

INTERNATIONAL FIRE SERVICE JOURNAL OF LEADERSHIP AND MANAGEMENT



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IFSJLM would not be possible without the financial support of the Dean of the College of Engineering, Architecture, and Technology and FPP. Their support represents a commitment to the continued professionalization of the American fire service.

As a further indication of the support of FPP to the international fire community, all issues of the *IFSJLM*, except the two most recent years, are available for reading **free of cost** at the Journal's website. Please go to <http://www.ifsjlm.org/PastEditions.htm> to read and/or download previous issues of the Journal.



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*Previous Recipients of the Dr. John Granito Award for
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Research Symposium 2008 (RS08)

Dr. John Granito

Professor Emeritus and Retired Vice President for Public Service and External Affairs
State University of New York Binghamton and Public Safety Management Consultant

Research Symposium 2009 (RS09)

Dr. Denis Onieal

Superintendent
National Fire Academy (NFA)

Research Symposium 2010 (RS10)

Dr. Lori Moore-Merrell

Assistant to the General President
International Association of Fire Fighters (IAFF)

Research Symposium 2011 (RS11)

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Perelman School of Medicine, University of Pennsylvania

Research Symposium 2012 (RS12)

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National Institute of Standards and Technology (NIST)

Research Symposium 2013 (RS13)

Dr. Anne Eyre

Trauma Training Consultant
Coventry, United Kingdom

Research Symposium 2014 (RS14)

Chief Dennis Compton

Chairman of the Board of Directors of the National Fallen Firefighters Foundation

***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)* headquartered 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 was 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. Please send required materials in hard copy to: Dr. Granito Award, C/O Dr. Robert E. England, Founding Editor, *International Fire Service Journal of Leadership and Management*, 487 Elm Avenue, Norman, Ok 73069. Or, if you prefer, scan and complete the nomination form and send all materials electronically to: bob.england@okstate.edu.

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

Founding Editor, *International Fire Service Journal of Leadership and Management (IFSJLM)*,
Fire Protection Publications, Oklahoma State
University

Welcome to Volume 8 of *IFSJLM*. This issue marks the fourth year of our transition from a biannual to an

annual issue of the “Red Journal.” Typically, readers should expect to see the annual edition released in September or October. When the issue goes to press, however, is largely dependent on when external peer reviewers accept four or more articles for publication. Regardless of the number of articles, the volume will be available no later than the end of the calendar year.

Sixth Annual Dr. John Granito Award for Excellence in Fire Leadership and Management Keynote Address presented at Research Symposium 2013 (RS13) by **Dr. Anne Eyre**, Trauma Training Consultant, Coventry, United Kingdom (UK)

The Making of a Hero: An Exploration of Heroism in Disasters and Implications for the Emergency Services

Abstract

This paper explores the phenomenon of heroism in the context of behavioural responses to disaster. Drawing on social scientific, media, and health and safety sources, it reflects on the impact and consequences of being labelled a hero. Consideration is given to the implications of heroism for the emergency services arising from recent cultural and legal developments within the United Kingdom (UK). The paper calls for a more informed understanding and debate about the meaning and implications of heroism in disasters.

Introduction

“Show me a hero and I’ll write you a tragedy.”

(F. Scott Fitzgerald Quote)

References to heroes and heroic acts in disasters are common, particularly when it comes to mass fatality incidents. Accounts and analyses of heroic acts appear in sources as wide ranging as the news media and popular culture through to academic papers and health and safety guidance literature (see References section and Appendix). However, although these various sources may be using the same term, are they all talking about the same kinds of behaviour and attributes/qualities?

This paper begins by examining the psychological and social context of major emergencies as potentially traumatic events and the significance of these for understanding disaster-related actions and behaviour. In some cases reactions to disasters may be as much about spontaneous, instinctive human responses as they are about the measured implementation of preprepared emergency procedures. It is important to acknowledge this reaction if we are to understand, anticipate, and interpret extraordinary and heroic acts where people risk their own lives in responding to the needs of others.

The newsworthiness and other social and political agendas served by the discourse of disaster heroes will be briefly referred to along with the wider consequences of being labelled a *hero*. For a member of the public who becomes the victim-cum-hero, finding oneself unwittingly caught up in a life-threatening event can be life-changing enough, but in the aftermath there may be additional costs associated with identifications of heroism such as additional survivor guilt.

Members of the emergency services may be described as everyday (albeit often reluctant) heroes to the extent that they deliberately enter environments of risk as part of their ordinary duties, but their actions in the context of major emergencies may attract additional attention and analysis in the following days and weeks. The paper considers the renewed focus on risk, health, and safety within emergency response prompted by a series of major incidents and investigations within the United Kingdom (UK) and the consequences these have had for revisiting the interpretation and guidance around acts considered heroic within the law, custom, and practice.

Understanding Disaster Experiences and Heroism

Exceptional events often generate exceptional individual and social reactions. To understand disaster-related behaviour, it is important to appreciate how such circumstances can impact on the perceptions, experiences, and social responses of those involved in them and what this means for questions of heroism. Focussing on disasters as psychological and social experiences gives some insight into understanding when behaviour is truly heroic and its implications.

Major emergencies or disasters are, thankfully, relatively abnormal events rather than everyday occurrences within communities.¹ Psychologists and sociologists highlight how behavioural responses reflect the ways in which they differ from normal, everyday experiences and routine emergency response. Major emergencies are, to a lesser or greater extent,

- of a different order in terms of emergency procedures and scale of response. The declaration of an event as a major incident or disaster usually triggers a specific set of procedural responses, namely the implementation of *special arrangements* such

as major incident plans. Actions described as heroic tend to fall outside of or beyond prescribed emergency procedures; they are usually spontaneous and unplanned, may be often committed by ordinary bystanders who are not following formal emergency procedures, or they may be committed by emergency responders breaking with or exceeding formal protocols.

- often described as *surreal* and quite different in feel from scenes displayed in disaster films or other imaginary scenarios. Many emergency responders reflecting on their first-hand experience of real disaster have emphasised the contrast with drills or exercises and the impact of such experiences on them both during the event and afterwards. Typical of this is the comment made by a firefighter who responded to the Ladbroke Grove train crash in London, 1999, in which 31 people were killed. Commenting on the initial reactions of shock while gathering up the personal belongings of those who had so suddenly died, the firefighter commented on the feeling of being unprepared for such an encounter: “In training, you are shown photos of other major incidents so you are prepared in that way, but nothing in my training prepared me for it when I saw it in real life” (BBC News, 1999).
- experienced as chaotic by those caught up in them and first on scene, at least in the initial phases at the point where sense is being made of what is occurring and before a coordinated emergency response kicks in. Initial emergency calls during the London Bombings, July 7, 2005, typified this reality with first responders facing “considerable difficulties in assimilating information that is coming in as clearly a very confused incident presented itself” (Hugo Keith, Queen’s Counsel [QC], speaking at the Inquest, October 11, 2010; Her Majesty’s [HM] Coroner, 2010). In such circumstances, heroic acts may be associated with their bringing leadership or order to bear or restoring control in the midst of chaos and destruction. The individuals who formed a *human bridge* to lead fellow passengers to safety in the midst of ferry disasters have been described as heroes in this sense (TNT Magazine, 2012; Kent Online, 2012).
- prolonged events, where notions of heroism are associated with notions of endurance as well as spectacular single acts (Smith, 2011). The *Fukushima 50* in Japan have been described in heroic terms. Heroism here has been linked to their continuing work to restore control over the ongoing threats and hazards caused by the nuclear disaster in Japan in March, 2011, as well as their initial, self-sacrificing responses at the nuclear plant as the disaster unfolded (Yokota & Yamada, 2012).
- potentially traumatic, insofar as those directly exposed to them have experienced, witnessed, or been confronted with an event or events that involve actual or threatened death or serious injury, or a threat to the physical integrity of oneself or others (American Psychiatric Association, 2013). Heroes may be those who take the *fight* rather than the *flight* option in disasters, rushing in to save others at the expense of themselves. As well as generating physical and psychological reactions during immediate impact, the traumatic nature of such events continues to generate psycho-social effects in the following days and weeks. For those whose natural instinct in disaster was to save themselves rather than others, survivor guilt may be compounded by the lavish praise being bestowed on the selflessness of heroes.
- large-scale community events with likely ripple effects and impacts. The community effects of disaster are described by the sociologist Kai Erikson (1976) in the aftermath of the Buffalo Creek flooding disaster in 1972. His classic ethnographic account gives a powerful description of the effects of collective trauma, which he describes as a blow to the basic tissues of social life that damages the bonds attaching people together and impairs the prevailing sense of communality.
 - Rob Gordon (2009) has analysed further the social processes and dynamics that transpire within a community when a disaster strikes. He describes how emerging distinctions and differences between individuals can cause cleavage planes, severing the fabric of social support systems, and causing tension and conflict during recovery stages.
 - Singling out and rewarding some individuals as heroic may create or reinforce unhelpful or unintended hierarchies of worthiness exacerbating group or community tensions, for example, where some individual acts or actors are formally commended with awards while others are not.
- public and political events in which every detail, decision, and action by those involved as victims, survivors, witnesses, and responders as well as the reactions of those mourning and bereaved may be observed, scrutinised, and evaluated. Legal accountability for actions in disasters, both individual and corporate, may be examined through lengthy processes and procedures such as inquests, public inquiries, and health and safety investigations. Far from praising the risk-taking behaviour and morality of heroes, legal judgements and disciplinary procedures may take a rather more negative view of such actions.

Disaster Behaviour: Bringing Out the Best in People

Social scientists have spent decades reviewing human reactions and responses to disasters as part of their studies of individual and collective behaviour. Their contribution is a reminder of the importance of ensuring the needs of people are at the heart of emergency planning, response, and recovery strategies. Working with emergency managers, they seek to make sure emergency plans and procedures are appropriate and successful by being based on experience and evidence about how people typically behave and respond in the impact and aftermath phases of disaster. Furthermore, their work plays an important role in demystifying and debunking the erroneous myths and beliefs often perpetuated by media and other, often partial, reports of disaster behaviour.

Examples of disaster myths include the notions that disasters produce wide-scale, counterproductive, and antisocial behaviour such as panic, social disorganisation, and looting. This is not to say that such phenomena do not exist, but rather that reports about their prevalence often tend to be exaggerated by the media. In fact, evidence from across different kinds of disaster and societies suggests that on the whole endangered publics and disaster victims respond and adapt well during and after disasters (Tierney, Bevc, & Kuligowski, 2006).

Contrary to the classic notion of the *disaster syndrome* — a zombie-like condition that renders disaster victims hapless and helpless (Quarantelli & Dynes, 1970) — social scientific research has also highlighted that, at least in the immediate aftermath of disasters, community resilience and unity, strengthening of social ties, self-help, heightened initiative, altruism, and pro-social behaviour more often prevail (Auf der Heide, 2004). An example of pro-social, positive responses to disaster was the way in which the people of Oklahoma reacted in the aftermath of the bombing of the Murrah Building on April 19, 1995. Behaviour later described as “selfless acts of heroism” (Coats, 2011) included local citizens and members of the emergency services running towards the disaster scene to rescue survivors immediately after the bombing rather than away from the building. This behaviour and other examples led to the term *The Oklahoma Standard* being coined to define a new level of caring during and after disasters:

When a need for blood was broadcast, it had to be followed by an advisory to stay home, because more people lined up than were needed. When an announcement was made that work boots were needed at the site, workers pulled up and took off their boots and left them. First responders from out of town found that they could not go to a restaurant and pay for their own meals. Either the restaurant owner would

refuse their money or another diner had already covered the ticket. The legend of the “Oklahoma Dollar” is based upon a first responder commenting that he was leaving Oklahoma with the same dollar he had when he arrived because, during his entire stay in Oklahoma, he had been unable to spend that dollar (Oklahoma City National Memorial and Museum, 2014).

The behaviour exhibited during and after this incident was not unusual for large-scale, mass-fatality incidents. Reinforcing the themes of Erikson and Gordon given earlier, Zunin and Myers (2000) refer to a *honeymoon* phase reflecting a common aspect of community responses in disaster. They describe this as following on from a rescue or heroic phase where people may risk their own safety to save others, including strangers.

Heroism, Self-Sacrifice, and Disasters

The association between life-saving actions and heroism dates back as far as Greek mythology where heroes (and heroines) were depicted as courageous characters displaying the will for self-sacrifice for some greater good of all humanity. They were often venerated as demigods and although today’s heroes may not quite be worshipped in the traditional sense, the cult of the hero personality may seem close to adulation at times. Today heroism remains associated with moral excellence and positive qualities such as nobility, bravery, and fortitude (McLeish, 1993).

Although the popular meaning and application of notions of heroism to disaster-related behaviour has been somewhat stretched in contemporary popular culture,² it still tends to be associated with positive moral qualities, meritorious life-saving endeavours, and exceptional acts of self-sacrifice. Examples where heroes have been identified by the media and praised for their actions include the extreme risk-taking as part of initial rescue efforts in responses to terrorist incidents in Oklahoma City, 1995; New York City, 2001; London, 2005; Glasgow, 2007; and Boston, 2013.

The hero label is commonly applied by journalists and members of the public as part of telling the story and a simplistic media discourse about good (heroes) and bad (blameworthy) people in the aftermath of disasters. It is interesting to see how the media return to familiar themes and phrases in telling stories from one disaster to another. The notion of a *human bridge*, for example, used to describe a British man helping fellow passengers to safety during the sinking of the Costa Concordia in 2012 was the same description applied to another British hero during the sinking of a ferry off Zeebrugge in 1987 (United Press International, 1987; M. Fricker, 2102; BBC News, 1987; and Kent Online, 2012).

Beyond the media, academic reviews also include references and analyses of the heroic actions of individuals associated with disasters, rescue, and

response (e.g., Lois, 1999). Levinson (2002) questions the appropriateness of these reviews. Analysing Israeli news media coverage of bombing incidents over two consecutive days in Jerusalem and Haifa in 2001, he critiques the accuracy of initial accounts, including dramatic reports of heroism that formed a key element of the coverage. Drawing on the work of others, Bennett and Daniel (2002) reflect on how accounts of heroism are part of what makes disaster stories *newsworthy*:

The selection of obtrusive incidents for reporting by newspapers depends critically on editorial perceptions of what kinds of event appeal to the public imagination. Stories about disasters have much to offer in this respect, as they can be dramatic, emotive and awe inspiring. Also they furnish numerous opportunities for reporting personal dramas and heroic rescues . . . for indulging the public's apparent fascination with horrific events . . . and for satiating the apparent wish of many people to experience vicariously the suffering and tragedy of others (p. 34)

The Disaster Hero: A Good News Angle on a Bad News Story

As well as raising the important question of whether accounts of heroism in disasters are accurate, such commentary helps explain why references to heroism may be so prolific in disaster reporting. Accounts of heroism are eminently *newsworthy*, satisfying the thirst for a good news angle on a bad news story. Not only this, disaster heroism is *newsworthy* in the classic sense because it involves unexpected and dramatic events and includes a human-interest perspective with which the audience may be able to personally connect and find meaning (Galtung & Ruge, 1965).

The newsworthiness of the disaster hero may even contribute to circumstances where the hero becomes the story in itself, well beyond reports of emergency rescue or response that initially impelled an individual or individuals into the limelight. A cult of personality may arise, established and propagated by the mass media and social media, whereby a hero's identity and actions take on a dynamic life and significance of their own, potentially in place of truth, accuracy, or proportionality.

An example of this is John Smeaton, a baggage handler at Glasgow International Airport, who was involved in helping to thwart a terrorist attack there in 2007. When terrorists drove a burning jeep filled with explosives into the airport entrance, Smeaton helped to wrestle one of the attackers to the ground. He was subsequently hailed a hero for having stood up to the terrorists and received a string of awards and positive affirmations. A John Smeaton Appreciation Society was set up on Facebook hailing him a *hero for our time*, and a tribute website received 500,000 hits in its first 48 hours. Smeaton gave television interviews

that were broadcast worldwide, and over the following months he was invited to meet a number of senior political figures including the Prime Minister and the New York City Mayor Michael R. Bloomberg. His awards included the CNN Everyday Superhero Award, a Daily Mirror Pride of Britain Award, and a Queen's Gallantry Medal.

A year later reports began to circulate in the national press that Smeaton's involvement in the incident had been exaggerated and that others who had done more to restrain the attackers had not been recognised with awards such as the Queen's Gallantry Medal. Smeaton was branded a fake and found himself on the receiving end of negative media attention. Interviewed five years after the incident, he described the impact of being assigned a hero label:

It was absolutely crazy. I just did what I thought I had to do . . . I went to help the police officer. Before I knew it, I am thrust into the limelight. I had everybody chasing after me. To be honest, I didn't know what way to turn, what to do It was very difficult. I am a normal guy, and all of a sudden I am on the front page of newspapers, on international news programmes. You don't know which way to turn. It was unbelievable. (BBC News, 2008)

Heroism as Resistance to Terrorism

A symbolic aspect of Smeaton's *heroism* was the sense that his actions not only thwarted a violent act but spoke for the wider public, nationally and internationally, in resisting the fear and threat generated by terrorism. In a television news interview days after the incident, watched by millions around the world, a journalist asked him what message he would give to any future terrorist who tried to launch an attack. Smeaton replied:

They can try and come to Britain, and they'll try and disrupt us any way they want, but the British people have been under a lot worse things than this and we always stand proud and (if) you come to Glasgow, Glasgow doesn't accept this, do you know what I mean, this is Glasgow, you know, so we'll set about you. (STV Glasgow, 2007)

In this setting, heroism represented resilience and defiance against the threat and vulnerability caused by international terrorism. Perhaps faith in the power of heroes in the face of violent and traumatic scenes affirms the social belief that goodness and goodwill will prevail over threats to safety and social harmony. The need to identify people as heroes may be an unconscious response to the sense of collective threat posed by the terrorists and a need to affirm the belief that most people are good, rather than bad, in a world that really is a safe place most of the time.

While at its roots there have been political connotations attached to legends of heroism and personality cults, equating heroic spontaneous reactions with political resistance to terrorism may be confusing. Similarly in defining heroism, there is an important distinction to be made between suffering injury during disaster and taking explicit actions to save the lives of others as an incident unfolds. It becomes problematic if survival per se becomes a reason to call someone a hero.

In the days after the Boston bombings, 2013, some media reports applied the *hero* label more generally to people present at the scene as victims, bystanders, and responders. The term seemed to be liberally used to distinguish between non-perpetrators and those who perpetrated the deliberate act of violence. The inference here was that *heroism* is associated with innocence and with resistance to evil and the terrorists' intention.

One seriously injured survivor, Jeff Bauman, attracted extensive media attention for his heroism that has been associated both with surviving and with trying to help the authorities identify the perpetrators by giving them a description:

We're just so proud of him, said his boss Kevin Horst. We do consider him a hero, both for what he did for law enforcement, whatever role he played in that, but more importantly, he's a hero for how he's handling this time. He's got such a great attitude. (WCVB, 2013)

The local news media reported how the Boston bombing hero was receiving dozens of letters each day from people moved by his story. His colleagues created *Team Bauman* T-shirts, and one news report stated that he had received more than \$600,000 in donations for his medical bills over the previous week (Peterson, 2013).

Everyone's a Hero, But Some are More Heroic Than Others

In the immediate aftermath of the Boston bombings, much media focus was on identifying and detaining the perpetrators, and so it is understandable that efforts to assist the authorities was greatly appreciated within the wider community. Loosely aligning notions of heroism to crime reporting in these circumstance, however, is unhelpful because, again, it blurs distinctions in this case between acts of genuine self-sacrifice and civic duty. Furthermore, it makes the decision to formally recognise truly heroic behaviour more difficult since everyone involved may potentially be identified as a hero.

Alternatively, calling everyone caught up in or responding to disaster a hero may be an attractive prospect for some people since it prevents differentiation and the idea of some heroes being singled out by the media as being more heroic than others. John Smeaton, for example, later acknowledged that others

too had acted bravely during the Glasgow attack, not just him, adding: "They all should be recognised for their efforts and behaviour instead of debating who did the most. It should not be turned into a competition." (Fraser, 2012)

Another example of this sentiment was displayed by Thomas Barrett, a patrolman in the Boston Police described by *Time Magazine* as *A Hero Among Heroes* for acting on his instinct and training in assisting injured people in the bombings. Barrett's response to the attribution reflected the instinct to label everyone involved as heroes, not just himself, as *Time Magazine* reported:

It's a moment of valour he won't soon forget. Barrett borrows a quote about a character from Stephen Ambrose's *Band of Brothers* to describe the experience: "His grandson asked him if he was a hero in the war," and he said, "No, I wasn't. But I served in the company of heroes." Last Monday, Barrett thought similarly. "That day, everybody from my station was a hero. Everybody from the police department was a hero. And at that point, everybody in the city was a hero." (Katz, 2013)

The Costs of Heroism: Intrusion and Survivor Guilt

Today disaster scenes are beamed into our living rooms, including breaking news stories covering every aspect of the unfolding drama. More than ever before, disasters have become public events in the sense of actions, reactions, and behavioural responses being captured, recorded, reviewed, and replayed through social and other media. The cost of this may be uninvited intrusions into privacy. For some people caught up in this media analysis, enduring coverage renders them unable to escape public attention, exposure, and scrutiny. This attention may be all the more unwelcome during particularly sensitive times such as the fraught emotional aftermath of a traumatic experience.

It is not unusual for those to whom the hero label is attributed to express reluctance and to resist or deflect media attention. Associating their actions with implications of extraordinary qualities and goodness may feel inappropriate or unfair. Examples of this following the Boston bombing include the following:

- A man photographed carrying a woman to safety after the explosions who, when interviewed, said: "While I appreciate the interest in hearing our perspective on today's horrific events, the spotlight should remain firmly on the countless individuals — first responders, medics, EMTs, runners who crossed the finish line and kept on running straight to give blood, and the countless civilians — who did whatever they could to save lives. They were the true heroes." (NBC News, 2013)

- An active-duty service member was photographed wrapping the red shirt he wore during the Marathon around the bloody leg of a man at the blast site. His reluctance to be identified led to his being referred to as “the man who gave the shirt off his back.” (NBC News, 2013)

Focusing on heroism can distract from the true horrors of confronting mass death and injury. Meanwhile for those whose natural instinct and reaction during disaster was to save themselves and flee from danger, notions of heroism may later feed powerful reactions of survivor guilt. Writing a few weeks after the Boston bombing, journalist Beth Teitell (2013) recorded how, since the attack, many of the wounded have shared their stories with the public. But, she adds, “In private, some uncounted number of runners and spectators are suffering from feelings of intense guilt because when violence struck, they didn’t dash in to help. Instead, they made sure their own loved ones were safe amid the harrowing chaos — or fled the danger to make sure they would survive to care for their families.”

Teitell interviewed Jane Blansfield Finch, a clinical social worker and Red Cross volunteer, about people’s reactions. Finch suggested that even though many anointed as heroes said they did not deserve the honour, the public veneration of those who jump to help in a disaster serves a greater purpose because it encourages altruism. At the same time she acknowledged that there is a downside: “It puts pressure on people to think, ‘If I’m not out there helping strangers, am I worthwhile?’” (Teitell, 2013)

Emergency Service Responders as Heroes

For members of the emergency services, there can be a strong sense that risk-taking comes with the job; but the exceptional conditions associated with disaster response and recovery has particular implications, both for their role and subsequent recognition of their actions in relation to heroism. When emergency responders become identified as disaster heroes, stories highlighting their personal circumstances and subsequent lives are invariably newsworthy, especially if they can be linked to a salacious or sensationalist storyline (e.g., Camber, 2011; Stritof, S. & Stritof, B. 2013). Unsurprisingly, for example, much media coverage was given internationally to Bryce Reed, the paramedic first hailed a hero for helping save victims of the fertiliser plant explosion in West, Texas, and later charged with the federal charge of possessing an explosive device.

After the London bombings on July 7, 2005, 23 members of emergency teams and transport workers who helped victims of the attacks were formally recognised in the Queen’s New Year Honours list in 2006 (BBC News, 2005). Many others who behaved heroically on that day were not so recognised. And in contrast to this period where certain heroic acts were formally recognised and publically praised, aspects of the emergency response as a whole were later criti-

cised, both in the report of the London Assembly in 2006 and in the inquests conducted during 2011 into why 52 innocent people died.

Although the emergency response on July 7 was commended on the whole, such intense public scrutiny and elements of criticism during the lengthy subsequent legal procedures must have had an impact on all involved in the emergency response, including those who may have felt a sense of falling *from hero to zero*. It is important that psychological, social, and organisational support is made available for responders during these later, longer-term phases following disaster as inevitable legal procedures take their course. The impact of events and their appraisal may be no less significant at these points.

Tributes to Fallen Heroes

When first responders lose their lives during disaster response, the impact on families, public service organisations, and the wider community is painfully felt and especially poignant, even more so when there is multiple loss. Tributes by key political and national figures in the aftermath of such events often make specific references to their bravery and heroism.

An example of this situation is the following comment made by Sanford Coats, the US Attorney for the Western District of Oklahoma, in remembering the tenth anniversary of the tragic events on September 11, 2001, and April 19, 1995:

Just like the morning of September 11, brave Oklahoma firefighters, medical personnel, and police officers risked their lives by going into a burning, unstable building in *selfless acts of heroism* [emphasis added] to rescue survivors. Indeed, one first responder gave the ultimate sacrifice in an effort to rescue survivors, becoming one of the 168 casualties of the bomb. (Coats, 2011)

After the explosion at the fertiliser plant in West, Texas, in April, 2013, where 11 of the 144 fatalities were firefighters, the news media made specific reference to the fact that most of the deaths were first responders and, as with other disasters where multiple members of the emergency services are killed, the mourning rituals and memorials received special media coverage (Fernandez, 2013). In an article entitled “Heroes in West, Texas, explosion honoured,” *USA Today* reported on President Obama travelling to the town to speak at the memorial service for those killed in the explosion and ordering flags at government building to be lowered to half-mast in honour of the victims (*USA Today*, 2013).

Heroism, Common Sense, and Common Safety

If heroism is about exceptional or extraordinary behaviour, should it be applied to the ordinary work of members of the emergency services? Clearly distinctions are made between the usual and exceptional work

of emergency responders when bravery awards are given to recognise particular acts of merit as opposed to actions that are more run of the mill. Notions of heroism as reflecting moral virtue also raise important questions about what kinds of attitudes and behaviours are right, appropriate, and desirable in those exceptional environments where many lives are at risk or in situations where the lives of some may be put at greater risk through potential life-saving actions for others. Such questions fall within the remit of health and safety law and practice, but there are broader philosophical and practical issues to consider: “There is (also) a need to stimulate a debate about risk in society to ensure that everyone has a much better understanding of risk and its management” (Lofstedt, 2011, p. 6).

In the UK, discussions about heroism in the emergency services have been prompted by just such a debate and developments in health and safety. In 2010 the UK Government commissioned a review by Lord Young of the operation of health and safety laws (HM Government, 2010). While the driver was to reduce bureaucracy, confusion, and fears of an increasingly litigious *compensation culture*, the review also focussed on activities of members of the emergency services and the implications for acts of heroism. It outlined the responsibility of employees under health and safety legislation to take reasonable care of themselves and others, but added that the nature of jobs within the emergency services means individuals may occasionally put themselves at risk to save the life of someone else. Where this happens, stated the report, the last thing that should be contemplated is a prosecution for noncompliance with health and safety legislation. Lord Young stated: “Where an unfortunate incident occurs and an officer puts him or herself at risk in the line of their duty to protect the public, I take the view that it would not be in the public interest to take action and investigate under health and safety laws” (p. 35). However, Lord Young also recognised that there was some ambiguity in such cases and a need for greater certainty in this important area. Indeed, this is illustrated in his comments further on in the report:

It is important to recognise that individuals have personal choices to make and they may choose not to put themselves at unreasonable risk.

However, those officers who go the extra mile and put themselves in harm’s way to protect the public should continue to be recognised and rewarded for their bravery. (p. 36)

The report thus recommended that “police officers and fire-fighters should not be at risk of investigation or prosecution under health and safety legislation when engaged in the course of their duties if they have put themselves at risk as a result of committing a heroic act” (HM Government, p. 36) and invited the Health and Safety Executive (HSE), the Association of Chief

Police Officers, and Crown Prosecution Service to consider further guidance to put this into effect.

