

INTERNATIONAL FIRE SERVICE JOURNAL OF LEADERSHIP AND MANAGEMENT



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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 has served in a number of academic positions for the past 27 years, and for the last 16 years has served at the State University of New York at Binghamton. He is Professor Emeritus and Retired Vice President for Public Service and External Affairs at SUNY Binghamton, which is consistently ranked in the top public universities by *U.S. News and World Report*. John has published numerous articles, chapters, and technical papers, served as co-editor of the 2002 book published by the International City/County Management Association entitled, *Managing Fire and Rescue Service*, and is a Section Editor of the NFPA® 2008 *Fire Protection Handbook*. Dr. Granito will be the first recipient of the award that honors him and his service to the fire service and to academia. Each year the recipient of the **Dr. Granito Award** will present the Keynote Address at the annual *IFSJLM* Research Symposium and will be the Guest of Honor at the reception held on Friday night prior to the Research Symposium.

Nomination Form

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

The nominee should have made a significant contribution to the advancement of fire leadership and management through his/her scholarly/academic writing. The Dr. Granito Award is not necessarily a life-time achievement award, although such individuals certainly should be in a prominent

position to be nominated. The nominee can be a person who, although early in their career as a practitioner/scholar or academic, has made a seminal contribution to the fire leadership and management literature.

To nominate an individual for the Dr. Granito Award, please submit by 15 January of the symposium year: (1) this form (or a copy of it), (2) no more than a one-page single-spaced letter explaining why you believe the person is deserving of the award, and (3) a copy of the nominee's resume or curriculum vitae. Send the materials to: Dr. Granito Award, Dr. Bob England, Editor, *International Fire Service Journal of Leadership and Management*, Department of Political Science, 531 Math Sciences, Oklahoma State University, Stillwater, Oklahoma 74078.

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

Nominator Name: _____

Address: _____

Zip/Postcode: _____

Contact Information:

Telephone: _____

Email: _____

Message from Dr. Robert England

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

Welcome to Volume 3, Issue 1, of *IFSJLM*. With this issue, the Journal begins a new tradition. The initial article that will appear in the first issue of *IFSJLM* each year will be the presentation given by the recipient of the Dr. John Granito Award for Excellence in Fire Leadership and Management Research. Dr. Granito

was the first recipient of the award that honors him and his service to the fire profession and academia. A brief overview of his service is summarized on page 3. We offer our sincere thanks to John for setting high standards that others can hope to emulate.

We urge you to nominate others for the award that honors those who advance the **science of fire leadership and management**. A nomination form is found at the bottom of page 3 of this issue of the "*Red Journal*."

Dr. John Granito, Professor and Vice President Emeritus, State University of New York Binghamton and Fire and Emergency Services Consultant

The Value of Research to Fire-Rescue Officers

The intent of this paper is twofold: to present to senior fire-rescue officers and other fire service officials a few thoughts concerning the value of additional and more rigorous research in the areas of management and leadership, and to comment on how research can contribute significantly to professionalization and better public protection. Over the years, most fire service research has focused on technical issues and field operations, an example being widespread concern over the most effective tactics for combating high-rise fires. Yet, a high percentage of the challenges today are created and driven by economic and social issues rather than a lack of technology or engineering. While technical advancements may ease certain of the economic and social problems fire-rescue organizations face, more effective management and more inspiring leadership certainly are necessary if the required levels of community service delivery are to continue across our nation, provided by viable fire-rescue departments.

It is, perhaps, this challenge of continuing viability for fire-rescue departments that cries the loudest for more skilled and sensitive management, and for more forthright and vigorous leadership. I believe that the *International Fire Service Journal of Leadership and Management* and the annual recognition of worthy researchers will contribute greatly to meeting the needs I describe. I mean to strongly encourage both experienced and newer researchers to contribute the reports of their inquiries on an ongoing basis. The *Journal* fills an important need, one which is not filled by any other fire service publication, and its support by the Political Science Department of Oklahoma State University and OSU's Fire Protection Publications unit is commendable.

