeled *political participation* and includes customer feedback in the form of online opinions and surveys. Here, citizens have the opportunity to evaluate their municipal government, thus greatly enhancing performance measurement.

Perhaps the seminal study examining stages in the development of e-government as a process was authored by Jungwoo Lee and appeared in *Government Information Quarterly* in July, 2010. Based on previous research and his own understanding of e-government, Professor Lee offered ten stages of e-government. They include:

- Stage One: *basic networking* — the technical prerequisite for latter stages.

- Stage Two: *presentation of information* — posting information for the public.

- Stage Three: *interaction*: two-way communication — questions/answers.

- Stages Four, Five & Six: *transaction* — two-way interaction with customers relative to aspects of service delivery (e.g., permits, fines, etc.).

- Stages Seven & Eight: *integration* — "data mobility across organizations, application mobility across vendors, and ownership to data transferred to customers" (p. 225).

- Stage Nine: *transformation* — "the necessity of the operational process transformation in order to provide more efficient government service" (p. 226).

- Stage Ten: *democracy or participation* — a long-term objective of e-government where tools such as online voting and surveys are employed in an attempt to improve citizen participation and involvement (pp. 225–226).

Lee abridged these ten stages into five stages: *presenting* (information), *assimilating* (interaction), *reforming* (transaction), *morphing* (participation), and *e-governance* (involvement).

Presenting concerns information dissemination. This one-way communication is basically what is found on any existing fire department's website and is critical to e-government since it provides users basic data about the department. Information, perhaps in several different languages, ranging from services offered by the department to the location of substations to contact information for personnel can be made easily available to interested parties. Information can also be made available as downloadable documents, thus allowing users easy access to ordinances, laws, codes, or regulations.

The second and third stages, *assimilating* (interacting) and *reforming* (transaction) can be compressed into one dimension for the fire service. This is the aspect of e-government where the user can interact and simultaneously transact with the fire department. Questions could be posed online and answered in a chat room. Permits and fire reports can be made available. Inspections and appointments can be booked online. Making citizen access to fire department services and personnel can be as easy as it is to go online and purchase an airline ticket, choose your seat, and print your boarding pass.

Lee's last two stages, *morphing* and *e-governance*, can also be amalgamated into one stage. *Morphing* (participation) refers to the process of changing the scope of services. *E-governance* (involvement) represents the final stage of e-government efforts, in which citizens have the ability to become more involved in governmental decision-making and perhaps even policymaking.

Government, including the fire service, needs feedback to evaluate performance and improve operations. Feedback must be reliable, accurate, and quantifiable. This comes in the form of performance measurement, "the collection and analysis of feedback on local government level" (Hatry, Fisk, Hall, Schaenman, & Snyder, 2006, p. 1). In short, measuring what an organization does and how effective it operates is paramount to its efficiency. One such way to gather such data is through the use of citizen surveys.

Surveys have long been used to gather customer feedback in business, more recently in government, but are seldom used in the fire service. The use of citizen surveys represents a twofold advantage to the fire service. First, survey data can greatly assist departments in determining how well the organization is doing according to users of services — citizens. Second, surveys can allow departments to evaluate the needs of their customers. Perceived needs, wants, and demands of the citizenry can be addressed and perhaps even incorporated into a fire department's website, thereby providing a greater service to the owners of government services — taxpayers.

Modernization in the fire service demands greater and more efficient delivery of services. Whether on the fireground or on a departmental website, today's fire departments must address the needs of citizens. As a multifaceted (i.e., staged) concept, e-government

holds great potential for bringing government closer to the people. E-government creates a pathway for better performance and citizen service.

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Additional Works Consulted

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Journal Information

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