Balancing Operational and Health and Safety Duties

This focus on risk, health, and safety within emergency response came at a significant moment in the UK. In the preceding years, the challenging nature and extremely dangerous environments in which firefighters and other emergency responders have to work had been highlighted by a series of serious and fatal incidents that had exposed emergency responders to personal risk in the course of their attempts to rescue victims. At the same time, the actions and risk assessments of responders were coming under some criticism by investigators, the media, and the public, including bereaved families. The incidents and investigations included the following:

- The London bombings, 2005, which killed 52 people and 4 terrorists, and where the response of the emergency services was reviewed and critiqued both through the inquest and a review by the London Assembly (Greater London Authority, 2006).
- The death of a woman trapped in a mine shaft in 2008 whose rescue was inhibited for over six hours. The fatal accident inquiry concluded Mrs. Hume may have lived if emergency services — and the fire service in particular — had removed her sooner. The sheriff’s ruling criticised procedural failings that led to the delay and said senior officers on the scene “rigidly stood by their operational guidelines.” (Carrell, 2011; BBC News, March 29, 2012)
- The Cumbria shootings, 2010, in which 12 members of the public lost their lives and a further 11 people were seriously injured. A peer review of the emergency response by the Assistant Chief Constable of West Mercia Police concluded that there were differing “risk thresholds” between the services and that the interoperability between the police and ambulance service needed to be improved (Chesterman, 2011).
- A fatal fire at a warehouse in Warwickshire, 2007, where four firefighters lost their lives. Warwickshire County Council was fined £30,000 after pleading guilty to a health and safety charge. Three fire service managers were prosecuted for manslaughter by gross negligence. After all were found not guilty, the Chief Fire Officer condemned the decision to press criminal charges against them (BBC News, December 7, 2012).

As a result of these and other incidents, the HSE began working with senior leaders of the police and fire services to clarify a number of complex and

interrelated issues. Their aim was to avoid a risk-averse culture, provide mechanisms for ensuring early and wide learning from incidents, and set out the expectations of the services in relation to the management of dynamic and often dangerous situations.

Redefining Heroic Acts of Emergency Responders

Endorsing the recommendations of the Young Report (HM Government, 2010), the HSE, Association of Chief Police Officers, police authorities, and fire and rescue authorities worked together to identify how a balance could be struck between high-risk operational duties and the health and safety of themselves and others. The result has been the issuing of statements and further guidance for both the police services and the fire and rescue authorities clarifying the balance between operational and health and safety duties in the emergency services and clarifying the meaning and consequences of acts deemed heroic (HSE 2009; HSE 2010).

In relation to the Fire Service, for example, the HSE has clarified its interpretation and actions relating to "heroism." The HSE will view the actions of individual fire-fighters as heroic when:

- it is clear that they have decided to act entirely of their own volition,
- they have put themselves at risk to protect the public or colleagues, and
- the individuals' actions were not likely to have put other officers or members of the public at serious risk.

In the event of the HSE being notified of a serious incident, inspectors may need to make initial enquiries about the nature of the incident and may need to conduct an investigation of the Fire Service's operational arrangements and management of health and safety. If during this investigation it becomes clear, however, that the incident involved an act of heroism by individual firefighters, then the HSE will not investigate the actions of the individuals in order to take any action against them (HSE, 2010).

Concluding Comments

There is likely to be much interest in the UK in the application of this guidance in the event of it having to be applied following future emergencies and disasters. More broadly, and with reference to the themes explored in this paper, members of the UK emergency services and the wider public might benefit from a more informed understanding and debate about the meaning and implications of notions *heroism*, particularly in the context of extreme events.

In the United States (US) too, where a different cultural and legal environment exists for considering issues around notions of heroism, litigation, and

health and safety, guidance exists (International Association of Fire Fighters [IAFF]/National Institute of Occupational Safety and Health [NIOSH], 2013) and further debate has begun about the context and consequences of *heroism*, the actions of emergency responders, and the implications of their actions both on families and responders themselves (Nicol, 2013). Ultimately, such reflections may also contribute to our thinking and expectations around good, worthy, and commendable behaviour in more ordinary circumstances.

The characteristic of genuine heroism is its persistency. All men have wandering impulses, fits and starts of generosity. But when you have resolved to be great, abide by yourself, and do not weakly try to reconcile yourself with the world. The heroic cannot be the common, nor the common the heroic. (Emerson, 1841)

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Endnotes

¹ In this paper the terms *major emergency* and *disaster* are used interchangeably to refer to large-scale incidents placing life and/or property in danger, often involving multiple casualties and/or fatalities and likely requiring multiagency response and assistance.

² For example an online game produced by the US Department of Homeland Security/Federal Emergency Management Agency (DHS/FEMA) claims to equip players with all the information, tips, and resources needed to prepare them to be a *real-life Disaster Hero* in the aftermath of natural disaster or a man-made disaster (See <http://www.disasterhero.com/>).

Appendix For Further Reading

Although the references that follow were not cited in the text of this keynote address, they proved useful resources in the writing of the article.

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About the Author

Dr. Anne Eyre is a UK sociologist specialising in psychosocial aspects of major incidents, emergency planning, and disaster management. Her work focuses on the management and support of people with the aim of ensuring the needs of people are at the heart of contingency planning, emergency response, and post-incident recovery.

Anne works independently and provides research, training, and consultancy services for a range of organisations within the public, private, and voluntary sectors. She also programme manages an annual UK conference on Fire-Related Research and Developments. This event, supported by the UK Fire Service College and the Institution of Fire Engineers, focuses on bringing researchers and practitioners together to promote evidence-based best practice, and often draws international representatives reflecting on US experiences and approaches.

After the 2004 Asian Tsunami, whose victims included many UK citizens, Anne coordinated the Tsunami Support Network established by the British Red Cross Society to support those in the UK affected by the disaster. Anne is also Vice-Chair of Disaster Action (www.disasteraction.org.uk), a charity representing the interests of those directly affected by disaster. In this capacity, she has assisted in providing strategic advice around family and community support to those responding to various mass-fatality incidents, including the September 11, 2001, attacks; the London Bombings, 2005; and the Aberdeen Helicopter crash, April, 2010.

Anne's publications have included two research reports commissioned by the UK Government focussing on the development of best practice in humanitarian assistance after a disaster. She is a Fellow of the Winston Churchill Memorial Trust and in 2006 spent time in New York and New Jersey examining community support strategies after the terrorist attacks in September, 2001. This report is available online through the Trust's website. Anne can be contacted at anne.eyre@traumatraining.com

“Fireground News” contains research presented at the *International Fire Service Journal of Leadership and Management (IFSJLM)* Research Symposium (RS) held annually in July at the International Fire Service Training Association (IFSTA) Validation Conference. These reports offer information useful to the well-being, safety, and/or professionalization of the fire service. As editor of *IFSJLM*, I decide which reports are presented at the Research Symposium and subsequently which are published in the *Journal*. The following two articles were presented at Research Symposium 2013 (RS13) on July 13, 2013.

Dr. David A. Barr, First Responder Health and Safety Laboratory, Department of Health and Exercise Sciences, Skidmore College and currently at Cardiovascular Physiology, Brigham and Women’s Hospital/Harvard Medical School

Dr. Lori Moore-Merrell, International Association of Fire Fighters (IAFF)

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The Deployment of Resources at Residential Structural Fires and Cardiovascular Strain in Firefighters

Abstract

The purpose of this study was to investigate the effects of crew size on time required to suppress a fire and the cardiovascular strain experienced by firefighters during a low-hazard single-family residential structure fire. Fire-fighting crews with four and five firefighters completed fire-suppression activities 25–30% faster than crews consisting of two and three firefighters. Additionally, the four- and five-person crews experienced less cardiovascular strain than the smaller crews did.

Introduction

Firefighters often perform physically demanding fire-fighting activities in extreme environmental conditions (Bos, Mol, Visser, & Frings-Dresen, 2004; Smith, Manning, & Petruzzello, 2001; Smith, Petruzzello, Kramer, & Misner, 1996, 1997; Soteriades, Smith, Tsimenakis, Baur, & Kales, 2011). It is well known that strenuous activity performed while wearing heavy impermeable personal protective ensembles (PPE) leads to significant physiological strain (Barr, Gregson, & Reilly, 2010; Soteriades et al., 2011). This physiological strain manifests mainly as elevations in heart rate to maximal levels, increases in core body temperature, and high levels of dehydration, all of which have potential to not only impair job performance but can also be detrimental to a firefighter’s health and safety.

There is strong epidemiological evidence that heavy physical exertion can trigger sudden cardiac events, particularly in sedentary individuals (Albert et al., 2000; Mittleman et al., 1993). According to the National Fire Protection Association® (NFPA®), 48.4% of United States (US) firefighter fatalities in 2012 were caused by stress/overexertion (Fahy, LeBlanc, & Molis, 2013). Of the 64 on-duty deaths, 27 were a result of sudden cardiac death. Research indicates that these sudden

cardiac events are 10 to 100 times more likely to occur during or following fire suppression than station activities and that firefighters with underlying cardiovascular risk factors are in the greatest danger of experiencing cardiac events in the line of duty (Kales, Soteriades, Christophi, & Christiani, 2007; Holder, Stallings, Peeples, Burrell, & Kales, 2006; Kales, Soteriades, Christoudias, & Christiani, 2003).

Entering a dwelling, maneuvering charged hose-lines, performing search and rescue activities, and rescuing trapped occupants are critical components of fire-fighting duties. The time required to achieve these critical tasks is important for a number of reasons; notably, it may affect civilian safety or survivability, and it has a large impact on the extent of property damage that results from the fire. Increased time performing strenuous work may also have a direct effect on firefighter health, safety, and survivability during operational duties.

The deployment of larger crew sizes may reduce work time needed to control the fire, thereby providing several potential benefits. Obviously, extinguishing the fire more quickly lessens the likelihood of civilian casualties and may decrease the magnitude of

damage to property that could significantly reduce financial loss. Furthermore, working for a shorter time and/or at a lower intensity may mean that firefighters experience less cardiovascular strain while engaged in fire-fighting activities.

The purpose of this study was to investigate the effects of crew size on time needed to suppress a fire and on cardiovascular strain experienced by firefighters. This study is part of a larger study conducted by National Institute of Standards and Technology (NIST) and the International Association of Fire Fighters (IAFF) and other study partners to investigate the effect of first-apparatus arrival time and response times on the time necessary to complete essential fire-fighting tasks (including extinguishing the fire). The findings of the original study are available from the NIST website (Averill et al., 2013).

Methods

The study was performed at the Montgomery County Fire Rescue Training Academy in Montgomery County, Maryland. All scenarios were conducted in a residential-scale burn prop (see **Figure 1**). The burn prop was constructed as a two-story duplex residential building with a common stairwell and movable walls between the sections to allow for multiple daily experiments. The burn prop contained two mirror-image, two-story units each totaling 2,000 ft² (186 m²), without basement or nearby exposures — a typical model of a low-hazard single-family residence identified in 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* (NFPA[®], 2010). Noncombustible furniture (angle iron and gypsum board construction) was fashioned to represent obstacles of realistic size and location for firefighters navigating the interior of the structure. The dimensions were typical of residential furnishings.

Figure 1: Two-Story Burn Prop



Descriptive characteristics of the participants are presented in **Table 1**. Participants included 163 full-time professional firefighters from Montgomery County

(MD) and Fairfax County (VA). Each firefighter was given a detailed verbal account of what the study entailed and provided written informed consent prior to participation. The study was approved by the Institutional Review Board at Skidmore College.

Table 1: Characteristics of Firefighters.

Characteristic	Mean ± SD
Age (years)	37 ± 8
Height (cm)	183 ± 7
Weight (kg)	90.8 ± 4.0
Body mass index (kg/m ²)	29 ± 3.6

Note: Height and weight were self-reported. Characteristics were obtained on 132 of the 163 participants.

Each fire-suppression scenario simulated an initial-alarm assignment response to a structure described in NFPA[®] 1710 (NFPA[®], 2010) as a *low-hazard* residential structure to which firefighters respond on a regular basis. In this case, it was a confirmed fire in the living room in the rear first-floor area of one unit of the structure. The pallet and excelsior configuration was chosen based on laboratory experiments that found such a configuration repeatedly produced a consistent and realistic quantity of heat and smoke similar to what firefighters routinely encounter at residential structure fires, without resulting in flashover.

Following a briefing and preparation period, the firefighters donned their PPE, which consisted of turnout coats and pants, antflash hood, gloves, boots, helmet, and self-contained breathing apparatus (SCBA) worn over a typical firefighter station uniform.

During each scenario, three engines, a ladder-truck, and a Battalion Chief (with an aide) were dispatched to the scene of a residential structure fire. The staffing level of responding fire apparatus varied incrementally in each scenario from two to five fire-fighting personnel (see **Table 2**). When two firefighters were deployed, the crew consisted of a driver and an officer. When three firefighters were deployed, the crew consisted of a driver, an officer, and a firefighter. This deployment pattern continued up to a five-person crew that included three firefighters in addition to a driver and an officer. Fire-fighting crews that normally operated together as a company participated in this study as a complete unit.

The time to complete each fire-suppression drill was recorded on a stopwatch to the nearest second. As part of the original study, each fire-suppression drill was broken into 22 specific tasks that were required to achieve three key objectives known to change fire behavior or tenability within the structure: (1) entry into a structure, (2) water on a fire, and (3) ventilation through windows (three upstairs and one back down-

Table 2: Staffing Components and Levels for Each Crew Size.

Crew size	Apparatus Deployed	Crew Components	Total on Scene
2	3 Engines, 1 Ladder Truck, Battalion Chief Car	8 Firefighters, Battalion Chief and Aide	10
3	3 Engines, 1 Ladder Truck, Battalion Chief Car	12 Firefighters, Battalion Chief and Aide	14
4	3 Engines, 1 Ladder Truck, Battalion Chief Car	16 Firefighters, Battalion Chief and Aide	18
5	3 Engines, 1 Ladder Truck, Battalion Chief Car	20 Firefighters, Battalion Chief and Aide	22

stairs window and the burn room window). For this study, the time to complete all tasks was recorded as the total work time.

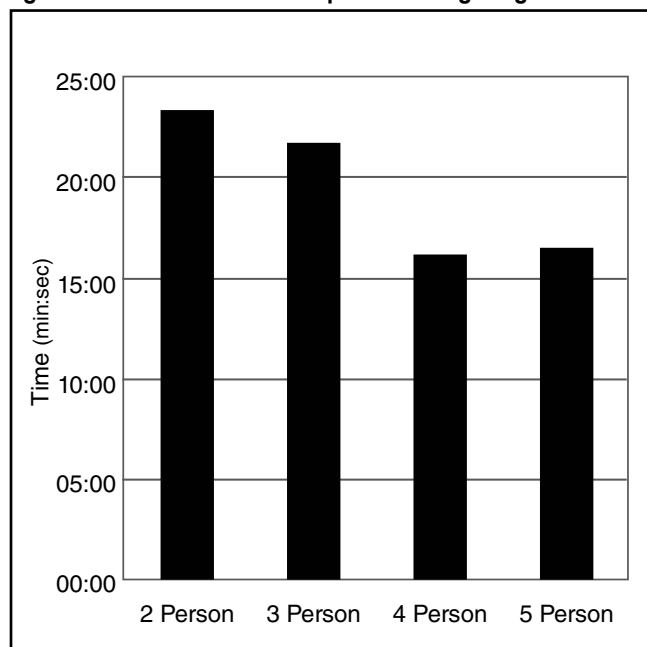
Heart rate, which provides an index of cardiovascular strain, was measured during each scenario from a strap worn around the chest of each firefighter and was recorded using a heart-rate monitor (Polar Electro, Kempele, Finland). As maximum heart rate is affected by age, heart-rate data are presented as a percentage of maximal heart rate using the formula $HR_{max} = 220 - \text{age}$ (Miller, Wallace, & Eggert, 1993).

Results

Data findings are summarized into two sections: The first section discusses time to complete fire-fighting tasks by crew size; the second section outlines firefighter cardiovascular responses.

Time to Complete Fire-Fighting Tasks

The time to complete all fire-fighting tasks differed by crew size (see **Figure 2**). Deploying a crew size of four

Figure 2: Overall Time to Complete Fire-Fighting Tasks.

firefighters reduced the time to complete all fire-fighting tasks on average by 7 minutes (30% faster) compared to the two-person crew size. The four-person crew completed the same number of fireground tasks on average 5.1 minutes (25%) faster than the three-person crew. The addition of a fifth person to the four-person crew did not show any additional decrease in fireground task times in this *low-hazard* residential scenario.

Cardiovascular Responses

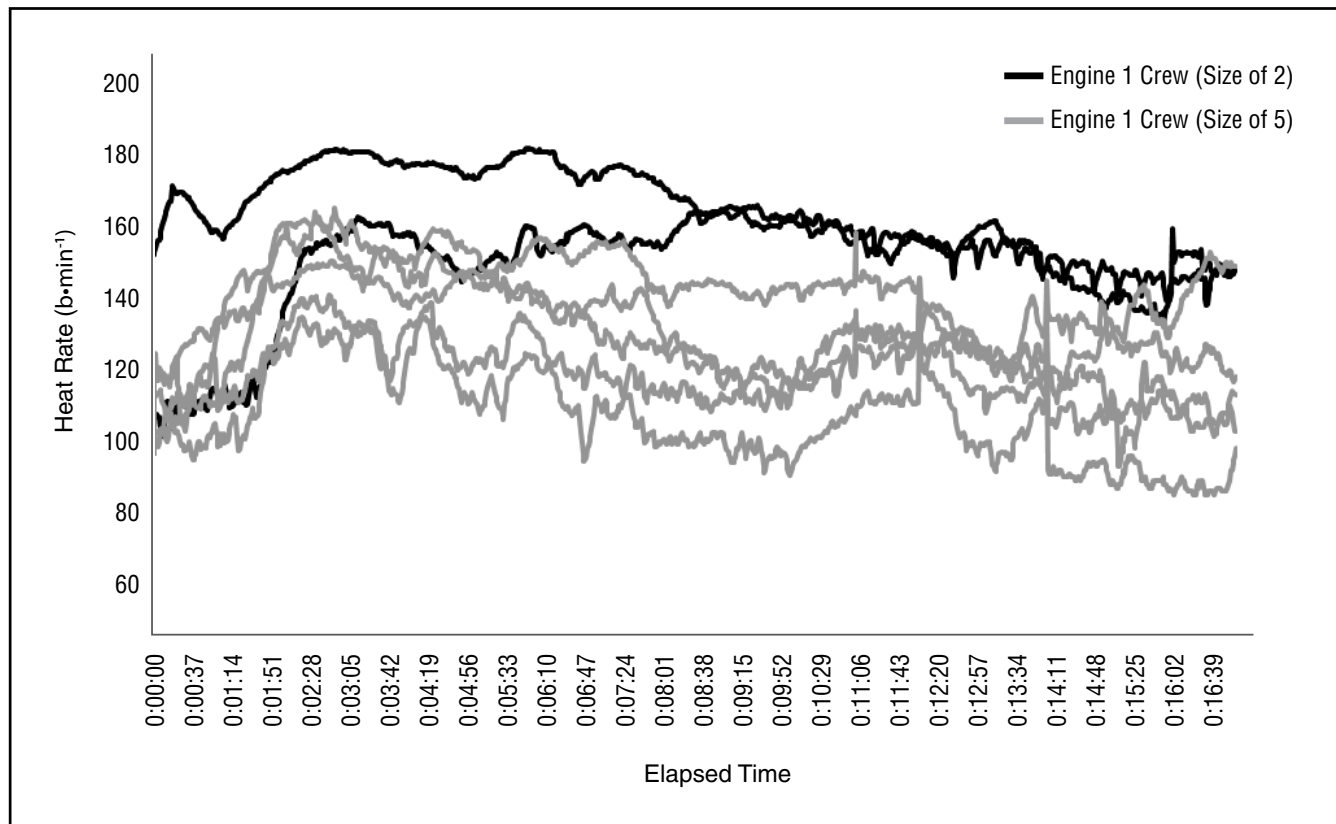
Table 3 presents average working heart rates (as percentage of maximum) for the first two arriving engines (Engine 1 and Engine 2) based on crew size and position (driver, officer, firefighter 1, firefighter 2, and firefighter 3). Heart-rate responses varied by crew size, position, and apparatus. In order to compare similar type of work, we reported only on engine work in this report and focused on the first two arriving engines because they engaged in work for a longer period before the fire was extinguished. Firefighters on Engine 1 (**Table 3**, upper panel) generally operated at a higher average heart rate compared to Engine 2 firefighters (**Table 3**, lower panel). For firefighters on Engine 1, there was a tendency for heart rate to decline as crew size increased. The average working heart rate for firefighters on Engine 1 when a crew size of two firefighters was deployed was 83% of age-predicted maximum values, whereas when a crew of five was deployed on each apparatus, the average working heart rate was 67% of age-predicted maximum values. Average working heart-rate responses in firefighters on Engine 2 declined as crew size increased from a three-person to a four-person crew.

Figure 3 expands on the data for two- and five-person crews on Engine 1 presented in **Table 3** by illustrating heart-rate responses of individual crew members throughout fire-suppression activities. Heart-rate responses for firefighters on Engine 1 were higher for almost the entire time spent during fire-suppression activities for a crew with two firefighters compared with a crew of five firefighters.

Table 3: Average Working Heart-Rate Responses in Firefighters of Different Crew Sizes Presented by Position from Engine 1 (upper panel) and Engine 2 (lower panel). Heart Rates Are Expressed as a Percentage of Age-Predicted Maximal Heart Rate (220 – age in years).

Engine 1 Average Working Heart Rates (% maximal heart rate)						
Crew Size	Driver	Officer	FF1	FF2	FF3	Average
2	82%	84%				83%
3	64%	71%	71%			69%
4	80%	71%	76%	66%		73%
5	75%	68%	67%	67%	60%	67%
Engine 2 Average Working Heart Rates (% maximal heart rate)						
Crew Size	Driver	Officer	FF1	FF2	FF3	Average
2	81%	69%				75%
3	74%	74%	72%			74%
4	82%	64%	68%	48%		65%
5	73%	56%	66%	63%	69%	65%

Figure 3: Heart-Rate Responses During Fire-Suppression Activities of Engine 1 for 2- and 5-person Crews.



Discussion

This study investigated the effects of crew size on each responding apparatus on the time to suppress a low-hazard, residential structure fire and on the cardiovascular strain experienced by firefighters of different crew sizes. The primary findings from this study were that fire-fighting crews containing four and five firefighters were able to complete fire-suppression activities on average 25% to 30% faster than crew sizes of two and three firefighters. This task completion also occurred in conjunction with a reduced cardiovascular strain. The combination of shorter time to suppress the fire and lower cardiovascular strain during suppression suggests a benefit to both trapped occupants and to firefighters.

When a two-person crew was deployed, higher working heart-rate values were observed in firefighters on Engine 1 compared to Engine 2. Engine 1 personnel performed the work associated with establishing water supply and stretching the attack line to the fire for fire suppression. In experiments deploying crews with a crew size of two, Engine 2 personnel supplemented the Engine 1 crew in their tasks. These findings are consistent with previous research that reported that secondary help who encountered similar environmental conditions to a lead group of firefighters experienced considerably less cardiovascular strain (Romet & Frim, 1987).

The high heart rates reported in this study, along with elevation that persisted throughout the fire-suppression activities are in agreement with previous research (Romet & Frim, 1987; Smith et al., 1996; Smith et al., 2001; Horn, Blevins, Fernhall, & Smith, 2013), showing that heart rates can increase dramatically during the initial stages of fire suppression and remain elevated throughout fire-fighting activities. The variability in heart-rate response is affected by crew size and position. A given firefighter's heart-rate response will be also affected by individual characteristics such as age, gender, fitness level, health status, medical conditions, and hydration level, and by environmental conditions (Smith 2011; Soteriades et al., 2011; Smith et al., 2013).

The findings from this study have important implications for the health and safety of firefighters because it is well documented that the leading cause of line-of-duty-deaths in firefighters is sudden cardiac events (Fahy et al., 2013). Stress and overexertion have been implicated as the main causes of these cardiac events. Therefore, reducing both the duration and the intensity of the cardiovascular strain imposed by fire-fighting by deploying larger crew sizes may have the potential to reduce incidence of sudden cardiovascular events.

During fire-fighting activities, increases in heart rate arise from the combination of strenuous work in protective clothing, reduced heat dissipation, and external heat sources. Reducing the workload and time spent in extreme environmental conditions resulted in reduced

cardiovascular strain. In addition to reducing the likelihood of sudden cardiac events, operating in larger teams will put firefighters at a reduced risk of developing dehydration and experiencing core-temperature increases to dangerous levels. Core temperatures increase as a consequence of both metabolic activity and environmental heat. When subsequent bouts of activity are performed in quick succession, the thermoregulatory strain increases further. Reductions in work time and intensity will also put firefighters in a better position to perform any additional activities at a later time in the same work shift if required.

Conclusion

This study was part of a larger study that showed when smaller crews were deployed at a residential fire, it took longer to complete the fire-suppression tasks, demonstrating that larger fire-fighting crews are more effective at fire-suppression activities during low-hazard residential structure fires. The current study expanded on these findings by reporting that average working heart rates of firefighters were higher when smaller crews were deployed. The combination of longer work times and higher working heart rates when two-person crews are deployed demonstrates that smaller crews experience considerably more cardiovascular strain compared with larger crews deployed to fight a fire of the same size. This information may be useful to communities and other decision makers to determine the number of firefighters they should have available to effectively perform fire suppression and to protect the health and safety of firefighters as they perform these public-safety duties.

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The full National Institute of Standards and Technology (NIST) Report on Residential Fireground Field Experiments can be obtained online at http://www.nist.gov/customcf/get_pdf.cfm?pub_id=904607 or on the parent study website at www.firereporting.org

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Combating Sudden Cardiac Death (SCD) in the United States (US) Fire Service

Abstract

Approximately 100 United States (US) firefighters die in the line of duty each year. Sudden cardiac death (SCD) accounts for 45 to 50% of all duty-related fatalities. Many aspects of fire fighting increase cardiovascular strain including activation of the sympathetic nervous system, strenuous physical activity, heat stress and dehydration, and severe environmental conditions. High levels of cardiovascular strain can trigger sudden cardiac events in susceptible individuals with underlying cardiovascular disease (CVD). This article presents a theoretical model for the interaction between underlying CVD in firefighters and the multifactorial psychophysiological strain of fire fighting. Recommendations to decrease CVD deaths in the fire service are offered.

Introduction

Cardiovascular disease (CVD) accounts for approximately 45% of all firefighter duty-related fatalities (Fahy, 2005) with both career and volunteer firefighters suffering a nearly proportionate number of deaths due to cardiac events (Fahy, LeBlanc, & Molis, 2009). **Figure 1** presents the number of fatalities due to cardiovascular events, asphyxiation, and burn injuries over the past 20 years. While the fire service is well aware that sudden cardiac death (SCD) is the leading cause of line-of-duty deaths, this graphic presentation clearly illustrates the need to address this compelling threat to firefighter health and safety. Just as the fire service has enacted policies, procedures, and educational and training programs to help protect firefighters from burns and asphyxiation, a better understanding of the causes of cardiovascular death and how it relates to the strain of fire fighting can serve as a basis to enact changes that will decrease cardiovascular fatalities. While there is widespread support for decreasing duty-related deaths and disability, efforts have been somewhat hampered by incomplete understanding of the complex, multifactorial interactions that lead to cardiac events.

This article (a) reviews medical causes of cardiovascular deaths, (b) summarizes cardiovascular strain associated with fire-fighting activity, (c) presents a conceptual model of how fire fighting can serve as a trigger for a cardiac event in individuals with underlying disease, and (d) discusses steps that fire service leaders can take to decrease CVD events in the fire service.