Note that I have attempted to distinguish here between the conduct of research and the reporting of that research. We need both very much, since unreported research obviously has very limited benefit. Simply think of the vast service provided by publications such as the *New England Journal of Medicine*, or the *Journal of the American Medical Association*, or the UK's *The Lancet*. My hope is that our *Journal*, with your efforts, will go on to provide practitioners with a similar high level of research coverage.

Some Needed Types of Research

Research often is defined as studious inquiry and examination to discover new or revised knowledge. It occurs to me that the following types of research are among those needed to serve as the foundation for improved fire service management and leadership:

- The identification and application of findings in a variety of disciplines such as political science, sociology, psychology, statistics, organizational behavior, economics, and business management that have useful transferability. Examples are the adoption by the fire service from economics of special service cost transferability to the private sector, such as hazardous materials response charges, and the provision of critical incident stress debriefing by trained psychologists;
- The transfer of computer applications to enhance information management, and thus fire-rescue officer decision making. An example is the sorting of response data to identify the daily volume of simultaneous alarms that would affect EMS response capacity with existing resources – the New Orleans post-Katrina project;
- Controlled research projects that examine historical data or that generate new data in order to draw conclusions concerning service delivery. Examples are code enforcement progress in retail, warehouse, high-rise, and other occupancies contrasted with numbers of inspectors – the KPMG/MMA Chicago study, and the NFPA Fire Department Analysis Project (FireDAP).
- Research projects that test conventional wisdom or that seek to learn firefighter and other perceptions of accepted practice. Examples are found in the OSU and DOE study projects (NY City/ Anchorage, and DOE National Laboratories) that seek to discover accurate and useful understandings of organizational safety climate;
- Large scale, broad-based examinations of both historical data and current findings in order to establish benchmarks and improvement steps. Examples are the IAFF Fire Fighter Injury study, the OSU LODD Reduction through Best Practices Phase 1 project, and the ongoing NIST-IAFF-IAFC-CPSE-WPI project on Response System Design;
- Research conducted to satisfy cognitive curiosity, remembering Robert Oppenheimer's statement that "...the deep things in science are not found because they are useful; they are found because it was possible to find them" (as quoted in Rhodes, 1988, p. 11). One great value of curious findings, of course, is that they provide springboards or stepping stones to functionality for the next researcher;

- Reviews of relevant literature, but with the necessary addition of new concepts stemming from a rethinking or a re-juxtapositioning of existing knowledge.

What Research is Not

Like true love or a junior aerial, research may be described best by what it is not. Research is not:

- The exposition of “How I did it.” While these may add to your repertoire, situational leadership tells us, as Heraclitus pointed out, that you can’t stick your toe in the same river twice;
- “Lessons learned” unless presented in a highly formalized and sophisticated way, with eminent transferability;
- A compilation of close call descriptions, although these could lead to a useful research construct;
- A description of what the writer might believe to be the best way to handle a given situation, although these may stimulate thought;
- The arrangement of data in order to demonstrate that what you already believe is correct;
- An article that recites or summarizes existing knowledge learned by the writer in a recent college class;
- An autobiography, no matter how exciting and well written.

Earmarks to Consider

What, then, are some earmarks of sound and useful research? Consider the following:

- Research that leads to an unbiased extension of what is already part of a formal body of knowledge, generally widely accepted by practitioners;
- Research leading to conclusions that can be duplicated through repeated trials;
- New or extended knowledge resulting, that makes sense in real-world operations, or that leads to acceptance after testing by practitioners;
- Controlled experiments that test null hypothesis;
- Research that recognizes variables and that controls for them;
- Research that has a large enough sample size (N) to have reasonable validity, or that sets a framework for continued trials with larger populations;
- Research that recognizes that a stratified or select population limits conclusions;
- Research that, if it concludes that additional study is needed, at least provides a sample structure and process framework for consideration;

- Research that, if grounded in statistics, uses the proper treatment of data. Dave McCormack often pointed out that the average man has fewer than two arms, yet shirt manufacturers never use that statistic.