Medical Cause of Sudden Cardiac Events

Although SCD can be caused by many conditions, the vast majority of cases are caused by a myocardial infarction (heart attack) or a primary ventricular

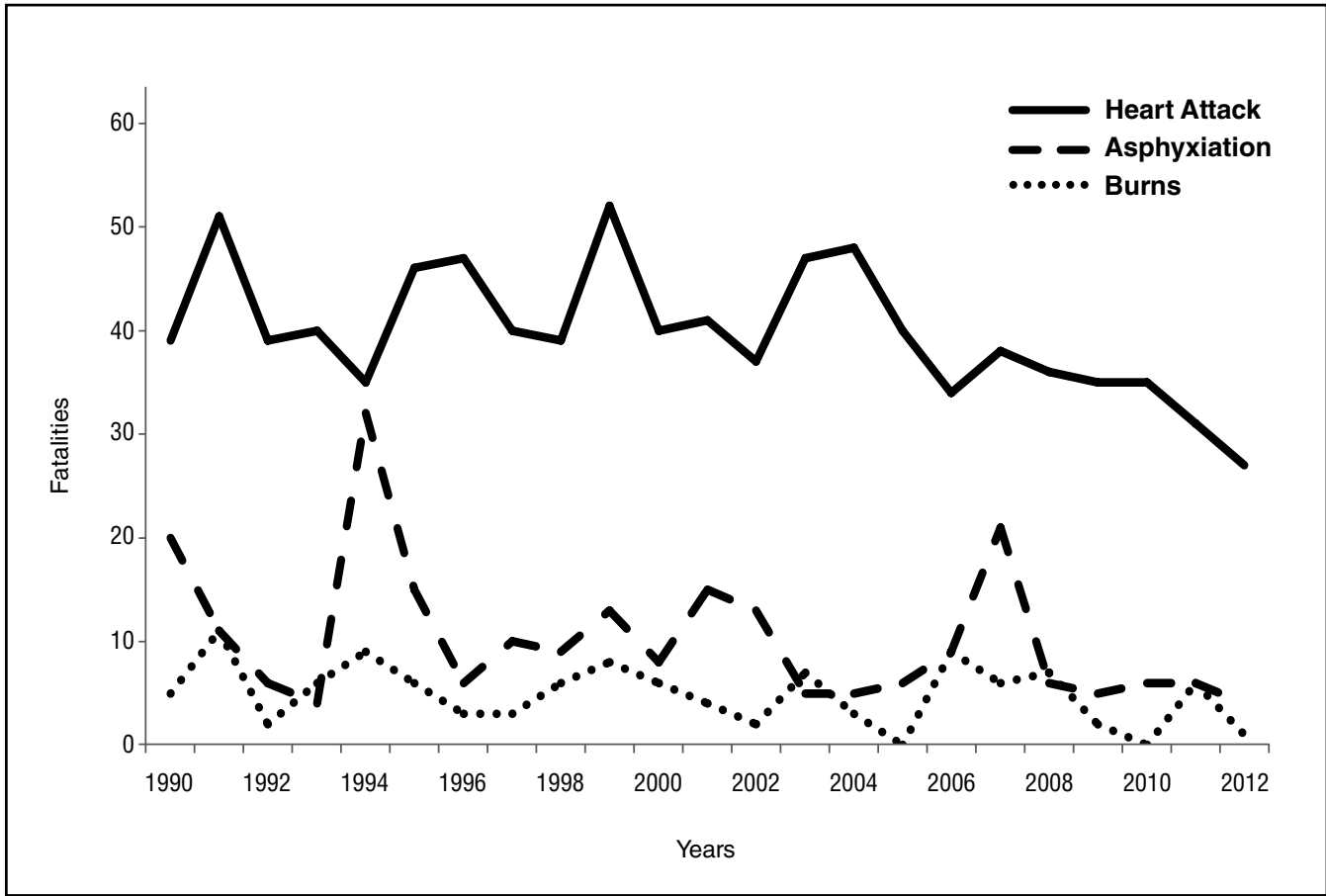
arrhythmia. Coronary heart disease (CHD) increases the risk of both a myocardial infarction and an arrhythmia. CHD is associated with progressive narrowing of the arteries due to atherosclerotic plaques in the coronary arteries supplying the heart. When the demands of the heart increase, blood flow from the narrowed arteries is decreased and oxygen delivery to the heart may become insufficient (called *ischemia*) and may be associated with symptoms such as chest pain and shortness of breath. Plaque rupture stimulates the formation of a blood clot (thrombus) and can cause sudden occlusion of a narrowed artery, leading to a myocardial infarction.

Cardiomegaly (enlarged heart) and left ventricular hypertrophy (LVH) are also associated with increased risk of fatal ventricular arrhythmias. The increased risk of SCD associated with LVH is independent of other factors such as age, gender, smoking status, diabetes, and serum cholesterol (Verdecchia et al., 2001; Schillaci, Verdecchia, Reboldi, Pede, & Porcellati, 2000; Casale et al., 1986). LVH commonly results from hypertension and/or coronary disease. Other risk factors for LVH include obesity, obstructive sleep apnea, and genetics. There is mounting evidence that cardiomegaly/LVH is common among US firefighters and plays a major role in CVD events in the fire service.

Acute Cardiovascular Strain of Fire-Suppression Activities

Fire fighting affects every major physiological system of the body. However, when considering cardiovascular events, the most relevant physiological responses include direct cardiovascular strain, increased body temperature, and dehydration. The physiological strain associated with fire fighting is affected by several

Figure 1: Contribution of Firefighter Fatalities from Heart Attacks, Asphyxiation, and Burns: 1990–2012 (Modified from Fahy et al., 2009).

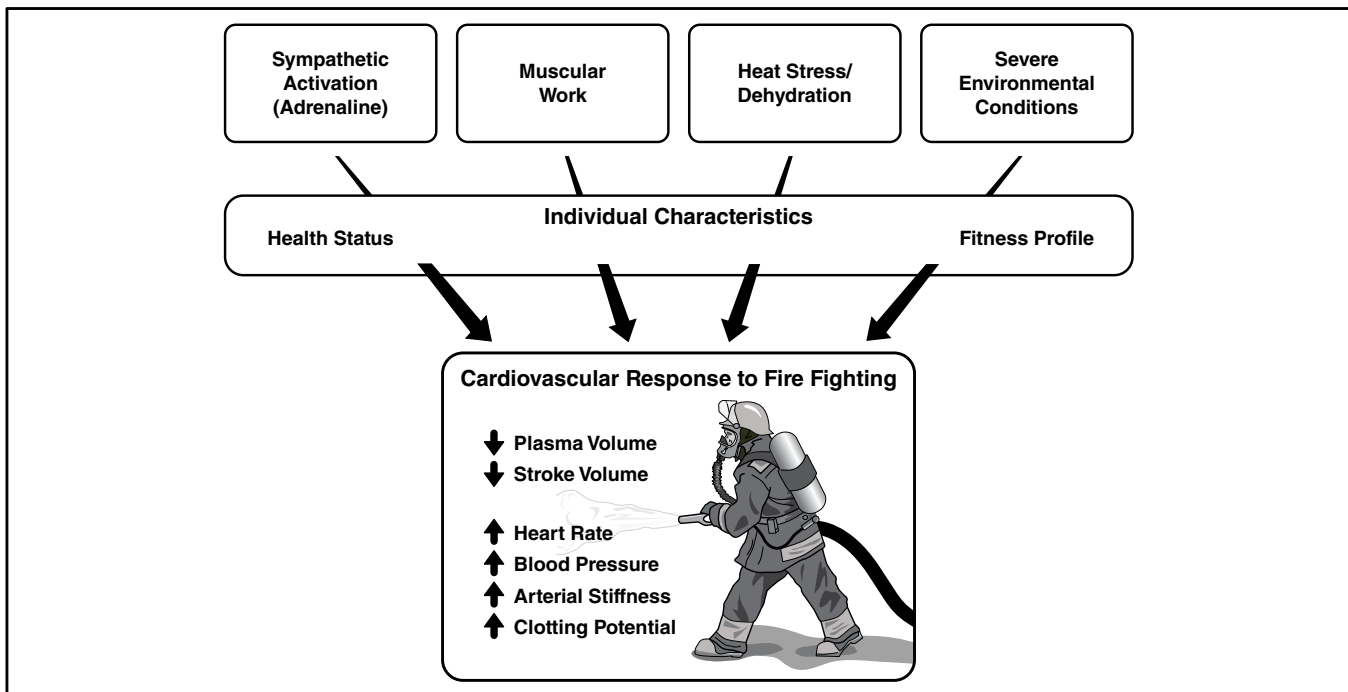


factors, including those that are related to the incident and the environment in which the job is performed and those related to the individual.

As shown in **Figure 2**, the magnitude of the cardiovascular strain of fire fighting is affected by sev-

eral interacting factors. Following the sound of an alarm bell, cardiovascular strain increases due to an adrenaline surge, referred to as *sympathetic activation*, resulting in elevated heart rates and blood pressure (Barnard & Duncan, 1975). Adrenaline release remains

Figure 2: Factors Affecting the Cardiovascular Strain Associated with Fire Fighting (Modified from Smith et al., 2013).



high throughout fire-fighting activities, crucially altering the physiology of firefighters on the fireground. The cardiovascular system is also taxed by strenuous work such as climbing stairs and ladders, performing forcible entry and ventilation tasks, and suppressing fires while wearing heavy (>55 lbs) personal protective equipment (PPE). Performing strenuous fire-fighting activities can increase core temperature by ~4°F in as little as 18 minutes (Smith, Petruzzello, Chludzinski, Reed, & Woods, 2001) and can result in dehydration equivalent to 1.1% body mass loss or 1 L of water loss (Fernhall, Fahs, Horn, Rowland, & Smith, 2012). Increases in body temperature and dehydration place greater strain on the cardiovascular system. The severe environment, including heat, excessive noise, and smoke exposure, further stresses the cardiovascular system. The combination of unique stressors at each fire scene interacts with an individual's health status and fitness profile to determine the magnitude and consequences of the cardiovascular response to each episode of fire fighting.

Research convincingly demonstrates that fire fighting causes significant cardiovascular strain, including:

- a. maximal or near-maximal heart rates (~190 bpm) (Smith & Petruzzello, 1998; Smith, Manning, & Petruzzello, 2001; Horn, Blevins, Fernhall, & Smith, 2013);
- b. an acute increase in systolic blood pressure (Bugajska, Zużewicz, Szmauz-Dybko, & Konarska, 2007), which decreases below resting values during recovery (Horn et al., 2011);
- c. increased stiffness of the arteries (Fahs et al., 2011);
- d. a 15% reduction in plasma volume (Smith, Petruzzello, Chludzinski, Reed, & Woods, 2001);
- e. a 13 to 30% decrease in stroke volume (the amount of blood ejected from the heart with each beat) (Smith, Manning, & Petruzzello, 2001; Fernhall et al., 2012); and
- f. increased clotting potential (Smith et al., 2011; Smith, Barr, & Kales, 2013).

Cardiovascular Disease (CVD) Risk Factors in Firefighters

The cardiovascular strain associated with fire fighting is strongly influenced by the individual characteristics of each firefighter, most notably his or her health status and fitness profile. Underlying CVD increases cardiovascular strain and greatly increases the risk of a cardiovascular event, whereas improved fitness decreases cardiovascular strain and hastens recovery from a given amount of work. Unfortunately, there is robust research evidence that large proportions of

firefighters have risk factors for cardiovascular disease and that many lack the fitness level required to safely perform essential fire-fighting tasks:

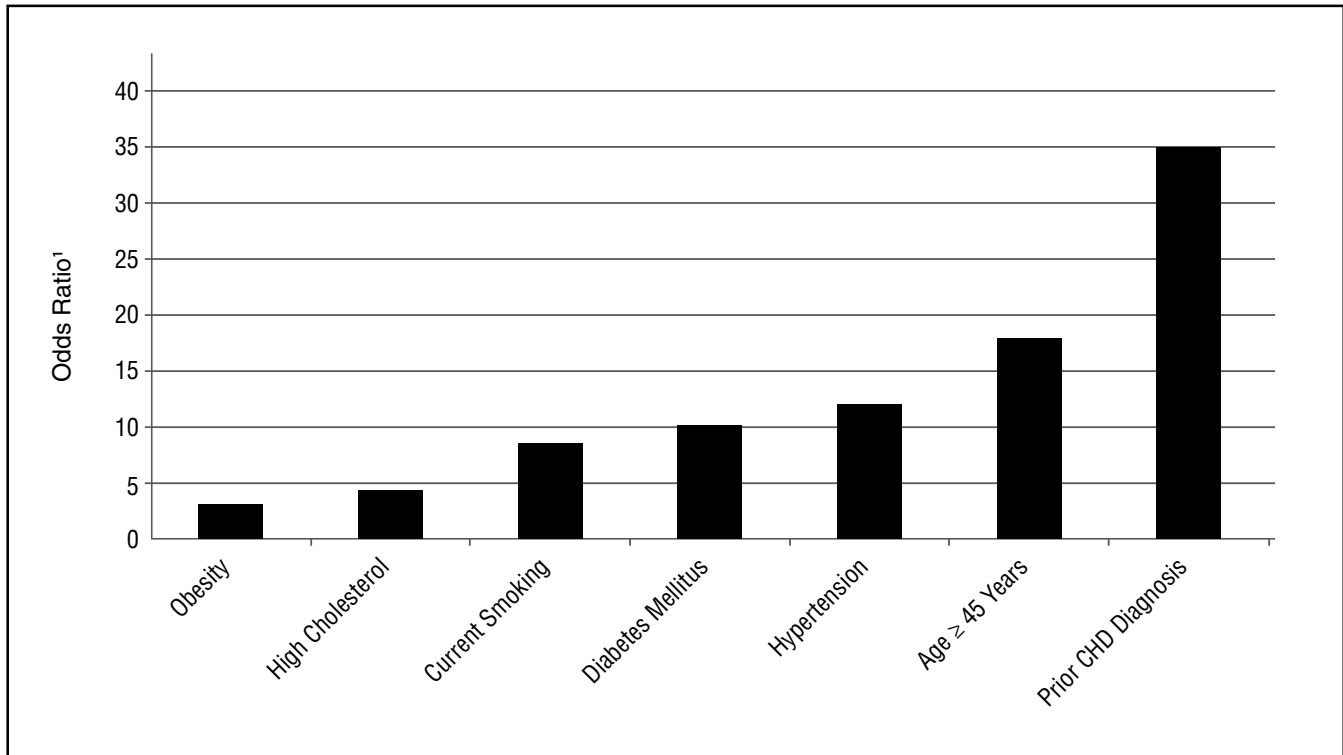
- a. 20 to 30% of firefighters have high resting blood pressure (Fahs et al., 2009; Kales, Tsismenakis, Zhang, & Soteriades, 2009);
- b. greater than 20% of firefighters have high serum cholesterol (Donovan et al., 2009; Soteriades et al., 2002);
- c. 75 to 90% of firefighters are overweight and 30 to 40% meet the definition of obesity (Fahs et al., 2009; Smith et al., 2012; Soteriades et al., 2005); and
- d. many firefighters do not meet the required fitness level to safely perform tasks on the firegrounds (Barr, Gregson, Sutton, & Reilly, 2009; Storer et al., 2014; Smith, 2011; Clark, Rene, Theurer, & Marshall, 2002), which can result in pathologic changes in the cardiovascular system (Baur, Leiba, Christophi, & Kales, 2012).

The fire service routinely weighs risk versus benefit on the fireground (i.e., *risk a little to save a little; risk a lot to save a lot*). Clinical research has provided a great deal of scientific data to guide the fire service in evaluating the risk of a firefighter suffering a cardiac event based on the presence of CVD risk factors or diagnosed CVD. **Figure 3** summarizes research documenting the relative risk of on-duty firefighter CHD fatalities by CVD risk factor (Kales, Soteriades, Christoudias, & Christiani, 2003). Figure 3 also reveals that obesity is associated with a threefold increased risk of duty-related death compared to a normal-weight firefighter. Obesity and increased body mass index (BMI) are also risk factors for job-related disability.

Smoking is a major CVD risk factor and is associated with approximately a ninefold increased risk of cardiac death among firefighters. The prevalence of current smoking in the fire service ranges from 10 to 18%, whereas the prevalence is 40 to 50% among those suffering duty-related CHD fatalities (Kales et al., 2003). Hypertension is a well-established major risk factor for CVD, with increased risk being evident with prehypertension. Figure 3 shows uncontrolled hypertension resulted in a twelvefold increased risk of duty-related cardiac death.

An existing diagnosis of CHD (based on peripheral artery disease, carotid stenosis, and history of thrombotic stroke or transient ischemic attack) is associated with the greatest risk by far of suffering a fatal cardiac event (a thirty-fivefold or 3,500% increased risk). While only 1% of career firefighters and 9% of volunteers have established CHD, 31% of firefighters who experienced fatal CHD events had a previously established disease (Soteriades, Smith, Tsismenakis, Baur, & Kales, 2011).

Figure 3: Risk of On-Duty Firefighter Cardiac Fatalities by Cardiovascular Disease (CVD) Risk Factor (Modified from Kales et al., 2003).



¹An odds ratio represents the likelihood that an outcome will occur, in this case, cardiac fatality, given a particular exposure, here, cardiovascular risk factor. There is a greater chance of cardiac fatality in firefighters if they have a prior diagnosis of coronary heart disease (CHD) than any other traditional risk factor for cardiovascular disease (CVD).

Sudden Cardiac Death (SCD) During Fire Fighting

Fire fighting includes multiple stressors, including:

- Physical stress (associated with strenuous work and heavy, encapsulating PPE);
- Emotional stress (associated with emergency activities); and
- Environmental stress (as a result of fire heat, smoke, and other products of combustion).

Together, these stressors may provoke or trigger a sudden cardiac event in individuals with underlying disease. Accordingly, there is compelling evidence that sudden cardiac events are more likely to occur during emergency operations or strenuous work than during routine station duty.

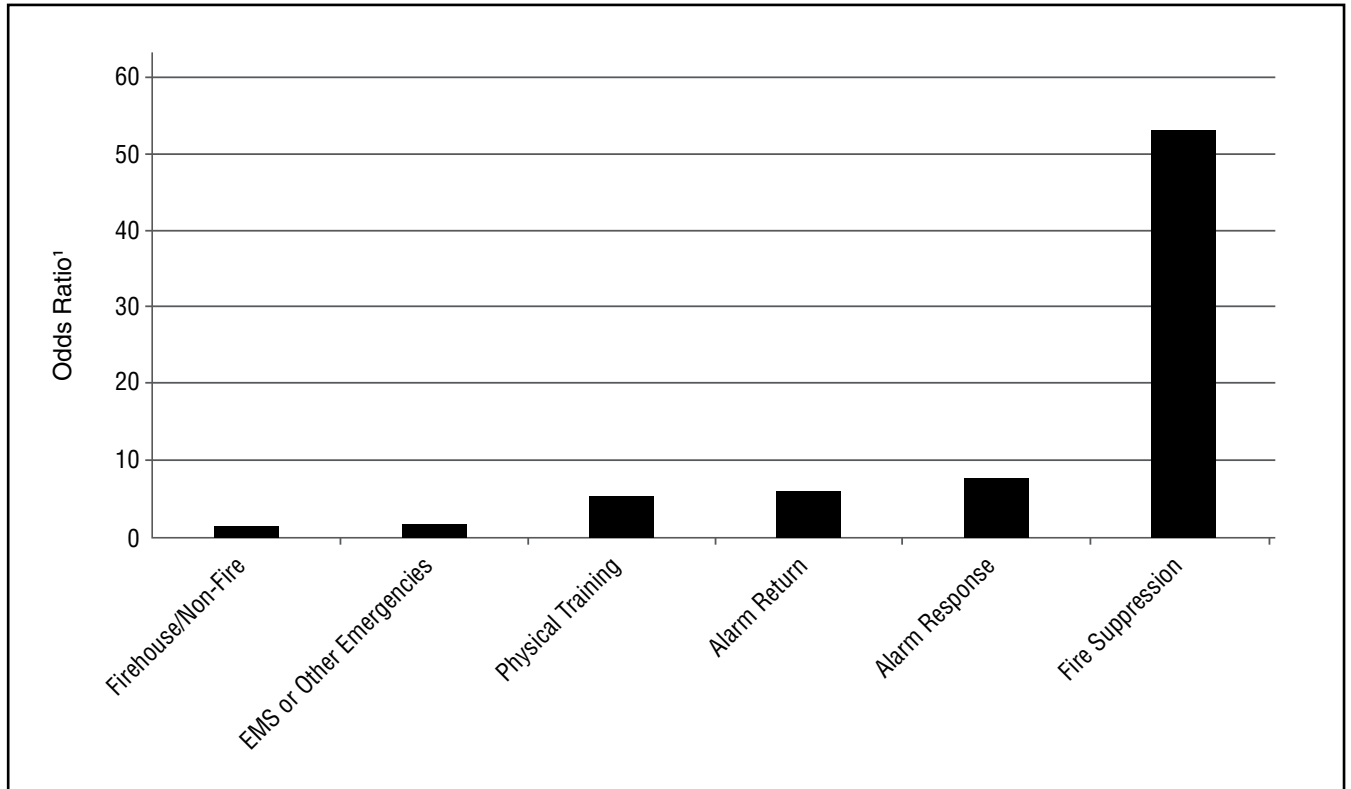
Despite the fact that fire-suppression activities comprise only 1 to 5% of total annual working time spent during all fire-service duties, more than 30% of line-of-duty CHD deaths occur during these activities (Kales, Soteriades, Christophi, & Christiani, 2007). As seen in **Figure 4**, this means that the risk of SCD during fire suppression is roughly 50 times the risk encountered during station duties (Kales et al., 2007). There is also an elevated risk (about sixfold increase) associated with

alarm response, clearly indicating that the adrenaline surge associated with alarm response results in powerful changes to the cardiovascular system.

Theoretical Model for Sudden Cardiac Events in the Fire Service

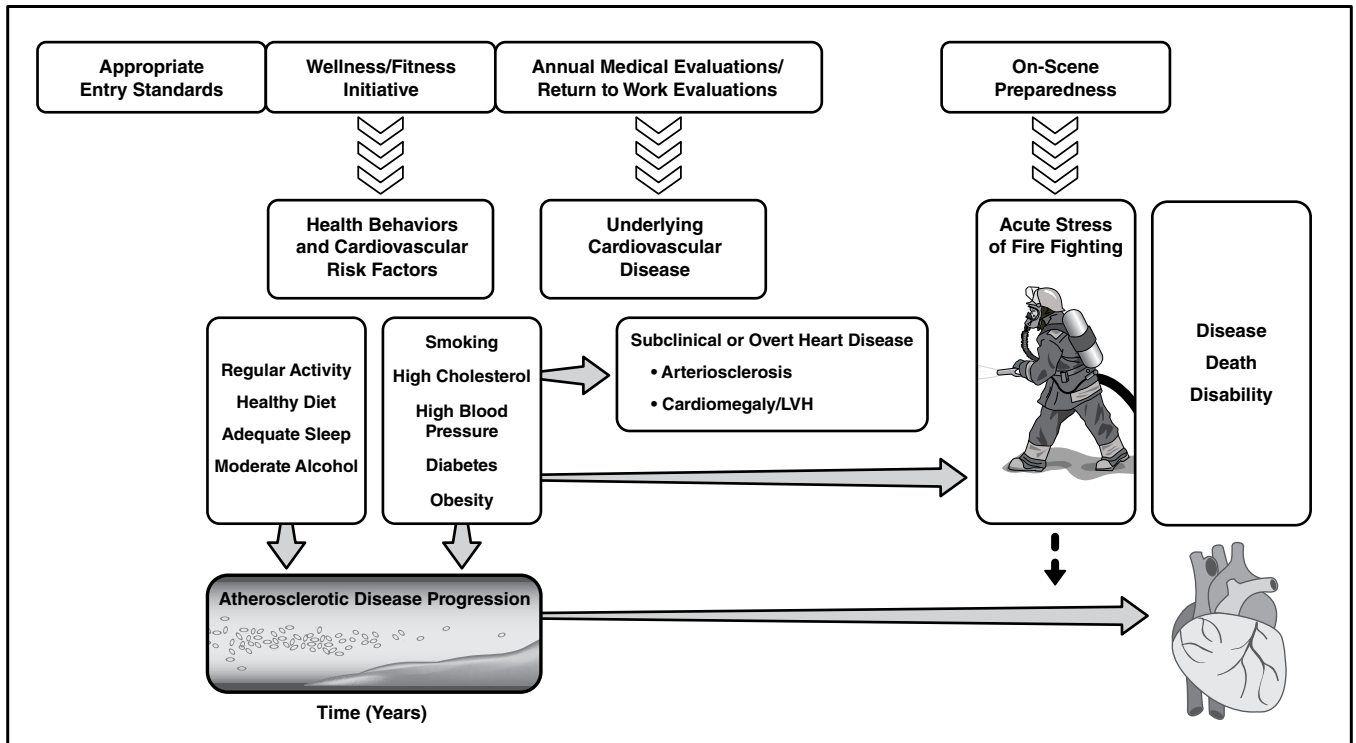
SCD in firefighters occurs because of a complex interaction between health behaviors and CVD risk factors, underlying CVD state, and the acute stress of fire fighting. As illustrated in **Figure 5**, CVD develops over many years, even decades; and this disease progression is influenced both positively and negatively by health behaviors and is reflected by the balance of CVD risk factors. As disease progresses, it may result in subclinical CVD (detected or undetected), which manifests as atherosclerotic heart disease, CHD, and/or structural changes in the heart such as cardiomegaly or LVH. In the presence of *chronic* underlying disease, the cardiovascular strain associated with fire fighting may lead to plaque rupture and thrombus formation and/or arrhythmia, which in turn may lead to an *acute* event — specifically a fatal or nonfatal cardiac event.

Figure 4: Risk for Sudden Cardiac Death (SCD) by Firefighter Duty and Emergency Medical Services (EMS) (Modified from Kales et al., 2007).



¹An odds ratio represents the likelihood that an outcome will occur, in this case, cardiac fatality, given a particular exposure, here, type of firefighter duty. There is a greater chance of sudden cardiac death during fire-suppression activities than any other duty performed by firefighters.

Figure 5: Theoretical Model for Sudden Cardiac Events in the Fire Service and Means of Mitigating Event Occurrence (Modified from Soteriades et al., 2011).



Note: Complete arrows indicate relationship to sudden cardiac death (SCD); broken arrows indicate relationship to SCD in susceptible individuals; stacked arrows indicate means to positively influence cardiovascular risk factors, cardiovascular disease (CVD), and cardiovascular strain.

Mitigating Sudden Cardiac Death (SCD) in the Fire Service

Fire service leaders can take the following five steps to decrease the risk of SCD among firefighters:

1. **Ban Smoking** — Smoking is associated with an increased risk of SCD as well as increased risk of cancer and respiratory disease. The fire service should completely ban smoking and tobacco products.
2. **Adopt and Implement Wellness/Fitness Programs** — By embracing a wellness/fitness initiative, the fire service can greatly influence health behaviors and reduce the annual number of fatal cardiac events that occur on the fireground (see Figure 5). By implementing a wellness/fitness initiative, fire departments can improve the firefighters' overall health and physical fitness profiles, and consequently reduce CVD risk factors. Regular physical activity, a healthy diet, and adequate sleep help ensure firefighters are prepared for the physical, emotional, and environmental stressors they may encounter while on a fire call. Additionally, a wellness/fitness initiative is an important step to address modifiable risk factors associated with SCD, including obesity, hypertension, high serum cholesterol, and Type 2 diabetes. Wellness and fitness can be accomplished by providing on-duty time for required regular exercise.
3. **Require Annual Medical Evaluations and Return-to-Work Evaluations** — Annual medical evaluations can improve detection of underlying CVD and permit more aggressive treatment of CVD risk factors. Paying particular attention to current modifiable risk factors (cholesterol, blood pressure, smoking, etc.), firefighters who are most susceptible to cardiac events should undergo screenings to diagnose subclinical or overt CVD. This step is especially important given that between 25 and 30% of all cardiac deaths on the fireground occur in firefighters who have a previous diagnosis of CVD, had a prior myocardial infarction, or have a stent. A physician who is familiar with the stress of fire fighting should provide return-to-work clearance for firefighters.
4. **Enact Obesity Standards** — Common-sense obesity standards should be enacted within the fire service. Obesity is linked to increased risk of injury, disability, cardiomegaly, and SCD. The enacted obesity standards should balance antidiscrimination and employment law considerations with the health and safety of firefighters to ensure that unnecessary risk of death is avoided.