The Value of Research to the Profession

Fire and rescue officers and officials, whether career or volunteer, will benefit from membership in a recognized profession, but for fire-rescue officership to become a recognized profession, a sufficient research endeavor is necessary. The basis for professionalization of the fire service management discipline must, of course, consist of several additional key elements in addition to a healthy research component. Some of these will be mentioned later in this paper.

It appears doubtful that those outside our interest area (which likely is considered by many to be an occupational specialty rather than a “profession”) will view us as a recognizable profession until we can demonstrate to their satisfaction that we really do “know what we’re doing.” I judge that a body of knowledge specific to the effective and efficient management of community protection is required for that demonstration. Of course, I am not proposing that we attempt to emulate physicians. I do, though, believe that our “profession” has a considerable distance to go before it will no longer be whipsawed by numerous municipal administrators and voters who have little confidence in our resource requests and other judgments. To measure our current professional impact, simply consider where we are with widespread sprinkler legislation, for example, or with code improvement requests or with minimum staffing standards.

Simply stated, services which are perceived by the public as being conducted and delivered by professionals typically are better supported than those which are not. Even worse, I note with chagrin that my neighbors accept with no question the recommendations of our local plumber, but pay little attention to the *FIREWISE* material distributed by our local fire department. I hope you will agree that there are distinct advantages to professionalization.

The Earmarks of a Profession

Professions are often defined as callings requiring specialized knowledge, intensive and frequently long preparation including instruction in skills and methods, in addition to having a body of scientific, historical, or scholarly principles underlying the skills and methods. High standards of achievement and conduct plus continuing education are required and scrutinized by peers. The type of work generally has the rendering of public service as its prime purpose. Earmarks typically include:

- A distinct and contributing body of knowledge which is ever-enlarging and being tested;

- A body of relevant literature that contains the required body of specialized knowledge, which is growing, and which conveys that knowledge to practitioners through written, graphic, oral, and other means;
- Focused and continuing study with recognized certifications;
- A formalized research program with the distribution of research findings;
- Maintenance and scrutiny of practitioner standards, and policing by professional associations using a quality assurance program;
- Clearly identified professional organizations with provisions for continuing education;
- A strong focus on improved public service.

To carry the concept of professionalism to our own field of interest, several key questions should be posed. These include whether a profession can include the categories of supervisor, manager, administrator, and leader, and whether all workers – career or volunteer – necessarily have to be professionals? The statement sometimes voiced by career firefighters that, “I’m a professional firefighter” has, of course, a different meaning and intent. However, it does seem reasonable to assume that the full range of department officers, given the right circumstances, can be professionals, although not all persons in a given field need to be. Part of the difficulty in dealing with these questions has to do with the changing definition of the word *profession*. While historically the *learned professions* have been identified as theology, law, and medicine, we now have many “sub-professions” in the health field, for example, and many thousands who would term themselves as health professionals who are not physicians.

For discussion purposes, this paper will consider fire-rescue officers as belonging to a “specialty” in order to test how close the specialty is to having the characteristics of a widely recognized profession.

As a hurdle to professionalization, consider that some members of the specialty:

- May not be certified;
- May not have a demonstrated mastery of the body of knowledge and skills required;
- May not function well, or at all, as a supervisor, manager or leader;
- May not have had formal training;
- May not be aware of shortcomings in knowledge and skills;
- May not be aware of best operational practices;
- May evidence obvious managerial and leadership failures.

We know, however, that a high percentage of specialty members – career and volunteer – are certified, well trained, knowledgeable and skilled in the specialty, and keep well abreast of the most up-to-date information. Unfortunately, there still exist many fire-rescue departments – both career and volunteer – where chief level officers are not selected on merit, and so we have a pronounced slope on the “where do we stand” graph. I feel it is important to note that without rigorous and on-going research efforts, plus the widespread dissemination of findings to practitioners, widely recognized professionalization cannot be achieved.