5. **Provide On-scene Medical Support and Incident Rehabilitation** — On-scene preparedness is important to mitigate SCD on the firegrounds. Having emergency services on-scene ensures that those firefighters who require medical attention receive it in a timely manner, thus reducing the risk of cardiac death. Additionally, incident rehabilitation is designed to ensure that firefighters are provided with rest, rehydration, and cooling, thereby lessening the cardiovascular strain experienced during subsequent work.

Conclusions

Fire-fighting activities involve heavy strenuous work, sympathetic activation (adrenaline release), and severe environmental conditions. The combination of physical, emotional, and environmental stresses results in considerable cardiovascular strain. The theoretical model offered in this article is based on extensive research and proposes that in susceptible individuals with underlying heart disease (most often CHD and LVH), the cardiovascular strain associated with fire fighting may trigger a sudden cardiac event. The precise mechanisms that result in a cardiovascular event may vary depending upon the underlying disease state. Increases in cardiac demand may cause rupture of vulnerable plaque, resulting in occlusion of coronary arteries; and this may be exacerbated by hypercoagulability, which increases the risk of thrombotic (blood clotting) events. Ischemia (a lack of oxygen delivery) can also result in direct electrical and mechanical changes in the cardiac muscle, leading to fatal arrhythmias. Exposure to environmental conditions (such as gaseous and particulate toxicants in smoke) may also increase susceptibility to arrhythmias (Dockery, 2001; Goldberg et al., 2001; Mittleman, 2007), particularly in those with LVH and other forms of cardiomegaly.

To help mitigate the cardiovascular strain in firefighters, the fire service should:

1. ban smoking;
2. adopt and implement wellness/fitness programs;
3. provide annual medical evaluations and return-to-work evaluations;
4. enact obesity standards; and
5. provide on-scene medical support and incident rehabilitation.

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Endnotes

¹Competing interests: Stefanos N. Kales has served as an expert witness in legal cases involving firefighters and was also contracted to revise the *Heart Disease Manual of the International Association of Fire Fighters*. Denise L. Smith has served as an expert witness in legal cases involving firefighters. Jacob P. DeBlois has no competing interests to declare.

²Authors' contributions: Denise L. Smith conceived the research and collaborated with Stefanos N. Kales on the development of the theoretical framework for the manuscript. Denise L. Smith provided the initial draft of the manuscript. Jacob P. DeBlois provided a significant review and revision of the manuscript draft. Stefanos N. Kales reviewed and provided significant contributions to the final manuscript. All authors read and approved the final manuscript.

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When the Smoke Clears: The Impact of State Fire-Safe Cigarette Policies on Reducing Fire Fatalities

Abstract

Fire-service professionals across the country have long known that cigarettes are a leading cause of fatal home fires. Tireless efforts by leaders in the fire service to persuade state lawmakers to adopt standards for fire-safe cigarettes yielded success first in New York and would be followed by legislative victories in every state by 2011. These standards required manufacturers to sell only low-ignition strength cigarettes, so labeled because they would self-extinguish if left unattended. The legislative purpose was to save lives and prevent injuries and devastation from cigarette-ignited fires. This study examines whether the states' fire-safe cigarette policies helped to reduce the rate of smoking-related civilian fire deaths. The evidence indicated that the policy had a modest impact on the decline in the rate of smoking-related residential fire deaths between the years 2005–2011 — a success that leaders and managers in the fire service need to share with lawmakers.

Introduction

Advances in fire management, code adoption, and emergency-response capacity have contributed to a decline in the number of civilian fire deaths worldwide during the last several decades. Between 1980 and 2011, the number of civilians who perished in United States (US) home fires dropped by more than half from 5,200 to 2,520 fatalities (Karter, 2012). Despite this remarkable progress, the rate of US fire deaths is still higher than most other industrialized nations including Canada, France, the United Kingdom (UK), Germany, and Australia (Geneva Association, 2012). While several factors account for differences in the rate of fire deaths internationally, smoking-related fires are among the leading causes for civilian deaths in residential buildings in the US (Hall, 2012). Ahrens (2011) estimated that US fire departments responded to about 373,900 home structure fires per year during 2005 through 2009 and that these fires involved 2,650 civilian fire deaths, 12,890 civilian fire injuries, and more than \$7.1 billion in direct damage. Among the fatal fires that occurred during this period where the cause was known (about 55%), smoking was the cause for 25% of civilian home fire deaths, while heating equipment and cooking equipment accounted for 21% and 15%, respectively, of the deaths in home fires (United States Fire Administration [USFA], 2011; Ahrens, 2011).

In an effort to reduce further the number of US fire deaths and the related devastation that engulfs families touched by such tragedies, fire service leaders in the International Association of Fire Chiefs (IAFC), representatives of the American Burn Association,

and proponents from other allied health organizations finally achieved legislative victory in 2000 when New York required cigarette manufacturers to certify their products as *low-ignition strength* (Coalition for Fire-Safe Cigarettes, 2012). This standard specifies that no more than 10 of every 40 cigarettes tested can burn to their full length when placed on 10 layers of standard filter paper (Coalition for Fire-Safe Cigarettes, 2012). The purpose of this design standard was to reduce the risk of fires ignited by leaving cigarettes unattended and other careless smoking behaviors.

Cigarettes that comply with this standard are made *fire safe* by using wrapping paper that has two or three thin bands of less-porous paper that act as *speed bumps* to slow down a burning cigarette. Left unattended, a burning cigarette reaches one of these speed bumps and should self-extinguish before igniting other materials such as furniture or bedding (Hall, 2012). In other words, without regular puffing by a smoker every 30 to 40 seconds, at least 75% of all unattended fire-safe cigarettes should self-extinguish in 30 to 60 seconds.

By 2011, every state had adopted fire standards compliant (FSC) legislation for cigarettes (also known as reduced ignition propensity [RIP]). The rationale for these new standards was similar in many respects to the federal regulations imposed on manufacturers of mattresses, upholstered furniture, and other products that addressed flammability and fire resistance. Hall (2012) explained that most of the home fires started by smoking materials (cigarettes, cigars, or pipes) were

started unintentionally and can be “attributed to some error in control or disposal” (p. 6). In fact, about 32% of fatalities result from individuals falling asleep while smoking; drug or alcohol impairment while smoking accounts for about 19% of fatalities in smoking-related fires (Hall, 2012). In many respects, the new regulatory regime for cigarette manufacturers represented a technical fix for a product that was intended to complement efforts by fire-safety educators to address a problem that stems primarily from smokers’ risky, careless, or impaired behavior (G. West, personal communication, March 15, 2011).

The purpose of this study is to examine whether the states’ fire-safe cigarette laws are responsible for any of the observed reduction in smoking-related fire deaths. Some reports suggest that the observed decline in fire deaths nationally might be due to the adoption of fire-safe cigarette legislation (Hall, 2012; Alpert, 2007; Seaman 2009; National Fire Protection Association® [NFPA®], 2010). Considering the pattern of decline in fire deaths nationally, there is evidence of at least a correlational connection. This study examines data on smoking-related fire deaths to determine if there is evidence for a causal relationship. The findings have import for the many professionals in fire management across the states who invested much effort and political capital in persuading legislative officials to enact fire-safe cigarette legislation. Providing feedback to these officials about the effectiveness of this policy is an important dimension of sustaining strong legislative relations for the next campaign to advance fire safety.

Data and Methods

The fire-incident data for this study were obtained from the USFA National Fire Data Center, which maintains the National Fire Incident Reporting System (NFIRS). These data are submitted voluntarily by more than 15,000 fire departments in the US; and while they do not constitute a *census* of fire incidents, about 75% of fire incidents are captured annually (USFA, 2013). These data represent the single best available source of information about fire incidents in the states.

In 2005, fire reports were required to follow the format specified in version 5.0 of the NFIRS manual that guides report coding into several distinct data modules (USFA, 2008). Due to differences in coding *legacy data* from the earlier NFIRS reporting system (version 4.1), USFA personnel suggested using data from 2005 and later for our analysis (M. Lawler, personal communication, September 20, 2011). As a result, New York could not be included in some of the analyses because its *before era* predated 2005.

The dependent variable in the study is the annual rate of civilian, unintentional, smoking-related residential fire deaths in each state. These data were derived from three different NFIRS reporting modules that were merged using five unique incident identifiers. A series

of screens was employed to exclude all fire incidents for each year that did not satisfy these relevant selection criteria for the dependent variable. Only records of fire incidents in which smoking-related material was the documented cause were included; we did not extrapolate to incident reports where the fire cause was unknown. To do so would have made it impossible to link specific incidents, ignition causes, and victim characteristics.

The main independent variable in the study is the states’ fire-safe cigarette policy. The variable was operationalized as a proportionate dummy variable that credited implementation for any part of a year that it was in effect. If the law was not in effect for any part of a year, the variable was coded 0. If the law took effect in January of a particular year, then the variable was coded as a 1. Laws that became effective in any later month were coded in 0.08 increments from 0.92 (e.g., February) through 0.08 (e.g., December). This coding scheme was chosen to capture, as accurately as possible, the actual portion of a year that the policy was effective (Houston & Richardson, 2008).¹ It is important to note that the effective date of implementation was not the same as the date when the policy was enacted by a state legislature. Typically, state laws provided for a *grace period* of up to two years during which the inventory of non-FSC cigarettes were marketed. Consequently, the period between legislative passage and actual implementation is part of the *prepolicy* period.

Data on annual adult smoking rates in the US were obtained from the Centers for Disease Control and Prevention (CDCP) annual reports: “Current Cigarette Smoking Among Adults” (CDCP, 2012a). Estimates of the smoking rates in each state for 2005 through 2010 were obtained from the annual Behavioral Risk Factor Surveillance System (BRFSS) survey that employed large state samples and land-line telephone interviews with noninstitutionalized civilian adults 18 years and older (CDCP, 2012b).

A particular issue for this variable involved a major change in the BRFSS sampling methodology for estimating the adult smoking population in the states during the 2011 CDCP data-collection effort. A new sampling methodology included, for the first time, cellular telephone-only households that comprised about a third of the sample size (CDCP, 2012b). The CDCP also replaced the *post-stratification* weighting method used in all surveys prior to 2011 with a different weighting method called *iterative proportional fitting* or *raking* (CDCP, 2012c). The 2011 BRFSS survey produced estimates of adult smoking significantly higher than previous annual surveys. The CDCP explained that “because of these changes, estimates of tobacco prevalence from 2011 BRFSS forward cannot be compared to BRFSS estimates from previous years” (CDCP, 2013).

Considering the established connection between smoking and home fire fatalities, it is important to include state smoking rates for 2011 in an analysis of

the factors that may affect the variation in the rate of smoking-material fire deaths. The challenge is how best to incorporate a 2011 measure of adult smoking in the states that is comparable to the CDCP figures for 2005 through 2010.

Following an approach described by Roth (1994) and Schafer and Graham (2002), we estimated each state's 2011 smoking rate by computing the annual average amount of change in smoking rates between 2005 and 2010 and then adjusted each state's 2010 CDCP smoking rate by that amount to obtain an estimated 2011 state smoking rate. Nationally, these 2011 computed estimates resulted in a decline of 0.51 in the percent of adults who smoked compared to the 2010 national average. Only two states (West Virginia and Ohio) recorded an increase in the 2011 rate of adult smoking. While estimating a data point for a single year from the known values for six previous years is never ideal, this approach enabled us to retain the largest possible number of observations for the largest number of states for the 2005 through 2011 study period.

Other variables employed in this study included population demographics and housing-stock characteristics. Data for these variables were obtained from the US Census American Community Survey for 2005 through 2011 (US Census, 2012).

The data in this study consist of pooled cross-sectional time series or panel data for 49 states during the seven-year 2005 through 2011 period. The unit of analysis is the state. There are 343 total observations. Two methods used to model the factors hypothesized to affect the rate of smoking-related deaths in the states are Ordinary Least Squares (OLS) and Random Effects Generalized Least Squares (GLS) regression models. To verify the data met OLS assumptions, relevant statistical tests were performed to detect the presence of problems such as multicollinearity, autocorrelation, and heteroskedasticity. Collinearity statistics, for example, indicated that the variance inflation factor (VIF) was close to 1 for each of the five independent variables used in the model, suggesting that multicollinearity (which inflates standard errors) was not present in the data. Autocorrelation or correlation of residuals (a not-uncommon occurrence in time-series data) can inflate or deflate standard errors. The Durbin-Watson score did not indicate the presence of serial correlation. A modified Wald test for group-wise heteroskedasticity indicated the possibility of weak heteroskedasticity in the data. To correct for possibly inflated or deflated standard errors, we followed Hayes and Cai (2007) to compute reestimated standard errors (corrected for heteroskedasticity) in the OLS model. This method generally produces standard errors that make inferences more conservative.

Since this study employs panel data, possible structural issues need to be assessed and corrected to avoid the possibility of generating biased estimators due to unobserved (omitted) variables (Beck & Katz,

1995; Wooldridge, 2010). Several additional tests for panel data were performed, and these detected the possible presence of heteroskedasticity, serial correlation, and unit effects. Unit effects refer to the systematic variance across different units (states in this study). Since each state has its own history before the study period, each unit (state) may differ systematically on the dependent variable (the smoking-related fire-death rate). The presence of unit effects means that the values of the dependent variable may differ systematically across states. These unequal variances may result in OLS models that produce inaccurate coefficients and standard errors. Consequently, we present the results from a Random Effects GLS Model that corrects for heteroskedasticity, serial correlation, and unit effects in panel data to obtain unbiased coefficients for the independent variables in the model.²

Variables in the Study and Previous Research

The standards and cigarette-test methods embraced by the states' FSC policy (the key independent variable in the study) followed those in New York's law, which were based on recommendations by a congressional study commission (Coalition for Fire-Safe Cigarettes, 2011). The year in which each state's legislation actually became effective is shown in **Table 1**. Implementation of the law involved a review by state officials of the cigarette test reports that were required to be submitted for each brand of cigarette sold in the state by manufacturers. The states' fire-safe cigarette legislation is basically identical. Only minor differences occurred with respect to the particular state agency charged with reviewing the manufacturers' certification reports (typically the State Fire Marshal) and the size of state fees for certification of each cigarette brand (fees ranged from \$250 to \$3,000). In all states, manufacturers were allowed to sell existing inventories of noncompliant cigarettes during the interval between adoption of the statute and its effective enforcement date.

The dependent variable in this study is the rate of US civilian smoking-related fire deaths.³ As indicated in **Figure 1**, this rate declined by about a third between 2005 and 2011. Although smoking-related deaths steadily declined, the profile of victims in these fires changed little during this period. Older adults aged 75 to 84 years had the highest risk of dying in smoking-material home fires. Most victims were male and white. The overall risk of dying in fires for children under 18 was low, but children under 5 years of age accounted for more than one of every four fatalities (44%) during the 2007 through 2011 period (Hall, 2012). In fact, more than half of all children under 16 years who died in fires were under 5 years of age in 2007 (Sternberg, 2011). As one fire chief observed, the prospect of saving just one of these lives was sufficient motivation to work hard to encourage state officials to pass fire-safe cigarette legislation. (G. West, personal communication, March 15, 2011).

Table 1: Implementation Years for State Fire-Safe Cigarette Policies.

2004	2006	2007	2008	2009	2010	2011
New York	Vermont	California Oregon New Hampshire	Illinois Maine Massachusetts Kentucky Montana New Jersey Connecticut Maryland Utah Alaska Rhode Island Minnesota	Delaware Iowa Oklahoma Pennsylvania Texas Idaho Indiana Kansas West Virginia Colorado Arizona Washington Louisiana Hawaii Wisconsin	Alabama Arkansas Florida Georgia Michigan Nebraska New Mexico North Carolina South Carolina Tennessee Virginia Ohio Nevada Mississippi North Dakota	Missouri South Dakota Wyoming

Figure 1: Trend in Civilian Smoking-Related Fire Deaths in the US (1981–2011).

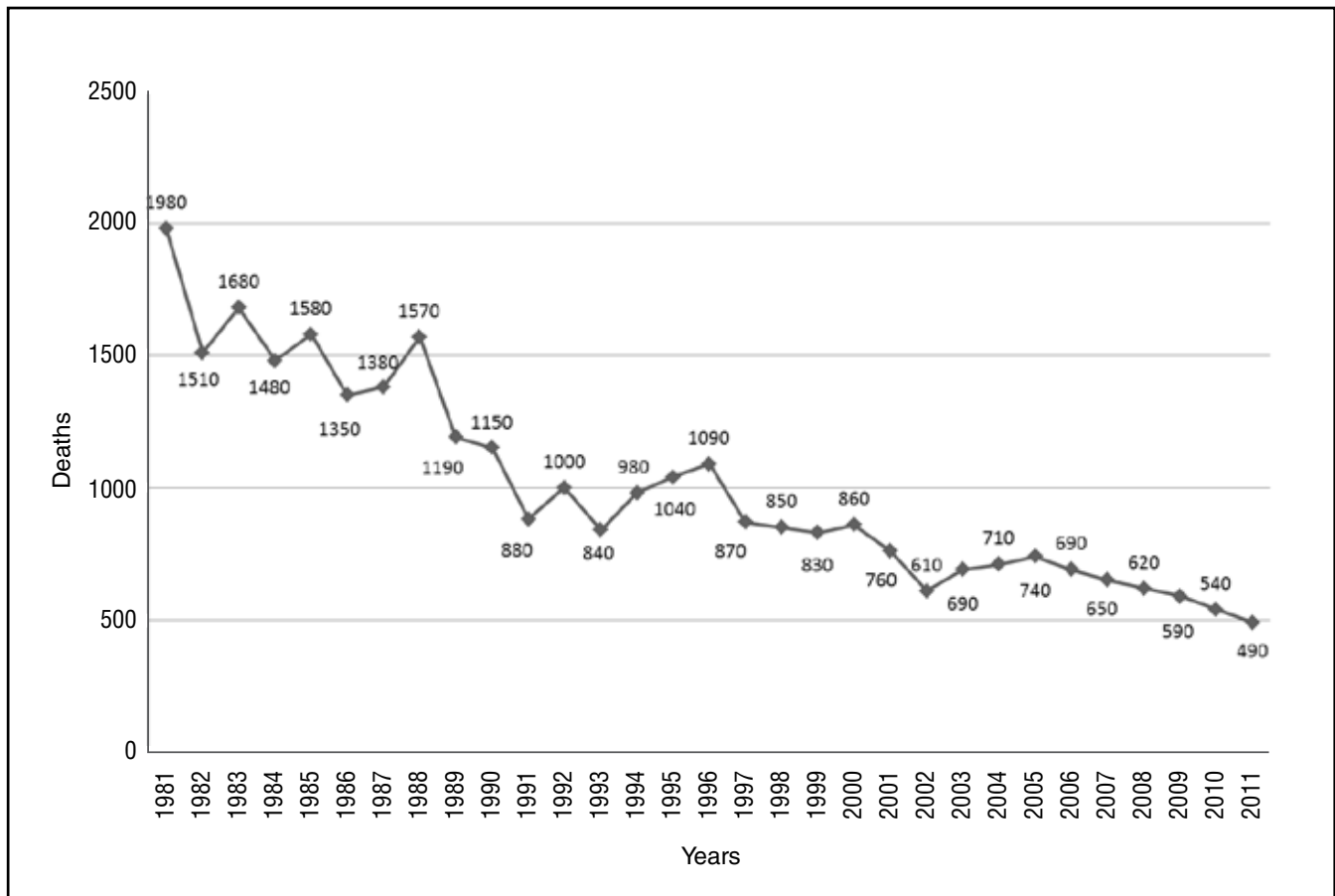
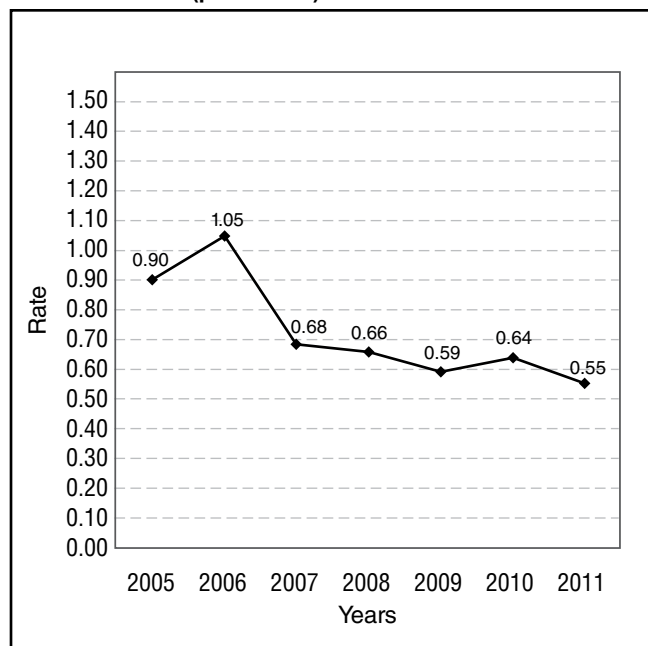


Figure 2 shows the annual mean rate of smoking-related fire deaths in the states from 2005 through 2011. During this period, the mean rate for these mortalities declined by about 39%, a reduction that was mediated by increases during 2006 and 2010. For proponents of the FSC policy, this overall pattern of decline was a highly desirable outcome. For this study,

it has substantive importance because it provides the requisite correlational evidence between implementation of the state FSC policies and an observed change in the dependent variable that must exist to consider a possible causal connection.

The magnitude and direction of the change in the rate of smoking-related fire deaths in the individual

Figure 2: Rate of Smoking-Related Civilian Home Fire Deaths in the US (per million) 2005–2011.



states after implementation of the FSC policy is shown in **Table 2**. These data indicate that 36 states recorded an overall decline in their mean rate of smoking-related fire deaths after policy implementation, while a dozen states experienced an increase in their mean rate. In the 36 states⁴ with lower mean rates after policy imple-

mentation, the overall rate declined from 1.04 deaths per million before policy implementation to 0.59 deaths per million after policy implementation. Among the 12 states with higher mean rates of smoking-related fire fatalities after policy implementation, the mean rate increased from 0.45 deaths per million to 0.69 deaths per million. Clearly, the decline in the mean rate of smoking-related fire deaths was broad-based, but it was not universal after the states implemented fire-safe cigarette legislation.

What factors other than the FSC policy might account for the variation in the dependent variable? Smoking is a leading cause of fatal residential building fires; lower rates of cigarette smoking in the states over time should be linked with fewer fires caused by this source and consequently lead to fewer smoking-related fire deaths (O'Connor et al., 2010; Diekman, Ballesteros, Berger, Caraballo, & Kegler, 2008). Hall (2012) also observed that lower rates of cigarette smoking should lead to fewer fires that ignite mattresses, bedding, and upholstered furniture — the items most often associated with fire deaths.

The National Health Survey defines smokers as those who report “ever smoking 100 cigarettes in their lifetime and now smoke every day or some days” (CDCP, 2012d). **Figure 3** shows that the national adult smoking rate declined from 24.6% in 1995 to 19.0% by 2011, a 23% reduction. The adult smoking rate registered its steepest decline between 1995 through 2005

Table 2: Mean State Rates of Smoking-Related Home Fire Deaths Before and After Implementation of Fire-Safe Cigarette Legislation (2005–2011).

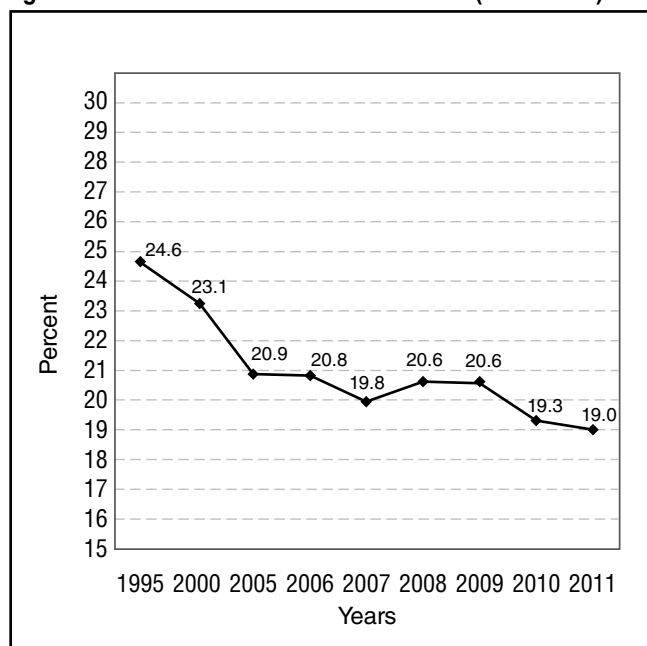
States with Lower Mean Rates				States with Higher Mean Rates			
State	Effective Date of FSC Law	Mean Smoking-Related Fire Death Rate Before	Mean Smoking-Related Fire Death Rate After	State	Effective Date of FSC Law	Mean Smoking-Related Fire Death Rate: Before	Mean Smoking-Related Fire Death Rate: After
Alabama	1/1/2010	0.304	0.105	Colorado	7/31/09	0.410	0.695
Alaska	8/1/08	4.520	2.147	Georgia	1/1/10	0.276	0.410
Arizona	8/1/09	0.220	0.075	Hawaii	9/30/09	0.000	0.370
Arkansas	1/1/10	1.406	0.345	Illinois	1/1/08	0.473	0.875
California	1/1/07	0.335	0.192	Kansas	7/1/09	1.460	1.516
Connecticut	7/1/08	0.673	0.142	Nebraska	1/1/10	0.690	0.820
Delaware	1/1/09	0.890	0.000	New Mexico	1/1/10	0.200	0.240
Florida	1/1/10	0.378	0.325	North Carolina	1/1/10	0.534	1.040
Idaho	4/1/09	1.520	0.213	Pennsylvania	1/1/09	0.142	0.476
Indiana	7/1/09	0.630	0.566	South Carolina	1/1/10	0.510	0.750

(Continued)

Table 2: Mean State Rates of Smoking-Related Home Fire Deaths Before and After Implementation of Fire-Safe Cigarette Legislation (2005–2011). (Concluded)

States with Lower Mean Rates				States with Higher Mean Rates			
State	Effective Date of FSC Law	Mean Smoking-Related Fire Death Rate Before	Mean Smoking-Related Fire Death Rate After	State	Effective Date of FSC Law	Mean Smoking-Related Fire Death Rate: Before	Mean Smoking-Related Fire Death Rate: After
Iowa	1/1/09	1.010	0.440	Utah	7/1/08	0.520	0.817
Kentucky	4/1/08	1.200	0.287	Wisconsin	10/1/09	0.144	0.265
Louisiana	8/31/09	0.180	0.110				
Maine	1/1/08	0.766	0.567				
Maryland	7/1/08	0.656	0.525				
Massachusetts	1/1/08	1.673	1.185				
Michigan	1/1/10	0.462	0.405				
Minnesota	12/1/08	1.070	0.630				
Mississippi	7/1/10	0.692	0.335				
Missouri	1/01/11	0.651	0.500				
Montana	5/1/08	1.420	0.757				
Nevada	6/1/10	0.470	0.185				
New Hampshire	10/1/07	0.260	0.190				
New Jersey	6/1/08	0.620	0.540				
North Dakota	8/1/10	1.860	1.460				
Ohio	5/1/10	1.450	1.080				
Oklahoma	1/1/09	1.270	0.620				
Oregon	7/1/07	1.370	0.634				
South Dakota	1/01/11	2.270	1.210				
Tennessee	1/1/10	1.900	1.805				
Texas	1/1/09	0.460	0.250				
Vermont	5/1/06	1.660	0.266				
Virginia	1/1/10	0.730	0.310				
Washington	8/1/09	0.744	0.590				
West Virginia	7/10/09	1.235	0.540				
Wyoming	7/01/11	0.323	1.760				
Means		1.04	0.59			0.45	0.69

Figure 3: Percent of US Adults Who Smoke (2005–2011).



when it dropped by 15 percent; the rate declined more gradually during the 2005 and 2011 period, dropping by only 1.9% (from 20.9% to 19.0%).

In addition to smoking rates, several studies have identified other causes of fire fatalities and the factors that might help to prevent them. Seven distinct categories of variables emerge, for example, as important for understanding the causes of fire fatalities from the collective works by Hall, 2012, 2013; Ahrens, 2012; Anderson and Ezekoye, 2013; Evarts, 2011; Karter, 2012; Eisenberg, 2005; Waugh and Hy, 1990; Waugh and Tierney, 2007; and Coe, 2009. These categories include (1) population demographics; (2) population behaviors (e.g., smoking, cooking, etc.); (3) housing-stock characteristics; (4) the presence of various combustible materials in the structure; (5) operational smoke alarms and fire-suppression technology such as sprinkler systems; (6) the adoption and enforcement of appropriate building codes; and (7) the availability of an adequate fire-fighting, rescue, and emergency medical care infrastructure and management capacity. Among these types of

variables, state-level data are available mainly for smoking rates, population demographics, and housing-stock variables.

Following Eisenberg (2005), we included two demographic variables (the percent population white and the percent population male) and a housing-stock variable (the percent of housing built between 2000 and 2004) in this comparative state analysis. **Table 3** shows the relevant descriptive statistics for these three census variables. Based on Eisenberg’s (2005) findings, we hypothesized that states with higher proportions of whites and males will have higher rates of smoking-related fire deaths, while states with larger proportions of newer housing (built between 2000 and 2004) will have lower rates of smoking-related home fire deaths since these newer structures may be more likely to meet contemporary building codes and have operating smoke alarms.

Findings

Table 4 shows the OLS and Random Effects GLS model results for the five variables described in the previous section that are hypothesized to affect the rate of smoking-related home fire deaths in the states between 2005 thru 2011. **The most striking finding in both models is that the states’ fire-safe cigarette policy had a statistically significant independent effect in helping to reduce the rate of smoking-related home fire deaths, controlling for the effects of the other variables in the model.** In the Random Effects GLS model that corrects for all of the issues with panel data, the states’ fire-safe cigarette policies were responsible for reducing the state’s smoking-related fire mortality rate by 0.233 per million. While this independent effect is best described as modest, it was the *only* variable in the Random Effects model to attain statistical significance. In other words, compared to the rate of adult smoking, state demographic features, or housing-stock characteristics, adoption of the FSC policy by the states was the most important reason for the observed reduction in the rate of smoking-related fire deaths.

In the OLS model, three variables in addition to the FSC policy attained statistical significance. The

Table 3: Descriptive Statistics for State Demographic and Housing-Stock Variables (2005–2011) N = 343.

Variable	Mean	Standard Deviation	Range	Skewness	Kurtosis
Percent housing built between 2000-2004	8.44	3.09	17.79	1.00	1.74
Percent male	49.31	0.73	4.2	0.96	1.27
Percent white	78.61	12.61	73.00	-1.36	3.67

Table 4: Fire-Safe Cigarette Policy and the Rate of Smoking-Related Fire Deaths in 49 States (2005–2011).

Heteroskedasticity-Consistent (HC) OLS Model					Random Effects GLS Model			
Variable	Coefficient	SE (HC)	t	P> t	Coefficient	Robust SE	z	P> z
Fire safe cigarette law	-0.222	0.098	-2.26	0.024	-0.233	0.091	-2.55	0.011
Adult smoking rate	0.037	0.016	2.32	0.020	0.026	0.028	0.91	0.363
Percent housing stock built between 2000-2004	-0.052	0.016	-3.20	0.001	-0.04	0.03	-1.17	0.240
Percent population male	0.327	0.115	2.82	0.005	0.209	0.205	1.02	0.309
Percent population white	0.005	0.003	1.50	0.133	0.006	0.006	0.94	0.347
Constant	-16.04	5.62	-2.85	0.004	-10.17	9.84	-1.03	0.302
Observations = 343 R ² = 12.6					Observations = 343 rho = 0.281			

coefficients of each were in the expected direction: (1) Higher rates of adult smoking led to higher rates of smoking-related fire deaths, (2) larger proportions of housing stock built between 2000 and 2004 led to lower rates of smoking-related fire deaths, and (3) higher male population proportions in a state resulted in higher rates of smoking-related fire mortalities. However, the variables in this model together explained only about 13% of the variation in the smoking-related fire-death rate.

In the Random Effects GLS model, none of the variables besides the FSC policy attained statistical significance. The best indicator of goodness of fit for the Random Effects model is the rho value. This measure represents the ratio of individual specific error variance to the composite (entire) error variance. The rho value of 0.281 indicates that about 28% of the composite error variance is explained by the variables in the model.

Causal claims about policy impacts always should be subjected to rigorous examination. Clearly, the most robust evaluation results can be produced by analyses that encompass several years of *post-FSC policy* fire-mortality data and that include variables that are measured and collected consistently over time. However, policymakers often need credible evidence about policy performance much sooner than the ideal research-design timeline. To complicate matters, government agencies sometimes change the methods used to collect data (such as smoking behavior) without consulting social scientists about how such changes would affect longitudinal analyses.

Within the limitations of existing data, we can examine the impact of the FSC policy only for those states that have at least two or more years of data on smoking-related fire deaths. We also can exclude all

data for 2011, the year for which the adult smoking rate was estimated based on the CDCP survey data from the previous six years. The downside of such an analysis is the loss of a large number of observations. Analyzing only the 15 states that have two or more years of *post-FSC* data on smoking-related fire deaths and excluding 2011 data altogether results in just 90 observations, a less than desirable *N* for purposes of regression analyses.

Table 5 shows the model results for these data from OLS and Random Effects GLS procedures. For this dramatically smaller group of states, the OLS model indicated that adoption of the fire-safe cigarette policy continued to have a statistically significant impact on reducing smoking-related fire deaths. The size of the coefficient was actually larger for this smaller group of states — a result that suggests several years of postpolicy mortality data might help to capture the full potential impact of the law. In the Random Effects GLS model, the coefficient for the FSC policy just misses attaining statistical significance at the 0.05 level. On balance, however, these findings provide us with additional confidence for validating the assertion that the FSC law had at least a modest impact in helping reduce the rate of smoking-related fire deaths in the states.

Implications

Tobacco use is the leading cause of preventable death, disease, and disability in the US and also is a significant contributor to the costs of health care (General Accountability Office [GAO], 2012). This study finds that the fire-compliant design standards for cigarettes adopted by the states helped to reduce the incidence of deaths in fires started by tobacco products. While

Table 5: Fire-Safe Cigarette Policy and the Rate of Smoking-Related Fire Deaths in 15 States with Two or More Years of Post-FSC Policy Experience (2005–2010).

Heteroskedasticity-Consistent (HC) OLS Model					Random Effects GLS Model			
Variable	Coefficient	SE (HC)	t	P> t	Coefficient	Robust SE	z	P> z
Fire safe cigarette law	-0.384	0.150	-2.56	0.011	-0.273	0.158	-1.72	0.085
Adult smoking rate	0.065	0.021	3.06	0.002	0.087	0.060	1.44	0.149
Percent housing stock built between 2000-2004	-0.108	0.037	-2.86	0.005	-0.069	0.055	-1.26	0.207
Percent population male	0.630	0.143	4.38	0.000	0.410	0.071	5.76	0.000
Percent population white	-0.009	0.006	-1.53	0.129	-0.015	0.015	-0.97	0.330
Constant	-29.67	6.85	-4.32	0.000	-19.04	3.07	-6.19	0.000
Observations = 90 R ² = 0.420					Observations = 90 rho = 0.489			

the impact was modest, the policy did help to prevent the loss of life. In a rational calculus, the value of the lives saved should far outweigh the modest implementation costs incurred by the states.

This policy success is important to communicate to state lawmakers. Providing useful feedback about program results to elected officials and the media about the consequences of a policy decision is a preeminent responsibility of public managers (Svara, 1994; Simon, 1997; Lee, 2009). It is also smart management (Ammons, 2008). Keeping lawmakers informed about policy performance (regardless of the outcome) builds trust, credibility, and a reputation for candor that helps to accumulate political capital that can be helpful in the next campaign to advance fire safety (Chase & Reveal, 1983).

The impact of the fire-safe cigarette policy measured in this study actually may have been attenuated by a tax loophole that was finally eliminated by Congress in 2012 (Esterl, 2012; Morris, 2012; Burke, 2012; Karuschak, 2012). Up until that time, the states and the federal government exempted *roll-your-own* (RYO) cigarettes made with pipe tobacco from the same tobacco excise-tax levies that were imposed on cigarette tobacco. This exception helped to explain why pipe-tobacco sales increased from 3.2 million pounds to 30.5 million pounds between 2009 and 2011 (GAO, 2012). Not only was the tax loophole eliminated, but the 2012 amendment to the federal transportation bill also redefined *tobacco manufacturers* to include any business with a roll-your-own cigarette machine, a change that many other states adopted that year (Morris, 2012). As a result, future analyses of this policy may find an impact even more substantial than that documented in this study.⁵

Finally, the proportion of unexplained variance in state smoking-related fatality rates underscores the fact that the fire-safe cigarette policy, while effective, is not a panacea. To reduce fire fatalities further still requires attention to both the technical and behavioral aspects of fire-safety policy. Since states with higher proportions of newer housing have lower rates of smoking-related fire fatalities, we speculate that compliance with recent building-code standards and the presence of operating smoke alarms in these dwellings may help to explain lower fatality rates. The next technical-policy challenge may involve promoting the more widespread adoption of code standards that require installation of sprinklers in new residences. However, we concur with Rhodes and Reinholdt (1998) that the strategies with the most promise for achieving further reductions in fire fatalities are probably those that seek to change individual behaviors such as fire-safety and prevention education efforts targeted at the most vulnerable and high-risk groups in communities. Unfortunately, proactive efforts that seek to train individuals to take more responsibility for their own safety are often among the first items in the fire service to be curtailed in times of fiscal stress. The enduring challenge for leaders in the fire service is at least twofold: (1) identify, promote, and evaluate those policies that address the technical causes of fires and (2) work to secure adequate community investment in those strategies proven to engage and educate the most vulnerable groups about fire safety. The extent to which contemporary leaders in the fire service see significant further reductions in residential fire fatalities may depend upon both the quality of their relations with legislators and their ability to forge partnerships with other interests to reach the most vulnerable groups in the community.

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Endnotes

¹An alternate operationalization of the FSC policy is to code the year in which the law became effective as a 1 and to code all other years as 0. Since the effective date of the states' FSC policy actually began in a variety of different months during various years, the fractional method of measurement was considered to be a more accurate way to capture what actually occurred *on the ground* in the states. Nonetheless, we computed the dichotomous measure and used it in the same analytical procedures as the proportional measure. This dichotomous measure produced virtually identical results with only a very minor reduction in the size of the coefficient in the models. Both the proportional and the dichotomous operationalizations remained statistically significant in the same analyses. For example, the Random Effects GLS model produced a statistically significant coefficient of -0.233 for the FSC policy when measured as a proportionate variable. When measured as a dichotomous dummy variable, it produced a statistically significant -0.199 coefficient. Regardless of how the policy variable was

operationalized, adoption of the FSC policy attained statistical significance in helping to explain the decline in the rate of state smoking-related fire deaths between 2005 and 2011.

²A likelihood ratio test was used to test for heteroskedasticity. A chi square value of 0.0000 indicated that the data were heteroskedastic. Heteroskedasticity occurs when the variance of the unobserved error, conditional on the explanatory variables, is not constant. Heteroskedasticity can yield biased variances that result in confidence intervals and t-statistics that are not valid (Wooldridge, 2012).

The Wooldridge test for serial correlation had a Prob-F value of 0.02 and indicated the presence of first-order autocorrelation. Serial correlation is the notion that a value for a variable is influenced by its own value in a previous time period. Serial correlation can result in biased standard errors and results that are less efficient (Drukker, 2003). The Block-F test detected the presence of unit effects.

To address these concerns with the panel data, a Random Effects model was estimated using a Generalized Least Squares (GLS) routine with corrections for heteroskedasticity and serial correlation. Among the more common solutions for unit effects in panel data are two modeling approaches: Fixed Effects and Random Effects. The Hausman test helps to determine whether unique errors were systematically correlated with the regressors and consequently whether a Fixed Effect or a Random Effects model would be the preferred approach for producing unbiased and accurate results. The null in the Hausman test is that the preferred model is Random Effects (that unique errors are not correlated with the regressors). Our test results ($p = 0.029$) suggested that a Fixed Effects model might be preferable, but Beck (2007) argued that when there is very small variation in the dependent variable over time and the data involve a small N, a Random Effects GLS model is preferred over a Fixed Effects model. Since our data exhibited both of these characteristics, we chose to present the findings from the Random Effects GLS model. Park (2011) also suggests that the results from a pooled OLS model should be presented under these circumstances.

For comparison purposes, we computed *both* the Random Effects GLS model and a Fixed Effects model. We found that the FSC policy, regardless of whether it was measured proportionately or as a dichotomous dummy, remained statistically significant with only a very small reduction in the size of the coefficient for the FSC policy in the Fixed Effects model.

³We examined smoking-related fire deaths because the reduction of mortalities in fires ignited by tobacco products is one of the principal goals of the states' FSC policies. Cigarettes are a leading cause of fire deaths

among smokers and nonsmokers, and this rationale figures prominently in the states' statutes. Work in progress also examines the impact of the states' FSC policies on the rate of smoking-related fire incidents and particularly the rate of injuries (other than death) by type (minor, moderate, severe, and life threatening). Together with the current study, these subsequent analyses will provide a comprehensive picture of the impact of the states' FSC policies.

⁴New York is excluded since we do not have comparable "prepolicy" data on the dependent variable. Rhode Island is not included in Table 2 because it did not report data on fire deaths during the study period.

⁵A complication future evaluations will encounter is the inability to compare CDCP survey data on adult smoking rates pre-2010 with 2011 and later because of the change in survey methodology.

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Leading by Example: The Role of Leadership in Firefighter Health

Abstract

In occupations such as the military, police, and fire service, leaders play an important role in promoting the health and safety of their employees. A growing body of research suggests that United States (US) fire service personnel face a host of health and safety challenges, including high rates of obesity, low physical fitness, and binge drinking. In order to address these health issues effectively, strong fire service leadership is needed on these issues. However, little data exists on the attitudes and opinions of fire service leaders regarding health and safety. This study presents data from part of a large, national, qualitative study on the health of firefighters. Themes related to the role of leadership and management as well as effective messages for motivating firefighters to be healthy were identified. The critical role of leadership (e.g., fire chiefs, company officers) in modeling and promoting health and safety practices was a prevalent theme across fire departments. Participants also noted that framing health and safety initiatives as important for the sake of your crew rather than for individual gain was an effective motivational tool for fire service leaders. Findings highlight the importance of engaging leadership in effecting department-level change for firefighter health.

Introduction

There is wide agreement in the United States (US) fire service that fire fighting requires high levels of health and readiness (Donovan et al., 2009; International Association of Fire Fighters [IAFF], 2008). The primary labor organization, IAFF, and the management association, the International Association of Fire Chiefs (IAFC), jointly developed standards for fire-department wellness programs that focus on increasing the physical preparedness of firefighters to perform strenuous activities. *The Fire Service Joint Labor Management Wellness-Fitness Initiative* (IAFF, 2008) documents a consensus among both labor and management that firefighters need “high levels of aerobic fitness, muscular endurance, muscular strength, muscular power, flexibility, and body composition in order to perform safely and effectively in the fire service” (p. 25). However, a large and rapidly growing body of research documents that most firefighters fall far short of this occupational standard of physical preparedness, and most fire departments do not require firefighters to demonstrate even minimal levels of fitness or health (Centers for Disease Control and Prevention [CDC], 2007).

Recent occupational health research has demonstrated that a majority of firefighters struggle with multiple health issues, such as low physical fitness (Donovan et al., 2009; Poston, Haddock et al., 2011), obesity (Haddock, Poston, & Jahnke, 2011; Poston, Jitnarin, Haddock, Jahnke, & Tuley, 2011; Poston, Haddock et al., 2011; Soteriades et al., 2005; Soteriades,

Hauser, Kawachi, Christiani, & Kales, 2008), metabolic syndrome (Baur, Christophi, & Kales, 2012), and binge drinking (Haddock, et al., 2012). For instance, Poston and colleagues (Poston et al, 2011), in a large population-based study conducted with 24 randomly selected fire departments, found that nearly 80% of firefighters were either overweight or obese, a rate which exceeds that found in the general public. Furthermore, a 2007 report by the National Institute of Occupational Safety and Health (NIOSH) found that only 39% of fire departments had a voluntary fitness program, and only 8 percent of those departments required participation (CDC/NIOSH, 2007). Research has demonstrated that firefighters from the small number of departments that provide active wellness programs are more healthy and fit than their peers (Poston, Haddock, Jahnke, Jitnarin, & Day, (2013). Thus, the fire service is in the awkward situation of strongly advocating high levels of fitness and health for its personnel while also supporting a culture that has produced low levels of fitness and unfavorable body composition, despite evidence that the wellness program that it advocates is effective.

According to Staley, Weiner, & Linnan (2011), promoting fitness in the fire service has proven to be a complex and difficult cultural phenomenon. A number of barriers to firefighter health and wellness are identified and have been categorized into clusters of intrapersonal, interpersonal, and organizational factors. Intrapersonal barriers include a lack of interest or motivation for improving personal health, perceiving having

received inadequate or incorrect information about fitness, or generally lacking knowledge about improving health. Interpersonal factors among crewmembers also have been suggested to play a role, in that crews tend to have behavioral norms that either encourage or discourage healthy behaviors. Organizational barriers include a lack of departmental resources, the challenges of scheduling fitness into the day between emergency calls, and the lack of leadership support. However, among the barriers identified, crew and department leadership were posited to play the largest role in whether firefighters value fitness (Staley et al., 2011). Specifically, firefighters believe that the personal fitness and expectations of both the crew captains and the department chiefs underlie whether firefighters will value health and fitness.

Occupations with fitness demands similar to the fire service, such as the military, have long recognized the critical role played by leadership in promoting health and readiness. For instance, a central tenet of the US Department of Defense's *Total Force Fitness* model is that leadership engagement is among the most crucial components in promoting military readiness and health (Bates, et al., 2010). Similarly, effectively addressing the health and safety needs of the fire service will require leaders who are able to navigate cultural barriers to fitness and incentivize firefighters to value it. Unfortunately, limited data is available about the relationship between leadership and health promotion among firefighters. In this national qualitative study, we examined the perceived role of fire department leader-

ship in improving the health and readiness of firefighters. In addition, we explored effective motivators for change among fire service personnel.

Methods

Data for the current study were extracted from focus groups and interviews conducted as part of a national qualitative study of fire service personnel's perception of health and wellness funded by the American Heart Association (Jahnke, Poston, Jitnarin, & Haddock, 2012). The study examined beliefs and perceptions of personnel with regard to psychological and physical health. Relevant institutional review boards (IRBs) approved protocols.

Fire Department Solicitation

Departments were primarily solicited through an article in *Fire Chief* magazine (Pyle, 2008). Using purposive sampling (Shadish, Cook, & Campbell, 2001), additional departments were sought to ensure a broad cross section with regard to region, size, and type (e.g., career, volunteer, and combination). A total of 34 departments were represented in the final sample.

Participants

As shown in **Table 1**, participants were primarily Caucasian and male, which is consistent with the demographics of the fire service nationally (Fox, Hornick, & Hardin, 2006). Personnel were from volunteer, career,

Table 1. Demographic and Occupational Characteristics of Personnel.

	Career (N=295)	Volunteer (N=48)	Combination (N=80)
Demographic			
Age (years)	41.8 ^a (10.6) ^b	37.1 ^a (14.9) ^b	38.9 ^a (12.7) ^b
Gender (% male)	93.2	79.2	87.5
Race (% Caucasian/White)	64.8	97.9	92.5
Of Hispanic Origin (% yes)	6.5	0.0	3.8
Occupational			
Time in the Fire Service (Years)	15.6 ^a (9.3) ^b	16.0 ^a (11.6) ^b	14.3 ^a (11.2) ^b
Rank/Position in Fire Department			
FF/FF paramedic (%)	56.0	64.4	66.3
Company Officer (%)	23.7	13.3	20.1
Chief (%)	15.4	17.8	11.3
Other Personnel (%)	4.7	4.4	2.6

^a Mean

^b Standard Deviation

and combinations departments. Participants included both firefighters and fire service leadership. In general, the leaders were department chiefs or his/her designee.

Focus Group/Interview Protocols

Focus-group interviews typically occurred at the fire stations with intact firefighter crews. Those in leadership roles were typically interviewed individually. Focus groups and interviews started with an introduction of the research team, an explanation of the study, and the signing of IRB-approved consent forms. Questions in the protocols covered a range of topics including the following: (1) general perceptions of health and wellness in the fire service, (2) physical fitness, (3) nutrition and the food culture in the fire service, (4) tobacco use, (5) alcohol use, (6) sleep challenges, (7) safety and seatbelt use, and (8) health-related policies and programs for firefighters. Themes that emerged related to leadership were typically the result of responses to questions such as the following: (1) How important do you believe your department/chief thinks health and wellness are? (2) What programs does your department use to benefit your health and wellness? (3) What messages about safety, health, and wellness are strong messages for firefighters? (4) If you could do anything to improve the health and wellness of the fire service, what would you do?

Analytic Approach

All focus group and interview recordings were transcribed verbatim for thematic analysis. For the first step, transcripts were separated by region (east, west, central) and by the interviewee (firefighters, fire service leadership) and analyzed separately. Transcripts were uploaded to NVivo (NVivo, n.d.), a computer program designed to assist qualitative data analysis. Next, a researcher who served as a facilitator in nearly all the groups reviewed the full transcripts for emergent themes. General themes were “parent” nodes and more specific subthemes within each code were noted as “child” nodes. Where the role of leadership arose as a theme, the statements were noted and summarized. Example statements were recorded. Next, two additional researchers who attended most of the sessions and were familiar with the transcripts reviewed the summary results. Areas of divergence of opinion were discussed and revised.

Results

A number of themes emerged around the importance and role of leadership in promoting health. Department leaders were noted as particularly influential in setting the tone and expectations of health. The impact of policies, procedures and resources allocated toward wellness also influence the perceived culture of department wellness. Suggestions also were presented for promoting health and wellness within a department.

The Role of Leadership

While policies and procedures (e.g., on-duty time for working out) and resources directed toward health and wellness (e.g., medical physicals, equipment) were regularly noted as important, one of the primary themes that emerged as influencing the department-level culture surrounding health and wellness was department leadership. The administration’s stance on health and fitness and the content of messages to their personnel were identified as having significant impacts on firefighters. When leadership made health a department priority, personnel were aware that it was a main concern, and they believed it positively influenced the culture of wellness in their department. In particular, a fire chief who sets an expectation of wellness was identified as key for setting the tone:

“We’re lucky to have a Fire Chief that makes it clear to our fire department that every day is a training day, every day is a wellness day. Every day we exercise. It’s mandatory and nonpunitive, so — pretty much [the chief] leads by example.” (Deputy Chief, Central Region, Career Type)

In particular, fire service leaders setting an example themselves were noted as sending a strong message about the relative priority of health. For example:

“. . . the Fire Chief and the Deputy Chiefs . . . they locker with us. You know what I mean? They . . . change clothes back there and all that, and they lead by example. Because I mean, . . . they work out.” (Firefighter, Central Region, Career Type)

“If you have a department [in which] . . . management does not place an emphasis on exercise or healthy eating, it doesn’t trickle down. Whereas, for example here, we place a great deal of emphasis on [health and exercise] to the point where even the people that work in the office a traditional 40-hour week are given the option of taking an hour of their work day aside from lunch to work out. Some of them take advantage of it, some of them don’t, but they [firefighters] [are] always watching you, you know, the guys are always watching and I work out 3 to 4 times a week over here now. I [worked out] . . . offsite for a while, but now I do it here . . . The culture starts with how management perceives it.” (Chief, Central Region, Career Type)

The importance of fire chiefs empowering firefighters and peer fitness trainers to create programs and engage in the development of fitness programs also was highlighted as an important goal for department leadership.

“Our firefighters developed this program. Had we tried to force this program on them — this very same thing — it would have fallen flat. So, it’s really not about . . . fitness as much as it is just about . . . people and the way we interact,

the way we guide, the way we lead, . . . [and] the culture that we foster.” (Chief, West Region, Career Type)

Personnel also identified the company officers as an important determinant for the priority that health and wellness plays in the firehouse. Often these individuals were noted as setting the schedule and determining what tasks take precedence each shift.

“I think the first line officer, whether it . . . [is] a lieutenant or a captain . . . is . . . going to [have] the biggest impact on their crew members as far as health and wellness goes.” (Chief, West Region, Volunteer Type)

“I think that the biggest impact on any firefighter . . . when it comes to health and wellness and cardiac disease is going to be their company officer. [A] tight bond [exists between the two].” (Chief, West Region, Volunteer Type)

In particular, company officers engaging in fitness and training their personnel were perceived as bolstering camaraderie and crew cohesiveness:

“For me, when I was new [to the fire department] . . . knowing that . . . my officers were willing to take the time . . . to work out or to lift [was important to me]. And even though . . . I [knew I] wasn’t as strong as they were, [we all did] it together. OK, we’re going to go run. Or we’re going to . . . go in the weight room and everybody’s . . . [going] to lift. And then, they’d show me how to hold [the weight] . . . , and stuff like that. And so, I felt a part of it, just like you do the Chow Club.” (Firefighter, Central Region, Career Type)

Policies, Procedures, and Resources

When asked about the relative priority of health in the department, many personnel indicated that the resources allocated to health and wellness were strong indicators of the emphasis the leadership assigned to the topic. Often, the amount of money dedicated to medical physicals or physical fitness equipment was noted as a measure of the relative importance of health to chiefs. In particular, when time while on duty was designated for physical training, it was perceived that fitness was important to the leadership. In addition, policies that make safety a priority were seen as being positive indications of the administrative direction.

“. . . we are very fortunate in this department to have a chief staff that truly cares about the firefighters and their safety and well-being [W]hen we’re out on the streets doing the job, they make it as safe as possible for us.” (Firefighter, West Region, Career Type)

“The biggest thing they did is they won’t let you . . . smoke anymore. We . . . [have to] sign a paper [which says we will not smoke] even before you are hired.” (Firefighter, East Region, Career Type)

How Leaders Can Promote Wellness

Outside of the traditional change agents, several key motivators were identified among participants as encouraging a movement toward better health among firefighters. One theme that commonly emerged was the benefit of emphasizing not only personal responsibility for health but also the shared responsibility among the crew. In particular, understanding the shared risk factors that firefighters face as a crew was noted.

“The job is . . . to serve and . . . [we are] here to help the community. [We] are not here to serve ourselves. [The job is] not self-serving.” (Chief, West Region, Career Type)

The camaraderie and competition between and among firefighters also was noted as a relevant motivating component.

“We [senior firefighters] ‘poke’ them [younger firefighters] . . . all the time. We’ll be in a fire and I see a . . . [younger firefighter] dragging and I’ll say, ‘I’m 48 years old son, what are you doing?’ They hate that.” (Chief, Central Region, Career Type)

“[Firefighters] . . . are competitively natured. So, if they see that they are starting to get a little paunchy and they are falling behind, . . . the other guys are merciless. It’s kind of an in-house peer attack if you start [letting your fitness] slip. So, I think that’s a big motivator for a lot of . . . [the firefighters]. They don’t want to fall behind. They don’t want to be called ‘fat’ . . . and they don’t want to be the butt of the jokes.” (Chief, Central Region, Career Type)

Discussion

In general, fire service personnel were optimistic about the direction the fire service is going with regard to health and wellness and reported perceiving a positive cultural change toward a healthier and fitter fire service in recent years. A number of factors were identified as contributing to perceptions that a department makes health and wellness a priority. In particular, department policies that allowed for and encouraged fitness and health (e.g., policies allowing time for working out while on duty) were noted as promoting a healthy culture. Allocation of resources for both medical exams and training equipment also were noted as contributing to a wellness culture. Leadership was identified as a key contributor to the perceived importance of health

and wellness within a department. In particular, having chiefs who themselves prioritized health, engaged in fitness, and watched their diets were perceived as setting the standard for their firefighters.

Our findings are similar to previous research that highlight the importance of leader buy-in for implementing health and fitness programs (Frattaroli et al., 2013; Kuehl, H., Mabry, Elliot, Kuehl, & Favorite, 2013; Mabry, Elliot, Mackinnon, Thoemmes, & Kuehl, 2013). In addition to the role of leaders such as chiefs, company officers also were perceived as key culture setters because they often have control over the schedule and priorities of the day. Having a company officer invested in the health of his/her crew was perceived as a key determinant of the priority that was placed on health. Findings highlight the importance of engaging leadership and both chiefs and company officers leading by example when it comes to health and wellness. In particular, the importance of leaders engaging in the health behaviors they are advocating were highlighted as important.

In addition to the department level and leadership factors, camaraderie and shared risk were key themes that emerged related to effective messages for motivating firefighters. A number of personnel indicated that, while they were reticent to make changes for themselves, they would make changes to improve the safety and effectiveness of the crew. They also noted that they were more likely to engage in healthy behaviors when their crew was working on being healthy and that positive peer pressure focused on improving wellness was a powerful motivator to change. Findings have direct implications for social marketing campaigns for those trying to motivate firefighters as well as for programs focused on health and wellness. It is likely that even those more reticent to change will find more success when choices to engage in healthy behaviors are collaborative rather than individualistic.

The primary limitation of the study is the potential selection bias. Departments were primarily selected based on their responding to a solicitation article in *Fire Chief* magazine (Pyle, 2008). Departments with personnel volunteering for study participation are likely those with more of an emphasis to and attention on health and wellness. However, the large number of personnel participating and the high rate of firefighters consenting to participate when solicited suggest findings likely are not biased. Despite this limitation, the findings paint a compelling picture about the role fire-service leaders play in health and wellness.

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Fiscal Stress and Cutback Management Among United States Fire Departments¹

Abstract

The purpose of this study is to analyze the impact of the Great Recession and its aftermath on United States (US) fire departments. Findings using (1) Levine (1978) and Levine, Rubin, and Wolohojian's (1981) seminal research on cutback management as a theoretical foundation, (2) survey data from over 1,600 US fire departments provided by the International Association of Fire Fighters (IAFF), and (3) qualitative accounts of reactions to stress from fire-related websites and newspapers suggest that the recent economic downturn has been hard on fire departments across the nation. Three out of ten (30.5%) of the union locals reported losing positions through attrition. Moreover, when layoffs through attrition are not enough, dozens of fire departments across the states have experienced company closures, station closures, and brown-outs (temporary closures). Research reported here is unique since it focuses on the impact of fiscal stress on a specific municipal agency/function (fire departments) rather than examining fiscal stress broadly across cities or states.

Introduction

From Glendale, AZ, to Tulsa, OK; from Philadelphia to Atlanta to Los Angeles, the news is the same — budgets are in crisis and firefighters must be laid off. The depth of the financial crisis is deep and emergency workers who haven't been handed a pink slip or heard the saber rattling of layoffs are lucky. (Ballam, 2010, p. 1)

As the above quote suggests, many US fire departments, like other municipal agencies, are experiencing significant cutbacks during and after the Great Recession.² Although organizational decline and cutback management are not new concepts and have been the focus of numerous studies since the late 1970s (see, for example, Levine, 1978, 1979; Levine, Rubin, & Wolohojian, 1981; Behn, 1980a, 1980b, 1985; West & Davis, 1988; Pammer, 1990; Bartle, 1996; Maher & Deller, 2007; Dougherty & Klase, 2009; Pandey, 2010; and Arnett, 2012), it is the breadth and depth brought by the Great Recession and its aftermath that concern some analysts. For example, Scorsone and Plerhoples (2010) assert

cutback management has perhaps entered a new and even more extreme phase among state and local governments. Government officials are being forced to adapt to an environment where service demands are rising even as both short- and long-term prospects for revenue are among the bleakest in modern history. (p. 177)

Other studies support this thesis.

Based on 2009 survey data from over 2,000 cities and counties collected by the International City/County Management Association (ICMA), Miller (2010) exam-

ines the impact of the recession on local governments. He notes:

Sixty-six percent of managers believe that the measures they have taken to mitigate the fiscal crisis — including increased use of fee-supported services and contracting out, reshaped employee benefits and pension systems, limited pay increases, tightened financial management procedures, and reinvigorated economic development efforts — represent a new way of doing business. (p. 33)

Using the same 2009 ICMA dataset, Thoreson and Svava (2011) report the distribution of responses to a survey question that asked managers about the effects the economic downturn was having on their communities. With 2,116 cities and counties reporting, findings were as follows:

- No impact — 0.5% (n = 10),
- Minimal impact — 17.5% (n = 370),
- Moderate impact — 44.5% (n = 941),
- Significant impact — 30.8% (n = 651), and
- Severe impact — 6.8% (n = 144). (p. 76)

The data show that few governments have escaped the consequences of fiscal stress and that almost 40 percent of the local governments experienced *significant* or *severe impacts*. In cities with populations in excess of 100,000, more than 60% percent of the jurisdictions experienced major budget problems. Based on data findings, Thoreson and Svava (2011) conclude: "The [fiscal] crisis has prompted deep reflection on what the

role of local government will be in the future. It has *not* [emphasis added] been a temporary downturn followed by a return to previous conditions.” (p. 82)

Martin, Levey, and Cawley (2012) concur;³ they assert that the Great Recession created a new normal for local governments with respect to finances (fewer resources), employment (smaller workforces), and services (new ways of delivering services) (p. 17S). “When one considers the evidence, it is hard to imagine that local governments can return to anything approximating what existed *ex ante* the great recession” (p. 25S).

Ammons, Smith, and Stenberg (2012) offer a rebuttal to this argument. The authors studied records and interviewed local officials in cities or counties that (1) filed for bankruptcy protection, (2) had their general obligation bonds downgraded to junk-bond status, or (3) had to accept the appointment of a Fiscal Control Board (FCB) to oversee local affairs during the years 1971–2005. Based on the evidence from previous recessions, Ammons, Smith, and Stenberg (2012) conclude that

severe economic hardship has rarely been a “game-changer” [for local governments]. Conditions triggered . . . by the Great Recession . . . are unlikely to change fundamentally the scope, quality, or delivery of services in most counties and cities or to reshape the local jurisdictional or intergovernmental landscape, despite predictions to the contrary. (p. 72S)

Regardless of the debate about the *transformational nature* of financial hardships that local governments have experienced the past few years, one fact remains — the most recent recession represents the most significant economic downturn in the US since the Great Depression. While several recent studies have examined how local governments (Miller, 2010; Thoreson & Svava, 2011; Pagano, Hoene, & McFarland, 2012) and state governments (Dougherty & Klase, 2009; Arnett, 2012) have responded to fiscal stress during this time period, cutback management research has not systematically examined the impact of the current financial downturn on a *specific* municipal government department (but see Packard, Patti, Daly, Tucker-Tatlow, & Farrell, 2008, for a study of cutback management strategies used in nine *county* human service agencies).

The purpose of this study is to summarize responses to fiscal stress among US fire departments during the Great Recession. Fire departments serve as the unit of analysis for three reasons. Fire and rescue services are (1) expensive, (2) essential and important, and (3) highly regarded by the public and city leaders:

1. Fire and rescue services are both capital and labor intensive. As such, they are expensive. As a percentage of general expenditures, public safety (largely police and fire) represents the largest outlay for American towns and cities (21.5% in 2006–2007; see England,

Pelissero, & Morgan, 2012). In addition, the American fire service is large, with over 1.1 million firefighters (about 756,000 volunteers and 344,000 career employees).

2. As first responders, fire personnel provide life-saving emergency services (e.g., ambulance, fire suppression, and hazardous materials clean up) as well as a host of other education and community services.
3. Public opinion polls show that the fire service commands high respect. For example, a Harris Poll in 2009 ranked *firefighter* as the *most* prestigious among the 23 occupations listed in the survey (see Corso, 2009).
 - Sixty-two percent of the respondents said that fire fighting had *very great prestige*. In comparison, other occupations that received ratings: scientist (57%), doctor (56%), nurse (54%), teacher (51%), police officer (44%), priest/minister/clergy (41%), and engineer (39%).
 - Similar high regards for the fire service emerged from a meta-analysis of 261 citizen surveys administered to more than 215,000 people living in cities, towns, and counties in 40 different states. Among 21 local services rated in at least 60 or more jurisdictions, fire services received the highest average citizen evaluations (Miller & Miller, 1991).

Finally, survey data collected by West and Davis (1988) from 357 municipalities show that public safety programs (police, fire suppression, and fire prevention) are the *least* “vulnerable to financial pruning efforts by local officials” (p. 214) during cutbacks.

The remainder of this article is divided into three sections. The first section provides an overview of the literature on fiscal stress and cutback management. Section two summarizes findings about how fire departments have responded to fiscal austerity during the Great Recession. Finally, we discuss the implications of the research.

Fiscal Stress and Cutback Management

As noted previously, the academic study of cutback management dates back to the late 1970s. The very fact that federal, state, or local governments would *shrink* or engage in decremental budgeting (Behn, 1985) seemed counterintuitive after more than four decades of government growth under Keynesian economics. The budgeting environment did change, however. For example, after years of financial woes, in 1975 the City of New York “was bankrupt in all but a legal sense” (Brecher & Horton, 1985, p. 267). The recession of 1973–1975 brought with it *stagflation*

(stagnant economic growth, high unemployment, and high inflation). In 1978, citizens in California approved Proposition 13 (People's Initiative to Limit Property Taxation), followed in 1980 by Proposition 2½ in Massachusetts. These initiatives ushered in a full-blown *taxpayers' revolt*.

It is against this backdrop that Charles Levine called for and led the study of cutback management, which he defined as “managing organizational change toward lower levels of resource consumption and organizational activity” (Levine, 1979, p. 180). He also noted that cutting back involved making hard decisions about who would be let go, what programs would be scaled back or terminated, and which clients would be asked to make sacrifices in services (Levine, 1979). As the title of an article written by Olson, Seymour, and Weaver (2004) asserts, “Downsizing is rough” (p. 10); real people lose real jobs.

In his seminal article on cutback management, Levine (1978) offers a four-cell typology showing the *causes* of public organization decline (p. 318). Two dimensions define the causes: (1) whether the conditions causing the decline are *internal* or *external* to the organization and (2) whether the causes are a product of *political* or *economic/technical* conditions.

The 2x2 matrix yields the following four decline situations:

1. **Political Vulnerability (Internal Location and Political Condition)** — The organization is marked by high fragility and precariousness, which limits its ability to resist budget decrements. Lack of (1) expertise, (2) a positive self-image, and/or (3) a history of excellence enhance vulnerability.
2. **Problem Depletion (External Location and Economic/Technical Condition)** — The short-term (e.g., natural disaster), medium-length (e.g., war; countercyclical employment program), or long-term (e.g., polio research and treatment; space program) problem/issue that the organization was created to address is solved or abandoned.
3. **Organizational Atrophy (Internal Location and Economic/Technical Condition)** — Declining organizational performance and capacity occurs due to system and management failures. Causes include, but are not limited to, inconsistent and perverse incentives, role confusion, weak oversight, continuous reorganization, and/or suspicion of outsiders.
4. **Environmental Entropy (External Location and Economic/Technical Condition)** — The capacity of the environment is unable to support the organization at prevailing levels. Declining economic bases result in financially troubled government jurisdictions and decremented budgeting.

For each decline situation, Levine (1978) offers a number of strategies officials can use to resist and smooth cutbacks. For example, for environmental entropy, the author suggests the adoption of user charges for services as a *resisting* strategy and identifies improving targeting on problems as a *smoothing* strategy (p. 321).

Building upon his earlier theoretical work and now working with Irene Rubin and George Wolohojian, Levine released *The Politics of Entrenchment: How Local Governments Manage Fiscal Stress* in 1981. In this classic study of cutback management, Levine, Rubin, and Wolohojian (1981) went to the field to study how four large urban areas reacted when confronted with the need to retrench. Examining the cities of Oakland, CA, Cincinnati, OH, and Baltimore, MD, plus Prince George's County, MD, they learned that each of these administrative units initially tried to improve efficiency, delay certain expenditures, and reduce services. The authors labeled these strategies *stretching* and *resisting*. The purpose of these strategies was “to do more with less and to avoid deep cuts that . . . [were] likely to trigger the antagonism of interest groups inside and outside the bureaucracy” (Levine, Rubin, & Wolohojian, 1981, p. 38). Administrative responses in the stretching and resisting category included productivity increases, management improvements, rationing services, cutbacks in the workforce through attrition, sharing agreements with other jurisdictions, raising revenue (e.g., increasing taxes and user fees), and regenerating the tax base (e.g., renewed focus on economic development) (Levine, Rubin, & Wolohojian, 1981).

The researchers found that local officials terminated few programs, at least at the outset. In addition, all the localities tried to persuade the state and county governments to assume certain service obligations, with some success. Where that strategy failed, the overwhelming choice of decision makers was to lower service levels across the board, maintaining the existing service mix and site distribution. Yet postponing expenditures has a differential effect; most delays were in capital spending and maintenance and thus predominantly affected public works departments.

As might be expected, the deeper the decline and the longer it lasted, the more likely local officials were to target cuts (versus across-the-board cuts), close facilities, terminate programs, and lay off employees (beyond attrition). Levine, Rubin, and Wolohojian (1981) call this stage of cutback management *cutting and smoothing* and characterize it as “severe decline” versus the more “moderate decline” in the stretching-and-resisting phase of cutback management (pp. 45–46). Another administrative response in this category includes local officials mandating productivity changes that may provoke antagonism and resistance among employees. Examples include reducing the number of police officers in squad cars or firefighters on trucks. Smoothing is the administrative reaction to cutting — an attempt to ameliorate the most negative

consequences of reductions in the hope of producing the least disruption to programs and personnel. Officials try to dampen the antagonism and weaken the resistance of internal and external groups adversely affected by the changes.

The authors note several other tendencies in the four communities. Almost every place found some substitutes for local revenue, primarily from state and federal sources. Even where formal authority was already strong and centralized, there was an additional effort to centralize authority, especially in the area of budgetary control. Somewhat surprisingly, neither external groups nor city employees were very effective in slowing down or deflecting proposed reductions in expenditures. They conclude that those cities with more centralized control and less political decision-making controls are likely to be more effective in managing the retrenchment process. In particular, the authors conclude that council-manager communities often handle cutbacks better than can cities with other forms of government.

Findings from the four case-study analysis led Levine, Rubin, and Wolohojian (1981) to conclude that

a clear relationship [exists] between revenue levels and the choice of retrenchment strategy. . . . [T]he deeper the decline and the longer it lasts, the more likely that cuts will be targeted, that programs will be terminated, and that personnel will be reduced by layoff than by attrition. (p. 194)

In other words, the more severe the decline, the more likely local governments engaged in cutting and smoothing strategies. The research did not show, however, that responses to fiscal stress followed a linear or fixed sequence of stages. Only in Oakland did declines in revenues result in a sequential pattern of stretching and resisting strategies followed by cutting and smoothing strategies. In Cincinnati, cutting and smoothing came first and was followed by stretching and resisting. In Baltimore, officials employed different retrenchment strategies at the same time.

A case study by Dougherty and Klase (2009) of eight Mid-Atlantic states' responses to fiscal stress in the early 2000s found strong support for the administrative response model advanced by Levine, Rubin, and Wolohojian (1981). Unlike Levine, Rubin, and Wolohojian (1981), however, Dougherty and Klase (2009) found that the "stages of fiscal stress for states are [emphasis added] fixed in their sequence" (p. 616); as severity increases, state-administrator responses move from stretching and resisting to cutting and smoothing.

The findings section that follows uses qualitative (primarily journalistic) evidence as well as quantitative evidence to assess the response of American fire departments to the Great Recession and its lingering effects. Based on the seminal cutback management research by Levine (1978) and Levine, Rubin, and Wolohojian (1981), the argument advanced in

this article is that if a fire department experiences organizational decline, the most appropriate *cause* for the fiscal stress is *environmental entropy* — the environment is unable to support the organization at prevailing levels (see Levine, 1978). The literature offers no evidence that fire departments generally suffer from any of the other three causes of organizational decline discussed by Levine (1978): (1) political vulnerability (lack of a history of excellence, expertise, or positive self-image); (2) problem depletion (the problem/issue the organization was created to address is solved); or (3) organizational atrophy (declining performance because of system or management failures). Findings are summarized using the cutback strategies identified by Levine, Rubin, and Wolohojian (1981) as organizational benchmarks indicating *severity* of decline, with stretching and resisting cutback strategies being less severe than cutting and smoothing strategies.

Findings

Firefighters are the *rock stars* of municipal employees; they are highly regarded generally by the public (Corso, 2009) and receive stellar evaluations by the citizens they serve (Miller & Miller, 1991). In turn, the belief among firefighters that the work they do is valued and supported by community members is important to their willingness to put in extra effort (Lee & Olshfski, 2002). Using survey data, Lee and Olshfski (2002) isolated the source of firefighters' commitment as public servants: "It was their job. Firefighters were committed to their job and to the role in the community the job imposed on them" (p. 112). Walters (2011) explicates further the special place of firefighters in the city.

As a matter of political gospel — and survival — firefighters are sacrosanct. No matter the depths of a municipality's budget crisis, neither the firefighters' ranks, pay, nor benefits are touchable. There are no reductions in force for firefighters. Yet, in cities all across the country, that is exactly what has been happening. The men and women . . . are becoming as vulnerable to budget cuts as other municipal employees. (p. 1)

In order to gauge the breadth and depth of the budget cuts on the American fire service, in April, 2009, the International Association of Fire Fighters (IAFF) sent an electronic survey entitled *Economic Crisis: Staffing Survey* to their 3,000-plus affiliates in the US and Canada. The survey asked respondents to use the date September 1, 2008, as the point of reference when reporting staffing changes. Union staff sent the survey to members again in January, 2011, and updated their database. In total, of all the US union locals contacted, 1,610 responded to the survey by January 11, 2011 (52% response rate). These data provide to date the most comprehensive, systematic overview of the impact of the recession on the American fire service.

Table 1 summarizes aggregate cuts across all US departments. Following the lead of Levine, Rubin, and Wolohojian (1981), the table shows cutbacks based on severity — with stretching and resisting strategies being less severe and cutting and smoothing strategies more severe.

Stretching and Resisting Strategies

Table 1 shows two strategies used by fire departments to *resist* further fiscal stress and *stretch* their resources: furloughs and downsizing through attrition. About 40 fire departments (2.5%) used furloughs, and almost one-third (30.5%, $n = 492$) of the departments experienced positions lost through attrition. In fact, for

all reported cutback actions reported in Table 1, *cuts through attrition* was the most frequently used strategy among the affiliates. Furloughs allowed departments to save positions. In Baltimore, for example, city leaders gave firefighters the option of taking five to eight furlough days instead of the potential loss of 100 firefighters (Walters, 2011). In 2010, hundreds of Phoenix (AZ) firefighters saved three engine companies and 40 jobs by voting unanimously to take a 2% cut in pay and four furlough days over the next two years (Holland, 2010). Instead of using furloughs as a resisting strategy, firefighters in Orlando (FL) agreed to forgo raises and made concessions in educational expenses and uniform allowances to

Table 1: Economic Crisis: Staffing Survey Report (US) (1,610 US union locals responded nationwide).

Stretching and Resisting Strategies	Percentage of Respondents
Furloughs (S&R-1)	
Locals with proposed employee furloughs	8.32
Locals with implemented employee furloughs	2.48
Locals with no employee furloughs implemented or proposed	89.19
Positions Lost Through Attrition (S&R-2)	
Locals with positions lost through attrition	30.50
Locals with no employee positions lost through attrition	69.50
Cutting and Smoothing Strategies	Percentage of Respondents
Layoffs (C&S-1)	
Locals with proposed layoffs	20.31
Locals with implemented layoffs	4.04
Locals with no layoffs or proposed layoffs	75.65
Company Closures (C&S-2)	
Locals with proposed company closures	10.62
Locals with implemented company closures	4.41
Locals with no company closures implemented or proposed	84.97
Station Closures (C&S-3)	
Locals with proposed station closures	9.32
Locals with implemented station closures	2.80
Locals with no station closures implemented or proposed	87.89
Brown-outs (C&S-4)	
Locals with proposed company/station brown-outs	5.65
Locals with implemented company/station closures per day/shift	6.71
Locals with no company/station brown-outs implemented or proposed	87.64

Source: *Economic Crisis: Staffing Survey*, International Association of Fire Fighters (IAFF), April 2009 and January 2011⁴

save the jobs of 46 colleagues. The department had previously lost 26 positions through attrition (Ballam, 2010).

To avoid layoffs, local officials have saved fire-and-rescue positions through retirements and voluntary resignations during the past few years. According to Lori Moore-Merrell, an IAFF Assistant to the General President, "It's really overwhelming, Cities big and small are offering early-retirement and early-out programs, leaving vacancies unfilled." (Moore-Merrell as quoted in Ballam, 2010, p. 1). In the city of Covington (population 40,600), the fifth largest city in Kentucky (KY), the city commissioners voted to cut fire positions through attrition. Public safety represents two-thirds of the city budget, with the police and fire department each receiving a one-third share. To trim the budget, the fire chief proposed not filling five positions and cutting overtime to save \$600,000 (Fox19.com, 2012). Every state in the union has lost positions due to retirements and resignations except Delaware, Hawaii, North Dakota, South Dakota, and Wyoming.⁵ Twenty-one states show that 30% or more of the affiliates have experienced layoffs through attrition. Eight states show that 40 to 50% of the responding union locals reported attrition layoffs: Massachusetts (50%), Alaska (50%), California (49%), Rhode Island (46%), Kansas (46%), Virginia (43%), Michigan (41%), and New Jersey (40%).

Previous research by Levine (1978) and Levine, Rubin, and Wolohojian (1981) identified a number of other stretching and resisting strategies that governments can use to mitigate the impact of fiscal stress such as mobilizing dependent clients; educating the public about the agency's mission; increasing productivity; sharing agreements with other jurisdictions; and raising revenue through taxes, fees, and grants. Data collected by the IAFF do not include systematic evidence about the use of these types of cutback strategies, but a large body of anecdotal and journalistic evidence does exist. The following three examples are illustrative of this literature:

1. In terms of resisting cutbacks and educating the public, the fire chief in Moline, IL, tendered his resignation after the city council voted to eliminate 12 firefighter/paramedic positions and privatize the emergency medical services for the community. The chief argued, "Their [the city council] number one priority should be the safety of their citizens. They care more about worrying about brick streets and leaf blowing" (Firehouse.com News, 2011, p. 1).
2. In June of 2012, the IAFF (2012) announced that 28 US cities had secured federal largess through Staffing for Adequate Fire and Emergency Response (SAFER) grants administered by the Federal Emergency Management Agency (FEMA). In total, FEMA awarded 69 million dollars, with the largest grant in the

history of the program going to Detroit, MI. The announcement of the \$22 million grant to Detroit came two days after the mayor threatened the proposed termination of 164 firefighters due to budget cuts. City officials can use SAFER grants, first enacted in 2009, to rehire previously laid-off firefighters. The grants do not require matching local money and represent, in essence, short-term monies to help municipalities weather the economic downturn.

3. Fire-department consolidation is an example of resisting stress, stretching resources, and enhancing productivity. On January 1, 2010, three municipalities in San Diego (CA) County — El Cajon (population 100,000); La Mesa (population 58,000); and Lemon Grove (population 25,000) — entered into a joint exercise-of-powers agreement for the management and delivery of fire and emergency medical services (Strong Cities/Strong State, 2012). A shared management team known as Heartland Fire and Rescue leads the reorganized (and consolidated) fire service. Officials expect the consolidation to save the cities more than \$500,000 a year.

Cutting and Smoothing Strategies

According to Levine, Rubin, and Wolohojian (1981), as fiscal stress intensifies, city leaders balance budgets using cutting and smoothing strategies. In the case of the fire service, this means layoffs, company closures, station closures, and brown-outs (temporary closures). Before examining IAFF data about the use of these strategies, some clarification of terms might be useful:

1. With respect to a *fire company*, National Fire Protection Association® (NFPA®) Standard 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*, recommends that a fire company be staffed with four firefighters, including a company officer, and that the company officer must remain as part of the company; he or she can't stay outside the building as Command. The standard further outlines that one firefighter will staff the pump, one firefighter will secure the water supply, and two firefighters will advance the hoseline (Kirby and Lakamp, 2012, p. 1). The loss of a fire company is a significant cutback.
2. A brown-out occurs when officials take an engine or ladder company out of service temporarily and the company members are reassigned to fill in personnel gaps in other companies (see McDonald, 2011). In 2011, for example, Fire Chief Willie McDonald proposed a flexible brown-out plan to the mayor and city council

of San Jose, CA, with savings equalling over \$3.5 million dollars (McDonald, 2011). Under the plan, the seven fire stations in San Jose with two companies would no longer have both companies staffed, in-service, and ready to respond to emergencies at all times. Two fire companies would be subject to a brown-out each day based upon available on-duty staffing across the seven stations. Firefighters from the two brown-out companies will be reassigned by senior officers to fill in for absent personnel or to perform other departmental duties and activities. In addition to the money saved, the brown-out plan allows all seven fire stations to remain open.

3. For purposes of this article, a brown-out is considered a smoothing strategy. As defined by Levine, Rubin, and Wolohojian (1981), smoothing is an administrative reaction to cutting. City leaders attempt to improve the most negative consequences of reductions in the hope of producing the least disruption to programs and personnel (pp. 45–46). Levine, Rubin, and Wolohojian (1981), in fact, suggest that management “may attempt to regain greater control over manning levels, promotions, hours, and shift assignments” as a smoothing strategy (p. 46).

Turning to the IAFF data in Table 1, of the various cutting and smoothing techniques used across the 1,610 union locals, administrative decision makers implemented brown-outs in 6.71% of respondents or 108 cities. The brown-outs were used to mitigate the impact of implemented layoffs in 64 of the affiliates (4%), company closures were used in 71 cities (4.41%), and the potentially more severe cutback strategy of closing fire stations was used in 45 jurisdictions (2.8%). As noted earlier, a fire station can house two or more companies, thus explaining the larger implications of closing a fire station versus a company.

A story from Baltimore, MD, highlights the fact that these cuts have human as well as safety implications (Campbell, 2012). In a cost-saving move to address a \$48 million budget shortfall, three city fire companies recently closed in Baltimore. One ladder truck (Company 15) occupied the firehouse on North Montford Street. The truck and the century-old company were taken out of service in the summer of 2012. The closing was emotional for the firefighters who constituted the company. Company officer, Captain Jim Oliver, mused that he had spent as much time with firefighters in Company 15 as he had with his own family (Campbell, 2012, p. 1). Local citizens also expressed concern for the company closing. Although the station will now be home to Engine 33, this fire apparatus does not have a ladder. Residents remember the occasions when a ladder was required to rescue residents in the neighbour-

hood over the years and were concerned that “Engine 33 won’t effectively replace the [ladder] truck” (Campbell, 2012, p. 2).

Cutting and smoothing strategies disaggregated to the state level show the following information:

- Union locals in Georgia (29%), Alabama (15%), Rhode Island (13%), Louisiana (10%), and Montana (10%) experienced double-digit layoffs.
- Affiliates in 11 states experienced double-digit brown-outs, including Iowa (31%), Alaska (25%), Wyoming (25%), Massachusetts (16%), Kansas (15%), New Hampshire (15%), New York (13%), Alabama (10%), Louisiana (10%), Montana (10%), and West Virginia (10%).
- Fire Departments in Arkansas (17%), Louisiana (15%), Georgia (14%), Massachusetts (11%), Florida (10%), and Montana (10%) report double-digit station closures.
- Only one state reported that more than 10% of the union locals had station closings: Georgia (14%). South Carolina (9%), Indiana (9%), Massachusetts (8%), and Utah (8%) approached the double-digit benchmark.

Discussion

The purpose of this study was to analyze the degree to which the Great Recession and its aftermath affected US fire departments. Using quantitative data provided by the IAFF and qualitative accounts from fire-related websites and newspapers, findings suggest that the recent economic downturn has been hard on fire departments across the nation. Three out of ten of the union locals (30.5%) reported losing positions through attrition. Levine, Rubin, and Wolohojian (1981) argue that positions lost through attrition are strategies used by local officials to *resist* further fiscal decline, and furloughs are examples of stretching existing resources. When resisting and stretching are not enough to stave off financial woes, next comes cutting and smoothing. And while the loss of jobs by layoffs across the union locals was only about one-eighth (13%) as frequent as not filling jobs vacated through attrition, the scope of the impact of the economic distress facing US fire departments is significant. Dozens of fire departments across the states are experiencing company closures, station closures, and brown-outs. In an article appearing in the August 26, 2010, issue of the *New York Times*, Cooper (2010) argues that the “Fire service was once a sacred cow at budget time. But the downturn has lingered so long that many cities, which have already made deep cuts in other agencies, are now turning to their fire departments” (p. 1). It seems Cooper was right.

The present study adds to the literature on fiscal stress and cutback management in two important

ways. First, unlike previous studies, the focus here is on a specific municipal function, fire and rescue services, instead of analyzing fiscal stress for a group of cities or states. This micro- versus macro-perspective provides the opportunity to examine reactions to fiscal stress across functional municipal areas. Second, data used in the analysis are systematic and comprehensive and provide an excellent overview of a large sample of cities' responses to fiscal stress.

In contrast, previous research has most frequently used the case-study methodology. The trade-off, of course, is that the cross-sectional IAFF data does not allow for a testing of the temporal nature of cuts (e.g., did resisting and stretching strategies precede cutting and smoothing?). The case-study approach allowed Levine, Rubin, and Wolohojian (1981) and Dougherty and Klase (2009) to determine the timing of cuts. In addition, case studies allow for the examination of a larger range of cutback management strategies used to combat fiscal stress such as productivity measures, management improvements, use of impact fees, etc. The use of survey research to gather nonstaffing and/or service-level cuts would add to the depth and breadth of our understanding of responses to fiscal stress.

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- ²Miller (2010) argues that “According to the Brookings Institution, ‘most economists’ deem the recession to have ended with the U.S. gross domestic product’s expansion in the third quarter of 2009” (p. 33). In the present study, unless stated otherwise, the term Great Recession refers to the period 2007 through 2012.
- ³For a discussion of organizational leadership in a global environment defined by permanent crisis, see Heifetz, Grashow, and Linsky (2009).
- ⁴We would like to thank Dr. Lori Moore-Merrell, Assistant to the President of the International Association of Fire Fighters (IAFF), and her staff at the IAFF for sharing the *Economic Crisis: Staffing Survey* data with us.
- ⁵State-level data is not shown in Table 1.

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Endnotes

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Mind-Body Integrative Training: Firefighter Personal Protective Equipment (PPE)

Abstract

*The purpose of this research is to determine if differences in performance outcomes exist between the use of paramilitary instruction and a method of teaching informed by the Chinese philosophy *Tài Chí* when learning to don structural fire-fighting clothing or personal protective equipment (PPE). We hypothesize that keeping students in a process focus (i.e., *Tài Chí* method) rather than a high-pressure outcome focus (traditional paramilitary method) results in increased proficiency in the skill-performance outcomes (Selk, 2009). The assumption is that *Tài Chí* helps integrate students' minds and bodies in the learning process and results in a higher quality of motor learning. The hypothesis is tested using an experimental design with test and control groups of students from Utah Valley University (UVU). Both the speed and degree of mastery of the skill are tested based on state standards for firefighters. Findings provide evidence that the steady motor-training method (*Tài Chí*) is a better approach than the traditional paramilitary technique of teaching the skill of donning structural fire-fighting equipment.*

Introduction

In modern society, a system of emergency response has been developed to protect citizens of our communities against the threat of fire. This system is comprised of dedicated, hard-working, and well-trained firefighters. For the majority of fire-fighting personnel, needed training is delivered by a fire academy. The National Fire Protection Association® (NFPA®) has established clear certification safety *standards* for these academies. Furthermore, state fire officials have mandated specific certification standards based on job-performance requirements that each person must meet to achieve the title *firefighter*. Because of these standards, a majority of fire programs adopt a paramilitary environment for such training. The term *paramilitary* refers to the organization of the program resembling that of military basic training, wherein the teaching style emphasizes high-stress environments focusing on accomplishing tasks in a given time period. This instructional environment is designed to help recruits achieve the standards set forth by the governing bodies. One particular aspect of learning focuses on *turnout drills*. These drills are designed to teach the recruits how to don their personal protective equipment (PPE) in an emergency.

Utah Valley University's (UVU's) Recruit Candidate Academy (RCA) has adopted this paramilitary teaching context and its methods. Recruits are introduced to the proper way of donning their PPE. Recruits repeatedly practice the process. After some practice, the instructors begin to implement punishment for failure to complete the skills correctly. A time limit is established; and if not met, a physical activity is implemented as a fixed punishment. This punishment is usually in the form of push-ups, calisthenics, or running. Candidates are drilled, tested, and so punished until they complete

the skill within the allotted period of time. Any step that is skipped in the performance of the skill is regarded as incomplete and results in a failure of the test.

The method in which the UVU's RCA uses paramilitary tactics and high-stress environments may, in fact, not be the most effective way of educating new recruits. Theory and research from sports and performance psychology suggest that the use of high-stress training combined with interrupted motor training is less effective than steady motor training provided in less stressful environments. Research reported here examines potential benefits gained by the use of steady motor practice instead of having recruits try to dress quickly under the pressure of being punished.

Literature Review

The majority of current practices used in preparing athletes (or in our case firefighters) for competition revolve primarily around practice of the technical aspects of movement with far less emphasis placed upon systematic training (Abernethy, 1999). Applied to firefighters, the step-by-step process of donning PPE is emphasized and affirmed by instructors closely inspecting student performance for missed steps like enclosures not being closed or skin being exposed where the garments are meant to overlap. Abernethy (1999) contends that not all types of practice are likely to be equally effective in promoting the development of expert performance. That being said, there are two options of training that can be used: (1) demonstrating an example of putting on PPE and allowing firefighter recruits to develop their own processes of donning the gear but emphasizing haste and completely donned ensembles or (2) demonstrating the steps of donning

the PPE and encouraging students to use a steady rhythmic approach to practicing and allowing speed in dressing to come naturally. Traditionally, as noted previously, UVU's RCA employed the first instructional method. In this study, firefighters learning to don their PPE using this method were called the control group. In contrast, firefighters using the second method (steady rhythmic approach) to don their turnout gear became the test group. We assumed that when tested, the recruits who use the steady rhythmic approach to practice getting into their PPE would have a higher rate of proficiency than the control group. *Proficiency* is defined as the degree to which students completed the required step in less than or a time equal to the maximum amount of time set by the fire-academy standard.

MacPherson, Collins, and Obhi (2009) explain that nonrhythmic movement characterizes inefficient or suboptimum movement performance. In contrast, rhythmic movement can improve gross motor skills performance; one ought to regard rhythm as a critical component of preparing for psychophysical performance (MacPherson, Collins, & Obhi, 2009). It was this overall rhythmic steady motor training that we believed would be an ideal method of learning new skills required in the donning of PPE.

The second aspect of the current UVU's RCA training method is inducing a high-pressure environment, particularly by punishing students for inadequate performance. This method, however, tends to decrease the proficiency of performance of unmastered skills during their acquisition. Yerkes and Dodson (1908) found that the relationship between arousal and performance proficiency approximates an inverted *U*, such that the optimum level of arousal is inversely related to task difficulty. Jackson and Csikszentmihalyi (1999) have called optimal performance *the flow*, which is a balance between the person's current ability and the challenge of the task being performed. The more the challenge exceeds the person's skill competence, the greater the experienced arousal and lower the efficacy in the performance. Christianson (1992) explains that excessive emotional arousal beyond what is individually optimal is correlated with successively lower degrees of learning and memory. In the case of the UVU's RCA, the high-stressed training method used can very easily push recruits over the optimal level of pressure and anxiety. In fact, the time pressure and threat of punishment tended to increase the perceived size of the challenge for many students. On the other hand, we believed that the steady rhythmic approach to practice would more likely maintain the balance between the challenge of the skill and motor-skill level as it developed and thus approximating each candidate's relative optimum arousal.

In addition, Christianson (1992), quoting Mandler (1975), explains about the physiological effects of the high-stress training method:

In situations in which the arousal of the sympathetic nervous system or emotional arousal becomes very intense, "it floods the attention mechanisms and decreases the amount of information that the organism can recruit effectively either from the environment or from its own memory store." (p. 298)

As such, due to the proven negative effects of anxiety, especially in the training of novice entry-level learners, a steady rhythmic approach may prove more beneficial. The UVU's RCA instructional program should consist of strategies aimed at encouraging a positive appraisal of the challenge and personal capabilities of the learner (Hill, Hanton, Fleming, & Matthews, 2009). By decreasing the amounts of stress and anxiety involved, the use of effective steady rhythmic training could result in higher levels of skill proficiency.

Experiencing *the flow*, or optimal performance, is more than just focus; it is a harmonious experience of mind-body integration that feels effortless and as if something special is happening (Jackson & Csikszentmihalyi, 1999). For example, Maslow (1994) explains that people who have such peak experiences feel a unity or convergence of all things in the moment. In other words, there is a perceived seamlessness between an individual's sense of self and his or her environment.

Mind-body integrative training is inspired by the ancient martial arts philosophy and method for teaching Kung Fu known as *Tài Chí Chuán*. While the philosophy of *Tài Chí* has many metaphysical principles involved in its theories and practice (Lo, Inn, Amacker, & Foe, 1979), its primary importance to this study is its focus on mind-body integration. Strength and speed come through the economy of motion of its flowing style. *Tài Chí Chuán* says,

If there is any uncoordinated place, the body becomes distorted and weak. First the mind is used to order the body. Later your body can follow your mind, and you can control yourself and still follow your opponent. (Lo et al., 1979, p. 74)

The principle of learning each step of a skill one by one and not getting the body ahead of the mind's ability to organize the movements is important. The idea is to allow the speed of the trainee to increase naturally as the steps in donning PPE gear are learned through practice without tension. Carlstadt (2004) points out that when a person is under pressure in a critical moment in sports, the increased anxiety can manifest itself physically in the increased flexing of the primary muscles that the athlete needs to move as intended, but opposing irrelevant muscle structures also increase in flex, which results in increased rigidity of movement. Even if this state of affairs is subtle, it can throw off the accuracy of performance in fine and gross motor skills.

While certification testing must be about proficiency of outcomes, our approach to training is to focus on the process rather than outcome. Selk (2009) says that *outcome focus* is a perspective that can undermine the success in performance of athletes and others. *Process focus* keeps the person on-task with his or her mind and body integrated. When the mind gets ahead of one's body and the action in the situation, he or she becomes vulnerable to skipping steps in the task. As such, the continuity of a step-by-step sequence begins to collapse, which influences task proficiency. When fire-fighting students are prodded by the instructors to concern themselves with speed, the students can become outcome focused when attempting to learn a skill. Moreover, when a student is told that failure to complete the task in the required time can prevent him or her from becoming a firefighter, the outcome stakes become *very high*. Our experiment examined the difference between (a) an outcome-focused, time-constrained, high-pressure skill drilling with (b) a process-oriented, lower-pressure, and flowing style of practice for improving the speed and accuracy through which fire-fighting students learn to don PPE.

Hypotheses

Based on the literature review, this study tested the following hypothesis: Steady motor training is more effective than high-pressure, high-stress motor training.

H_0 : There is no difference in produced skill proficiency between traditional high-pressure PPE turnout drills and relaxed steady-paced PPE donning rehearsal.

H_1 : Relaxed steady-paced PPE donning instruction produces increased skill proficiency when compared to traditional high-pressure PPE donning drills.

Methodology

As noted previously, to test this hypothesis a controlled experiment was conducted with two groups comprised of 32 participants in a control group and 30 participants in the test group. The independent variable for our experiment was the teaching style by which individuals were trained in donning their PPE. The control group was taught using the paramilitary method that stresses high-pressure, high-stress motor-training conditions currently used in many fire academies. The test group was taught using rhythmic, steady motor training. The dependent variable was the performance proficiency test of the certification standard for donning the gear in 45 seconds with no errors (skill mastery).

We used convenience sampling of university students to obtain our sample of 62 participants. Because recruit academy training works with mostly college students that are roughly 18 to 30 years of age, it was important that both of our groups were comprised of

individuals within that age range. Participants were recruited from the UVU campus, the surrounding community, and our beginning emergency medical technician (EMT) courses. Because the study examines performance proficiencies acquired through training, we excluded volunteers who had prior training in donning fire-fighting PPE. Because of the physical requirements of the study, volunteers with medical conditions, as determined by the review of consent forms, were excluded from participating. Participants were subdivided into manageable *learning-group* sizes of 10 to 15 members.

Study participants were fitted with PPE supplied by UVU. The gear consisted of (1) one fire-approved helmet with face shield; (2) a flame-resistant overcoat donned with hooks and Velcro®; (3) fire-resistant trousers with suspenders, again attached by Velcro® and hooks; (4) fire-protective gloves and hood, and (5) rubber steel-toed fire boots. The study leaders taught the study participants (firefighters-to-be) how to put on their PPE by donning their own PPE, explaining each piece and enclosure so that the learners could do it correctly. Then the study participants practiced donning the gear with the instructors, who either ordered them to go faster and mentioned push-ups for punishment (the control group), or they were encouraged to relax, take their time, and let the skill improve with repetition (test group).

Groups were trained for approximately one hour and tested for skill proficiency. Study leaders recorded for each study participant the time taken to fully don the PPE and the amount of mistakes he or she made within that time. However, the standard required no mistakes and completion in 45 seconds or less. Therefore, any mistakes theoretically meant the time kept running, even though a participant may have believed he or she had completed the skill accurately.

Our data-collection instrument was a skill-proficiency sheet listing the required steps to don PPE according to the certification standard. Each participant was observed by a study leader who timed the test and recorded each completed step in the PPE donning test. The researcher stopped the time when the participant clapped his or her hands signaling that he or she believed the skill was complete. The required steps were (1) don fire-resistant hood, (2) don and fasten all closures on pants/boots and coat, (3) turn up collar on coat, (4) don helmet and tighten chin strap, and (5) don fire-fighting gloves. If the individual being tested did not complete one of these five tasks, it was considered a failure of the test. The researcher examined the participant's PPE to check for unclasped enclosures, gaps between garments where they were designed to overlap, and garments that had not been donned. The observations were recorded with the time on the skill-proficiency sheet. Binary designations of pass or fail from these sheets were entered into Statistical Package for Social Sciences (SPSS) statistics software for analysis.

Data Analysis

Figures 1 through 3 show the data for both the test and control groups. **Figure 1** provides a breakdown of individuals in the test and control groups who passed or failed the Utah state standard in regards to the time it took them to completely don their PPE. As the data indicate, 19 passed and 11 failed the PPE turnout drill among study participants using the rhythmic steady motor training (i.e., the test group). Comparable figures for the control group using the high-pressure paramilitary method were 17 individuals passed and 15 failed.

Figure 1: Pass/Fail Rate of the Utah State PPE Turnout Drill for Test and Control Groups.

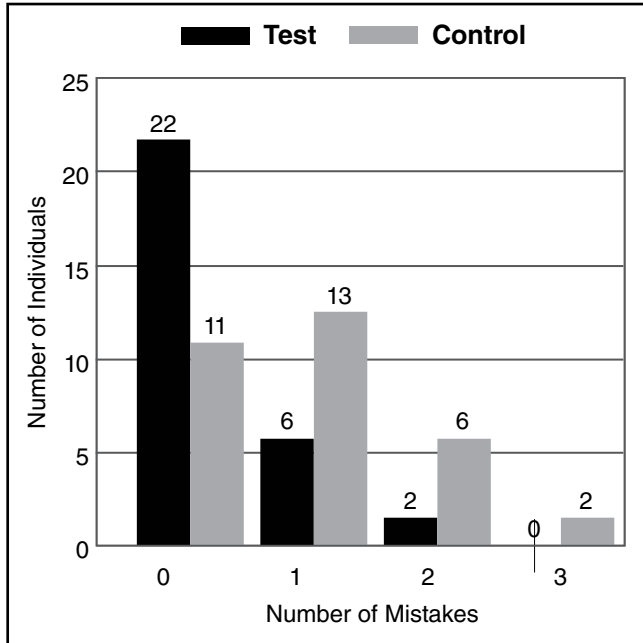


Figure 2 shows the frequency of individuals who completed the PPE turnout drill in less than 30 seconds, 30 to 34 seconds, 35 to 40 seconds, 41 to 45 seconds, and 46 or more seconds. For test-group participants, no person completed the drill in less than 30 seconds, 5 people took 30 to 34 seconds to don their PPE equipment, 11 participants took 35 to 40 seconds, 3 individuals completed the task in 41 to 45 seconds, and 11 test group members took 46 seconds or more to complete the task. For control-group participants, the statistics were, respectively, 0 (less than 30 seconds), 5 (30 to 34 seconds), 7 (35 to 40 seconds), 5 (41 to 45 seconds), and 15 (46 seconds or more).

Finally, **Figure 3** details the number of mistakes (from 0 to 3) that study participants made when donning their PPE for both test- and control-group members. The frequency of mistakes among test-group members were 22 people made no mistakes, 6 individuals made one mistake, 2 participants made two mistakes, and 0 people made three mistakes when donning their PPE. For control-group members, 11 people made no mistakes, 13 individuals made one mistake, 5 participants made two mistakes, and 2 members made three mistakes.

Figure 2: Frequency of Time (in Seconds) to Complete PPE Turnout Drill for Test and Control Participants.

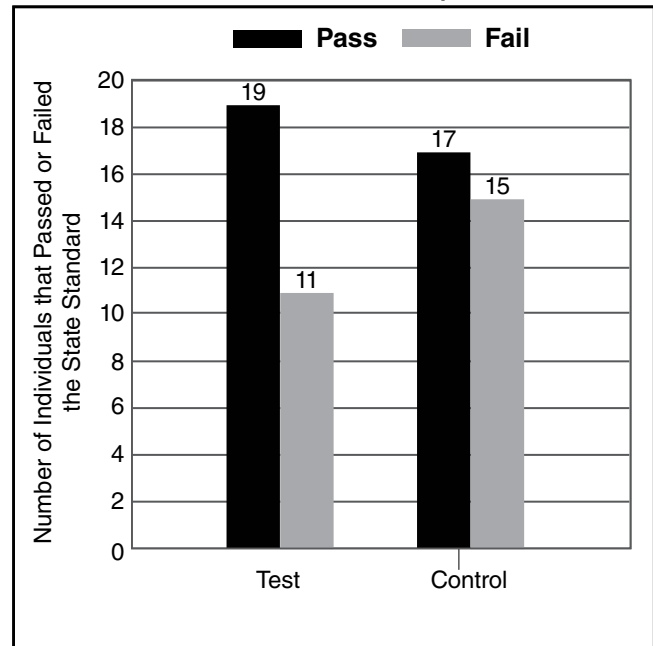
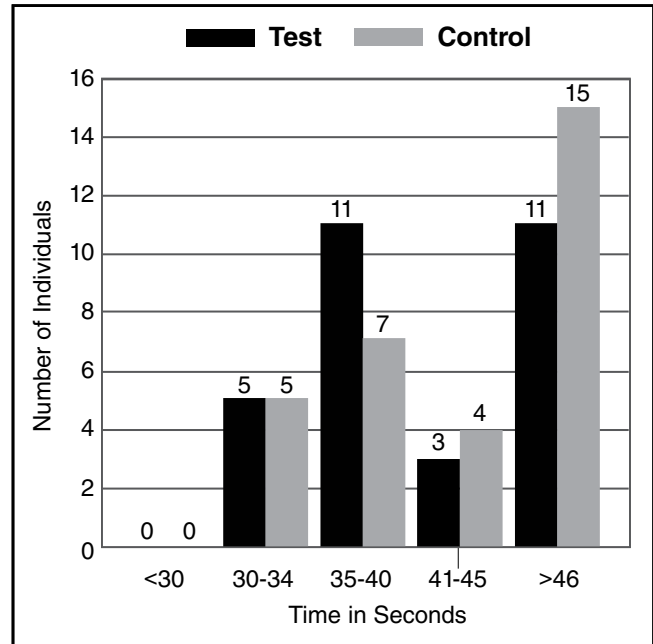


Figure 3: Number of Mistakes (0 to 3) for Test and Control Group Participants.



Two different methods were used to analyze study data. The first method was a z-score test using individuals' times in both the test and the control groups. Given that this was a left-sided test, the z-score had to be less than $-Z$ alpha (which in this case was -0.05) to show a statistically significant difference between the two groups and thus allow the study researchers to reject the null hypothesis. The null hypothesis stated that there is no difference between traditional paramilitary, high-pressure PPE donning drill instruction and relaxed, steady-paced PPE donning instruction. The null hypothesis could be expanded further because time is directly dependent upon an individual's ability to

pass Utah's state standard for firefighters by completing each step of the exercise. The calculated z-score for the time was -1.645. Based on individuals' time (and their pass/fail rate), the data showed that there was no statistically significant evidence to reject the null hypothesis. However, each individual's time was stopped when he or she believed that the task had been completed according to the standard. Our calculation of mistakes indicates that not all who believed they had made the time actually did so due to errors in their performance.

The second method used to analyze the data was the Fisher's Exact Test, which analyzes the statistical difference between the mistakes made by both the control and test groups. Mistakes, however, are interesting in the fact that they directly determine skill mastery. In other words, the amount of mistakes made directly indicates the degree of deficiency for a skill requiring mastery. Therefore, one mistake was a failure to demonstrate proficiency but multiple mistakes indicated lower degrees of deficiency as they accumulated. When testing for differences in mistakes between the test and control groups, our results showed a p-value of 0.0000051. This p-value is below 0.05, which indicates that there is a statistically significant difference in mistakes made between test- and control-group members. Based on this finding, we can reject the null hypothesis. In other words, the data shown suggest that rhythmic steady motor training is a better method of teaching the skill of donning structural fire-fighting gear.

Discussion

In general, from a pure numerical point of view (see Figures 1 through 3), the test group seemed to outperform the control group in *both* the PPE donning speed rate and in skill mastery, but statistically speaking our test group only showed higher skill mastery. Because study researchers stopped PPE drill time based on a student indicating he or she believed the task had been completed, completion times do not necessarily reflect a *passing* of the skill. In other words, a student could believe that he or she had successfully donned the PPE when in reality he or she had actually forgotten or insufficiently donned the safety equipment. We believe the state of affairs supports the old adage that *haste makes waste* in the sense that students leave themselves vulnerable to injury and possible death by donning gear in a rapid but deficient manner. Perhaps over time such errors in donning gear would be corrected with more and more practice. However, as fire-fighting instructors and/or researchers, we believe that mastery first and speed second should be the order of priorities in fire psychomotor-skills acquisition.

The control group used in the study was based on the need for building high-stress, high-stake consequences so as to sufficiently test the hypothesis of

whether the paramilitary teaching/learning environment is beneficial or not. However, due to the study-recruitment process, that study participants were told that they were participating in an experiment, and that volunteers were used, clearly we were limited in the level of the stressors we could introduce. In contrast, in the real world fire-fighting recruit candidates who wish to become firefighters as their terminal objective *must* successfully complete the PPE basic-training drill and receive certification. Without the high-stakes consequences of getting dismissed from the academy and excluded from continuing, the anxiety for the control group was likely less than genuine.

The experiment provided no ethical or practical way that we could have simulated the testing to have genuine high-stakes testing anxiety as a part of the study. In short, a limitation to this study is that *real* firefighter candidates under high-pressure training may have a cumulative effect of high-stakes testing anxiety, peer social pressure, and the aversion to failing. On the other hand, we can say that *real* recruits in high-stakes situations would benefit from having the performance and social anxiety dimensions moderated through a less-pressured learning environment. Therefore, our results show that skill proficiency is met more often through mind-body integrated methods of practice without added pressures by the staff, but we cannot account for a student's own test anxieties and social anxieties in the context of a real academy. Evidence presented here supports the idea that *Tài Chí* style teaching is still more efficacious while being less impacting on the recruit's sense of self-efficacy and self-concept as an emerging firefighter. Furthermore, based on the statistical data analyzed, *Tài Chí* may, in fact, be the better alternative simply because it has shown to increase skill proficiency. Perhaps incumbent firefighters who use the mind-body integration (*Tài Chí*) style of skills practice might polish and improve their own skill proficiency in both accuracy and efficiency. Test-retest experiments using incumbent firefighters can help answer this question.

From a historical standpoint, high-pressure paramilitary style training is intended to psychologically and emotionally inoculate recruits from stress and help them build coping abilities and focus under pressure. In lay terms, this type of teaching is meant to *toughen* them up for the real world of fire fighting. In some cases, academy staff may be found to deride, insult, challenge, and intimidate recruits with the intentions of *turning up the heat*. In the present study, we did not employ any of these tactics for ethical reasons. Moreover, we do not believe such tactics are appropriate teaching tools. However, the fire service is full of anecdotal stories of autocratic and even bullying staff in basic-training programs. We believe our results show this approach undermines student success.

Perhaps teaching mental skills apart from psychomotor fire-fighting skills is a better approach. Teaching people to cope emotionally while trying to learn a new psychomotor skill might be too much. There may be individuals who are excluded from fire-service careers based on not doing well in developing mental/emotional resilience while at the same time performing motor learning to increase physical coordination. Historically, in the fire service there may have been needless exclusion of candidates who would have otherwise done fine without the ceremonial high-pressure traditions. We suggest that the skills be acquired first to the level of mastery and then introduce a high-pressure environment.

Study Limitations

We firmly believe that this study has significant implications for fire-service training in general. However, we also recognize that performing such skills in a controlled environment is likely to limit the study's ecological validity. The rapidly changing and serious nature of real fire scenes does not allow firefighters the opportunities for mistakes that our experimental design provided them. On the other hand, that is exactly why firefighters must first attend training academies for instruction before they are allowed on the fireground.

Experiment participants were drawn from the student body of a university. As such, the generalizability of the results is limited to college students learning how to don PPE using two different instructional methods. Findings might be different for a different learner demographic. For example, adult learners who have had intense and pressured life experiences may have developed coping mechanisms that would aid them in skills acquisition using high-stress instructional techniques. However, we believe that using research participants in the environment of the actual Utah Fire and Rescue Academy and using standard-issued firefighter equipment provided a sufficient degree of real-world simulation to a typical academy-training environment. The study was also limited owing to the duration of practice time that participants were given to mastering PPE donning skills. Perhaps with hours of practice using the traditional paramilitary method or the steady rhythmic style, the statistical differences we found in the experiment would disappear. Overall, however, we believe that the results reported here are useable outside of the experimental context we created, and we urge others to replicate the study.

Conclusion

The purpose of this study was to test the hypothesis that steady psychomotor training is more effective than high-pressure, high-stress motor instruction when used to teach firefighters the skills required to successfully don their PPE. Data analysis showed support for this hypothesis. These findings could affect the fire community and the way fire academies instruct new recruits. Additional studies are needed to strengthen the case for Tàí Chí style psychomotor training.

Overall, the purpose of standardized testing is to determine whether a fire recruit meets the minimum standard of proficiency, which requires that he or she efficiently perform each step of the task correctly. In the real world, the aspirational standard is for firefighters to do their work as efficiently and effectively as possible in an emergency context. While we believe there is a time and place for high-pressure simulation exercises, there is also a place in firefighter training that allows recruits to learn how to use their PPE and other tools in such a way that creates a greater degree of coordination in manually manipulating these resources for safer and more effective work.

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About the Authors

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The Academic Workshop features articles written by **masters and doctoral students** from domestic or international universities that highlight the use of a quantitative or qualitative methodology, a research design, and/or a conceptual framework applied to fire-service issues and problems. With the continued growth of graduate programs in fire leadership and management, more and more students will prepare papers that can guide research focusing on fire and rescue services. In some cases, the student may have not taken his or her project to the field and gathered data or directly tested her or his research question(s). Nevertheless, these papers represent solid research designs that can help other students conceptualize and formulate how to study fire leadership and management problems.

Articles in *The Academic Workshop* are peer reviewed. As editor of the *IFSJLM*, I first screen an article for possible inclusion in this section. Next, two peer reviewers analyze the article. If all three individuals agree that the manuscript represents a solid learning tool, I invite the author to publish the manuscript in the *IFSJLM*.

The following article was written by Brian Hutchinson, a front-line firefighter of 14 years in the Vancouver Fire & Rescue Services in Vancouver, British Columbia, Canada. The research comes from his masters thesis for his MA degree in Disaster and Emergency Management. The version of the thesis presented here is significantly truncated from his original masters paper and was chosen for inclusion in *The Academic Workshop* as an example of how a qualitative method, in this case ethnography, can be employed to distill important data that can be used to impact program planning and implementation. As such, the version of the paper presented here excises several sections of the paper (e.g., literature review and theoretical framework) from the original longer manuscript. Rather, the focus is on how Brian is able to develop a three-tiered theme analysis based on his semi-structured interview data. Brian's research demonstrates the power and utility of carefully executed qualitative analysis.

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Career Urban Firefighters' Perceptions of Citizen Volunteer Participation in Disaster-Management Response

Abstract

Ethnography is a qualitative methodology facilitating in-depth research into groups sharing a common organizational culture. The purpose of this ethnographic study is to discover obstacles and opportunities for the proposed use of citizen volunteers in the Vancouver Fire & Rescue Services (VF&RS) located in Vancouver, British Columbia (BC), Canada. As proposed, volunteers would be organized into Neighborhood Emergency Assistance Teams (NEATs) and activated for use in disaster events falling outside the normal scope of emergency response. Development of the NEAT program is an effort by VF&RS and the City of Vancouver (CoV) to acknowledge the necessity and critical nature of engaging communities as a means of preparing for catastrophic events (Reynolds, 2012; VF&RS, 2011). Data gathered from semistructured interviews of 26 firefighters and 4 subject-matter experts (SMEs), for a total sample size of 30, were analyzed using thematic network analysis to discover common themes in attitudes and perceptions among the respondents concerning the use of volunteers in delivering fire and rescue services. Emerging from the analysis were 16 basic themes that were collapsed into five organizing themes that, in turn, were organized into two global themes. Global Theme 1, organizational and cultural aspects of the fire service impede innovation and progress in the area of disaster management, points to obstacles in the use of volunteers in the VF&RS. In contrast, Global Theme 2, participatory approaches to disaster management enhance capacity and resiliency of the fire service and society, suggests that interviewees believe the use of volunteers through the NEAT program holds considerable promise for delivering disaster-management services in Vancouver. The article concludes with 14 policy recommendations that provide the VF&RS the opportunity to enhance the development of comprehensive disaster emergency management through strategies incorporating the use of citizen volunteers.

Introduction and Study Context

In Canada and the United States there is a growing recognition that the frequency and magnitude of disasters may at times overwhelm first responders with social, economic, and even political impacts (Flint & Stevenson, 2010; Litzenburg, 2006; Rotolo & Berg, 2011). The City of Vancouver (CoV), an urban municipality geographically located in the province of British Columbia (BC), recognizes that natural and human-made disasters can potentially overcome the resources and preparedness capability of the city, leading to extensive destruction and prolonged recovery (Vancouver Fire & Rescue Services [VF&RS], 2012). Vancouver is home to approximately 600,000 citizens, anchors the third largest urban centre in Canada, and has been identified as having the highest risk of an earthquake, which would likely be the most destructive natural disaster the nation could experience (Government of Canada [GoC], 2012). The VF&RS employs approximately 800 uniformed personnel and provides fire and emergency medical services operating out of 20 fire halls (VF&RS, 2012). In 2011, the organization responded to almost 46,000 calls for assistance.

Recognizing the potential vulnerability of the CoV, the VF&RS has attempted to enhance societal resiliency by calling for a more citizen-based, participatory approach to disaster and emergency response that incorporates community emergency response teams (CERTs) within the formal VF&RS response infrastructure. This CERT model calls for the use of citizen volunteers, which the CoV and the VF&RS have designated as *Neighborhood Emergency Assistance Teams (NEATs)*, that would be activated for use in events that fall outside the scope of normal emergency response (Simpson, 2001). The scenario most often associated with NEAT activation, as perceived by VF&RS and city staff, is the potential for a catastrophic earthquake to impact the geographic area of southwestern BC, the area in which the CoV is situated.

Development of the NEAT program is an effort by both the VF&RS and city leaders to acknowledge the necessity and critical nature of engaging community members in the preparation for and response to catastrophic events (Reynolds, 2012; VF&RS, 2011). According to Flint and Stevenson (2010), this integration of citizen volunteers and formal response agencies supports societal resiliency on both the individual and community levels.

Despite the potential for NEAT teams to augment VF&RS resources, historically the organizational survival of *career urban fire departments* has necessitated the devotion of considerable resources towards the defense of their autonomy by actively resisting the use of volunteers (Dynes, 1994). Moreover, fire fighting has a unique culture based on a shared set of attitudes, values, conventions, and social practices that support the exclusion of those who are identified as *interlopers*, something common among many

cultural groups (Coleman, 2004). Deutsch (2005) notes that those considered cultural outsiders, in this case citizen volunteers, are at a disadvantage due to a lack of knowledge and understanding regarding the norms of behaviour and the system of beliefs fundamental to career urban fire-service culture. Moreover, the academic literature examines the culture of the urban fire service and highlights its mechanistic nature and adherence to authoritarian and hierarchical practices and structures (Catts & Chamings, 2006). Thus, from both a cultural and organizational perspective, the career urban fire department is most often characterized as insular and closed to nonmembers. As a result, implementation of a participatory approach to service delivery involving the use of citizen volunteers may be resisted and/or create conflict in a unique cultural and organizational setting such as the career urban fire service that tends to guard against and resist change, both as a defensive and offensive strategy (Hulett, Marc, Thomas, & Moccio, 2008).

The purpose of this study is to investigate the culture of the career urban fire service and the use of citizen volunteers. More specifically, the research examines how the cultural socialization of firefighters influences their perceptions towards and their willingness to work alongside citizen volunteers in disaster-response programs such as CoV's proposed NEAT initiative. As Tran and Lee (2011) note, the process of cultural socialization entails specific social information, skills, and strategies that are distinct to a social group or subculture. The process of socialization increases the social competence of group members but is quite often exclusionary of nongroup members. In fact, formal recognition of citizen volunteer utility, legitimacy, and capabilities in disaster response remains limited, with the fire service often ascribing to the viewpoint that volunteers are more of a liability than a resource (Flint & Stevenson, 2010; Litzenburg, 2006; Simpson, 2001; Wenger, 1991). This level of *disconnect* between fire-service personnel and community members' (i.e., citizen volunteers') willingness to help in disasters and the concepts associated with vulnerability reduction, increased resiliency, and a participatory approach to service delivery is the focus of this study.

Ethnographic Methodology, Data, and Thematic Network Analysis

This section outlines the ethnographic methodology, data, and thematic network analysis used in the present study.

Ethnographic Methodology

Within the wide spectrum of qualitative approaches to research, *ethnography* is a methodology that can facilitate in-depth research into groups that share a common culture (see Fetterman, 2010; Hammersley & Atkinson, 2007). As noted previously, this ethnographic

study investigates attitudes of career urban firefighters employed in the VF&RS about the use of citizen volunteers in the proposed NEAT disaster program. The literature discussed in the previous section suggests that many biases and barriers exist in the urban career fire service that may impede the successful incorporation of citizen volunteers in disaster management. Examining and identifying fire-service cultural barriers prior to implementation of a citizen-based participatory approach to disaster-management response may enhance sustainability of the proposed program. Findings emerging from this study and subsequent recommendations may assist both the VF&RS and the CoV in planning and implementing participatory approaches to disaster response.

Data

The identification and analysis of perceptions held by career urban firefighters about the use of citizen volunteers in a formal, disaster-response program was the primary objective of this study.¹ In addition, the research sought to investigate the presence or absence of cultural barriers within the VF&RS to inclusion of participatory approaches in disaster management. Topics discussed during semistructured interviews with research participants included, but were not limited to, change, disaster response, volunteerism, fire-service culture, and implementation of VF&RS strategic objectives. Four questions guided the discussion:

1. What underlying social conventions and cultural attitudes exist within the fire service concerning the use of citizen volunteers?
2. How do social conventions and cultural attitudes found within the fire service influence firefighters' perceptions of citizen-volunteer utility in disaster or emergency response?
3. How is the willingness of career urban firefighters to work alongside citizen volunteers in NEATs influenced by the perceptions identified in the previous responses.
4. What mechanisms could facilitate integration and interoperability of citizen volunteers and career urban firefighters in disaster response?

Initially, five male and five female career urban firefighters from within the VF&RS were approached purposively for study inclusion. The snowball-sampling process entailed each participant being asked to pass information concerning the research on to one or two coworkers assigned to the suppression division of VF&RS. Of those referrals, the first 18 male and female firefighters who approached the researcher for inclusion were accepted as participants, resulting in a sample of 28 firefighters. A review of literature related to sample-size determination for qualitative research indicates that optimum sample size for qualitative studies is typically 20 to 25 participants, with most qualitative

studies not exceeding 50 participants (Charmaz, 2006; Ritchie, Lewis, & Elam, 2003). The purposive sampling strategy used to gather study participants centered on identifying and engaging individuals considered information-rich with regard to the research topic (Suri, 2011). Snowball sampling, often referred to in the literature as *chain sampling*, is the most widely utilized sampling tactic in qualitative research. This sampling strategy allows for the addition of new information-rich study participants based on the recommendations of the originally selected research interviewees (Noy, 2008).

During a three-week period, raw data were collected via semistructured interviews conducted with research participants and subject matter experts (SMEs). In total, 32 semistructured interviews with 28 firefighters (14 males and 14 females) and 4 SMEs (all male) were conducted. Subsequently, at their request, 2 subjects were dropped from the study — for a total sample size of 30.

Interviews took place on off-shift hours and away from the fire-hall setting due to both the unpredictable nature of the regular work environment and to ensure participants could share their thoughts openly. The interviews were recorded and transcribed verbatim, which, when combined with the researcher's notes, provided the raw data on which the analytic *thematic network analysis* was based. In order to de-identify the data and preserve and protect anonymity, research participants were assigned a number preceded by the letter *P* when referencing participant viewpoints through quotes (e.g., P22).

Participant feedback on researcher-derived themes distilled from the interviews was gathered using a structure laying technique (SLT); that is, all research participants were provided with a synopsis of the 16 basic themes derived from their interviews. While some research participants supplied minor clarifications of the themes derived from their particular interviews, all interviewees agreed that the themes were representative of their viewpoints and their voices. The SLT provided the researcher with communicative validation of participants' perceptions obtained during the interviews and was essentially a second interview carried out electronically, by telephone or by email.

In addition to the data secured from the 30 research participants, reports, proposals, and internal memoranda produced by the CoV and VF&RS were gathered and studied. This information provided more detail about the NEAT initiative and additional context for the data collected during the interviews. The design and conduct of the study progressed over a 10-month time frame.

Thematic Network Analysis

Interpretation of the interview data formed the core of this qualitative research study. The process of interpretation and collection of the data was achieved through three steps: (1) recording the data, (2) transcribing the

data, and (3) constructing themes or realities based on the transcribed text and researcher notes. Thematic network analysis was employed to discern common themes in text and to organize these to facilitate identification of significant concepts, patterns, and structures.

Analysis of the data entailed four methods: (1) word repetitions, (2) indigenous categories, (3) key-words-in-context, and (4) metaphors/analogies in addition to the concepts associated with pattern coding (Miles & Huberman, 1994; Ryan & Bernard, 2003). The initial goal with this aspect of data analysis was to generate a wide range of themes, with subsequent identification of the most important themes worthy of further analysis (Ryan & Bernard, 2003). Subsequently, the focus of analysis centered on the construction of thematic networks. Thematic network analysis is well established as a means of illustrating themes in qualitative research (Attride-Stirling, 2001) and entails development of basic themes, organizing themes, and global themes derived from the textual data.

Findings

Findings are often defined in the literature as discoveries, judgments, or pronouncements offered by qualitative researchers as a result of data collection, analysis, and interpretation within a research study (Sandelowski & Barroso, 2004). Thematic network analysis resulted in the identification of 16 basic themes, 5 organizing themes, and 2 global themes.

At the primary stage of analysis, 16 basic themes were identified from the interview data. These *basic themes* are the lowest-order themes derived from the interviews through the coding process. Next, came the process of identifying *organizing themes*, which are basic themes grouped together based on commonalities in attitudes, perceptions, and beliefs. Five organizing themes emerged from the thematic network analysis. Finally, analysis of the five organizing themes allowed for the identification of two *global themes*, also referred to as *super-ordinate themes* in the literature (see Attride-Stirling, 2001). These global themes encapsulated key metaphors underlying the interview data as a whole. **Figure 1** presents the 16 basic themes, 5 organizing themes, and 2 global themes distilled from data collected during the interview process.

To reiterate, these themes provide an overview of how firefighters employed by the VF&RS perceive the role of citizen involvement in disaster response. As such, the data are intended to provide the VF&RS with an understanding of how volunteer-based programs such as NEAT are perceived by front-line firefighters and the challenges and opportunities inherent in such programs. Discussion now turns to the thematic network analysis organized around the two global themes.

Global Theme 1: Organizational and Cultural Aspects of the Fire Service Impede Innovation and Progress in the Area of Disaster Management

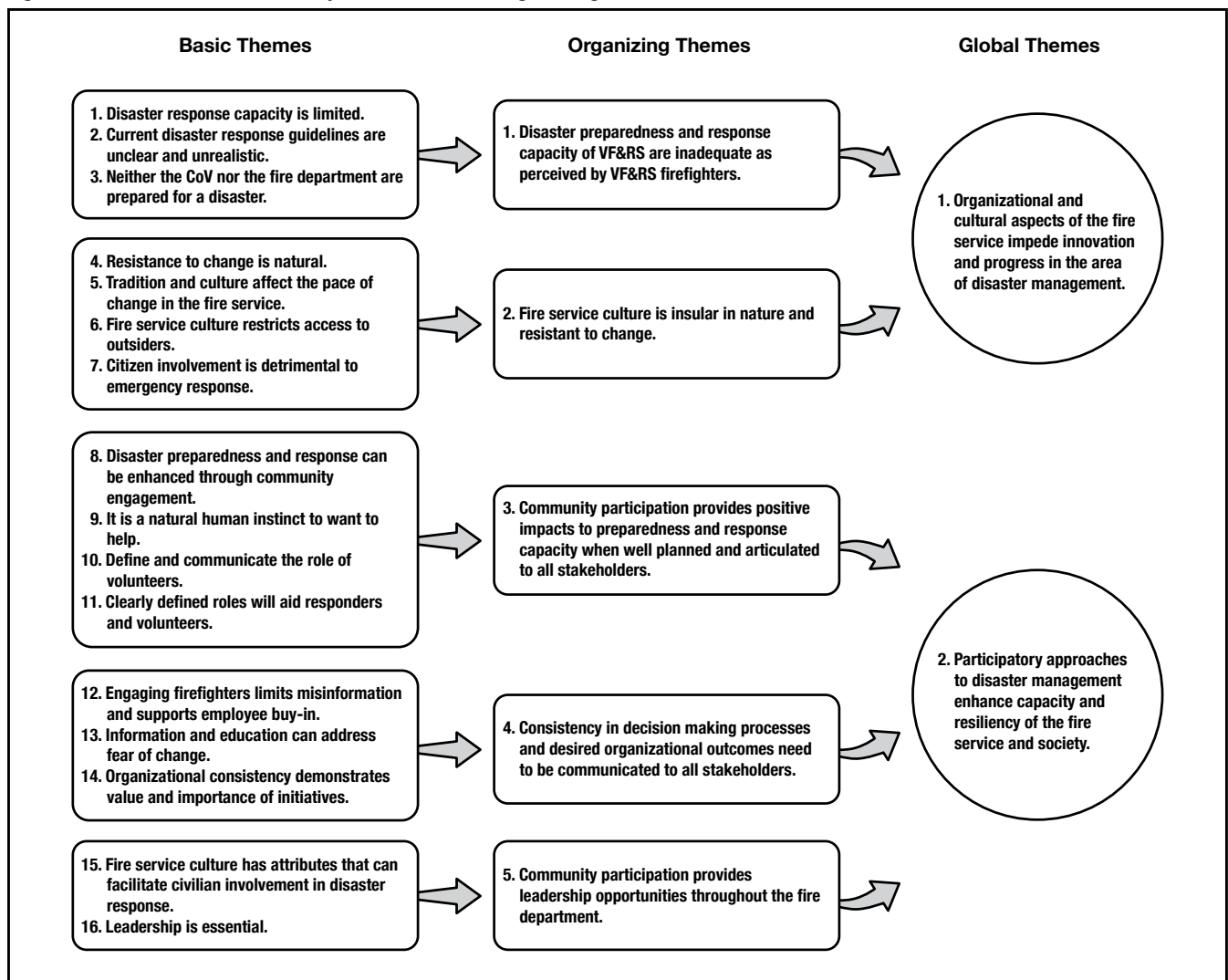
As a super-ordinate theme, Global Theme 1 proposes that organizational and cultural characteristics of the VF&RS department may inhibit progress towards embracing participatory approaches involving citizen volunteers in disaster management. The foundation for this global theme is two organizing themes, which in turn are derived from seven basic themes. Organizing Theme 1 and Organizing Theme 2 describe research participants' perceptions of VF&RS as an organization and the fire-service culture in which they are embedded. Perceptions of disaster preparedness and the response capacity of the VF&RS underlie discussion points in Organizing Theme 1. Inclusiveness, exclusivity, and consequences of change in the fire-service culture encapsulate the focus of attitudes in Organizing Theme 2.

As the primary responders to crises, emergencies, disasters, and catastrophes, firefighters often work in the midst of chaos and confusion. The ability to remain calm and focused during these events is aided by the knowledge that the organization in which they operate is structured in such a way as to provide support in a sustainable and robust manner. Interviews with firefighters in the present study raised questions about the ability of front-line firefighters to perform their roles based on inadequate preparations and limited capacity of the VF&RS in the face of disaster impact. A consensus among research participants aligned with the viewpoint of one firefighter who articulated the position that "you're only as strong as your weakest link, and I think right now our weakest link is ourselves" (P30). Another interviewee echoed similar sentiments by noting the VF&RS is intent on "just dabbling in a little bit of everything without . . . the quality of training that . . . allows you to become proficient in any one of the . . . [areas] . . . that is expected [of firefighters]" (P19).

Frustration was also expressed throughout the data-collection phase regarding departmental guidelines. For example, one firefighter observed, "I've read our SOGs [Standard Operating Guidelines]; they are amazingly ambiguous at times about how things are going to transpire and there is not a really good operational level understanding of them" (P20).

A perception articulated by numerous research participants concerns how the fire department has *dropped the ball* on disaster preparedness. Or, in the words of one senior firefighter, "we have dropped the ball on this one [disaster-management training] over the last 20 years, since I've been in the fire department anyway" (P27). It is important to remember that firefighters take great pride in their profession and their role in society. As such, for a firefighter to express this level of

Figure 1: Thematic Network Analysis: 16 Basic, 5 Organizing, and 2 Global Themes.



Source: Derived from original semistructured interviewed data collected by the author.

disappointment generally indicates an issue of serious concern. The level of importance ascribed to disaster preparedness caused one study participant to observe, "That's one part of the job I'm highly disappointed in . . . we are not prepared" (P6).

With respect to exclusivity and resistance to change as characteristics of the fire service (see Organizing Theme 2 in Figure 1), the literature suggests cultural groups can be insular in nature, internally and externally, and are not generally welcoming to those perceived as outsiders (Carrizzo & Gerling, 2006; Hulett et al., 2008). Embedded within a very traditional fire-department culture, research participants identified numerous concerns around incorporating citizen volunteers into their work environment. Culture, as described by VF&RS firefighters, evoked a volume of perceptions. Comparisons were made between the fire department and a secret society in which cultural barriers "are so thick you could cut them with a knife" (P11). A genuine level of concern was expressed by study participants for the citizen volunteer who might encounter a cultural environment described by one interviewee as hostile,

close-minded, and that "perpetuates . . . the exclusion of . . . new and alternative ideas" (P15).

The word *xenophobia* was mentioned a number of times in the course of data collection as a descriptor of the fire-service culture within the VF&RS. A common definition of xenophobia refers to the relations and perceptions of an in-group (e.g., firefighters) towards an out-group (e.g., citizen volunteers), including a fear of losing identity, suspicion of the other group's activities, aggression, and a desire to eliminate the out-group's presence to secure a presumed purity (Braham, Bracalenti, Bolaffi, & Gindro, 2002). This sentiment is expressed well in one junior firefighter's concern about the purpose of volunteers and their impact on fire-service cohesion and culture when she/he stated "we're not a bunch of hippies singing Kumbaya; we don't throw open our own arms and hug everybody walking in the door" (P30). Therein lays the crux of the inclusion/exclusion issue in the VF&RS. Professionally, interacting with the public is a key role, and yet there is an underlying sense that "we [firefighters] do not want to open . . . up . . . the fire halls . . . [and let people in]" (P27).

Interview participants also reflected on the proposition that the fire service is “exceedingly slow to accept change, if ever” (P18). Research on the concept of change in the fire service concurs with this sentiment, acknowledging that in many instances efforts to implement change have been mediated by the strong cultural influences internal to these agencies (Fitzgerald & Stirling, 1999). In defense of this state of affairs, a senior firefighter interviewee declared, “There’s a reason it hasn’t changed much; it’s because it’s always worked” (P27). A popular point of view among research participants is that the reason for change in the VF&RS is not effectively communicated and is often perceived as simply “change for change’s sake” (P14).

Global Theme 2: Participatory Approaches to Disaster Management Enhance Capacity and Resiliency of the Fire Service and Society

Global Theme 2 clearly shows that study participants overwhelmingly support the value of participatory approaches and volunteerism in disaster-response efforts in the VF&RS. As such, several avenues are available to the VF&RS to enhance societal resiliency through participatory approaches to disaster preparedness and response. The three organizing themes, derived from the nine basic themes shown in Figure 1, that define Global Theme 2 are based on the concepts of (1) planning and communication, (2) organizational consistency, and (3) fire department leadership.

Research participants describe citizens of Vancouver as wanting to help, eager to volunteer, and ready to lend a hand in times of need. Keltner, Smith, and Marsh (2010) refer to this desire to help others as the *human compassionate instinct*: a state of being in which compassion and benevolence is an evolved part of human nature. Interviewees noted this benevolent spirit was alive and well in the CoV. For example, one firefighter noted that although the volunteers do not have any particular disaster-management training or skills, they have “strong back[s] and big heart[s]” . . . and those characteristics will “win the day” (P8).

As a basic theme, concerns about the lack of organizational consistency by VF&RS are deep-seated and prevalent throughout the research sample. Three of the most prevailing attitudes in the data derive from this basic theme. Perceptions referred to fire-department initiatives as “fly-by-night,” “flavor-of-the-day,” or just another item “piled on our plate” (P29). The expression *fly-by-night*, as articulated by several research participants, suggests that some extremely valuable programs lose momentum almost immediately after being launched due to being “bumbled from the very beginning” (P29).

The idea of *flavor-of-the-day* was expressed by an overwhelming majority of research participants. It speaks to a tendency for the fire department to redefine its priorities on an ongoing basis.

Organizational inconsistency and reprioritization caused many firefighters to ponder what their roles in the organization are, what the department expects from them, and where as an organization the VF&RS is heading. An outcome of this situation is *priority fatigue*, wherein firefighters perceive a lack of follow-through by the fire department in so many programs that they no longer want to be involved or to commit themselves to something that likely will not last.

One study participant argued that the fire department leadership should be concerned that firefighters believe the “biggest problem [in the VF&RS] right now is we are not following through on [our program] change [initiatives]” (P6). This perspective has resulted in a widespread perception that the city and the fire department implement projects as *window dressing*, something that looks good from the outside but covers up a lack of depth or sustainability inside. As such, firefighters find it difficult “to get behind something or someone when you don’t feel like it or them [*sic*] are behind you” (P19).

When interviews turned to the topic of organizational leadership in the VF&RS, lack of consistency and management skills were noted as problems. Concerns were also raised about what motivates fire-department leadership. One interviewee noted that it seemed to him/her that “Doing the right thing is not the motivating factor; looking like you’re doing the right thing is what matters” (P26). Many other study participants were quick to note, however, that leaders who articulate vision and demonstrate consistency in action will engender significant support from front-line VF&RS firefighters.

Conclusions and Recommendations

Findings emerging from the thematic network analysis clearly show that VF&RS firefighters recognize that vulnerability to natural and human-made hazards necessitates an enhanced volunteer-based response capacity to strengthen resiliency and foster a robust recovery from disaster impacts. Many of the research participants possess knowledge of the role citizens have played in previous disasters globally and understand that through programs such as NEAT, community members become a resource rather than just victims (Lichterman, 2000). The analysis of interview data identified organizational hurdles and cultural barriers within VF&RS that can potentially hinder efforts to increase the capacity and capabilities of the fire department to effectively use volunteers. Nevertheless, Global Theme 2 demonstrably shows that study participants (i.e., VF&RS firefighters) believe participatory approaches to disaster management enhance capacity and resiliency of the VF&RS and society in general. The task remaining is to overcome perceived organizational and cultural aspects of the VF&RS that impede innovation and progress in the use of citizen volunteers in disaster-management programs such as NEAT.

For example, firefighters in the research sample indicated concern and hesitation around practical applications of citizen involvement in disaster-response operations. Unfamiliarity with emergency services operational parameters, inadequate training, and the potential of volunteers to exceed their scope were equated by interviewees with an increased risk of injury or death to both citizen volunteers and career firefighters. Frustration arose pertaining to fire-department resources devoted to training citizens while firefighters perceived their own training as substandard and inadequate. Familiarity with past fire-department initiatives and programs caused research participants to be anxious about how the VF&RS leadership would follow through with the NEAT initiative, which in turn reflects on the professionalism of firefighters themselves. Interviewees were not complimentary regarding thoroughness, consistency, or quality of the training and educational product being delivered internally or externally to the community. Engaging front-line firefighters in the development and delivery of participatory approaches to disaster management involving citizen volunteers is a first step in addressing perceived firefighter problems. The 14 recommendations that follow are intended to provide opportunities for development of sustainable and productive strategies in support of the use of volunteers in the VF&RS:

1. Firefighters need to be educated on what plans and capacities exist regarding disaster response within the CoV and VF&RS.
2. Disaster-management education must begin upon entry into the VF&RS.
3. Education in advanced concepts of disaster management must be incorporated into the company officer development program.
4. Disaster-response guidelines for front-line personnel must be reviewed, revised, and communicated throughout the fire department.
5. Roles and expectations of the fire department towards both front-line firefighters and NEAT volunteers must be communicated clearly and concisely.
6. Educational programming must be developed and delivered to fire-suppression staff regarding individual and family disaster and emergency preparedness.
7. Change within the VF&RS needs to be communicated in a manner that addresses concerns of firefighters and takes into account the unique culture and traditions of the fire service.
8. As a key concept underlying NEAT, participatory approaches to disaster management must be incorporated into an educational component for firefighters.

9. The NEAT program must be implemented in a collaborative manner, engaging firefighters in a comprehensive manner from the very beginning.
10. Screening and selecting citizen volunteers must be done in a comprehensive manner to ensure NEAT legitimacy.
11. Front-line firefighters must be the primary means by which community members are approached and engaged for the NEAT program.
12. NEAT program information and educational sessions must highlight the role of professional firefighters in the community.
13. VF&RS must demonstrate consistency and commitment to programming through open communication to firefighters acknowledging fire-department failures.
14. Succession planning and career-development paths must be developed by VF&RS and incorporated into formalized training sessions for all firefighters.

These 14 recommendations provide an opportunity for the VF&RS to enhance development of comprehensive disaster strategies incorporating a participatory approach. The long-term commitment and maintenance of these recommendations help ensure the means by which sustainable change can occur. When engaged and informed, firefighters will step forward and can be counted on to make programs and projects a success; they just need to be armed with the proper tools — information, education, and organizational support.

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Endnote

¹An original assumption tested in this research was that female firefighters would be more supportive of the use of citizen volunteers than would male firefighters. An analysis of the survey data proved this assumption was false. There was no discernible difference between men and women firefighters' attitudes about the use of volunteers to assist in disaster management in the VF&RS.

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