The Professional Status of Fire-Rescue Officers

Despite the distance some officers appear to be from professional status, there are many positive vectors present in the specialty, and a significantly high and growing number of officers who are as “professional” as one can get at this time in the specialty. Without question many would say, and I would hesitate to argue, that they *do* belong to a profession. I add only that the necessary research and dissemination programs are only now beginning to appear.

We *do* have certification, accreditation, and a fully operational Center for Public Safety Excellence. We have strong and effective professional associations and organizations such as IAFC, IAFF, NFPA®, and others, and we have had for some time fully accredited college level degree programs. There is an overarching federal organization – USFA – with a national training academy, plus related programs with a recommended curriculum. We have various categories of “professional qualifications” plus a standardized testing program. We have bodies of knowledge well published as training documents – although mostly related to technical and field operations. We do, indeed, have much that contributes to professionalization. But as the old show tune asks, “What ain’t we got?” Well, we don’t have a very active and productive research program that visibly contributes to the practice of management and leadership. Fortunately, however, we now have an academically based refereed journal that stimulates research, publishes peer-reviewed research reports, and has the potential for widely based distribution of those reports. Further, it brings together both experienced and newer researchers for this annual symposium.

I expect that through the good work of the researchers here today and others, the *Journal* will serve an expanded and much-needed role in our nation, as the UK publications do there. Good management and leadership research provides clarity, confirmation or denial, newer and more productive ways of viewing challenges, and a springboard to obtaining local answers.

If I were to title an article about today’s typical chief officer, I think I’d borrow the one William Moore used as a book title in 1971, *Blind Man on a Freeway*. Or perhaps I’d lean toward Wendell Johnson’s 1946 book,

People in Quandaries. Anyway, here is my list of a few of today's challenges that cry for some genuine research in administration and leadership:

- Discovering methodologies to use in functional consolidation, merging, and combining;
- Identifying operational performance measures;
- Determining response crew staffing requirements;
- Managing and leading combination departments;
- Maintaining effective volunteerism;
- Identifying results of combining fire and police services;
- Preparing and presenting viable long-range plans;
- Downsizing methodologies;
- Managing growth;
- Creating and maintaining productive labor-management relations;
- Creating and then managing diversity;
- Adding to the service delivery package;
- Creating a safety-oriented organizational climate;
- Building and using an information management system;
- Creating a meritocracy in testing and promotions;
- Entering and surviving the political process;
- Organizing and managing a fire-based EMS deliv-

ery organization;

- Increasing department income options;
- Leading emergency management and military officials;
- Managing a Balkanized fire-rescue service;
- Maintaining personal growth and development;
- Assigning resources effectively;
- Keeping out of legal and related traps;
- Creating and maintaining firefighter wellness.

I close by emphasizing that both community fire protection and the fire-rescue organizations that provide it are enhanced by professional leadership. Research is a vital component of professional vitality and viability, and America's fire-rescue service needs to be supported and strengthened by it. Our *Journal* – whose motto is “Building Theory to Impact Practice” – is the best stimulus for, and the most effective distributor of, those research findings. I encourage you as individuals, as students in higher education, as organizational leaders, as members of the Executive Fire Officer program, and as college and university faculty to push your own and other research efforts in management and leadership, and to use the *Journal* to its fullest.

References

Rhodes, R. (1988). *The making of the atomic bomb*. New York: Simon and Schuster.

Dr. Warren D. Jones, Fire Chief and Emergency Manager, Evans, Colorado

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The Role of Developmental Experience in the Career Development of Fire Chiefs

Abstract

This article reports on the developmental experiences of 14 Fire Chiefs of the Year as selected by Fire Chief magazine. Two specific developmental experiences, (1) the first fire chief experience and (2) hardship that resulted in personal and professional loss and pain, produced the strongest personal learning and change in leadership and management behaviors. Four career-development recommendations critical to incumbent and aspiring fire chiefs are offered. They are that (1) developmental experience opportunities be made available to fire service personnel much earlier in their careers; (2) greater focus be placed on leadership and management experience in the early career; (3) learning from hardship be incorporated into leadership and development; and (4) more opportunities be provided to learn political skills outside the confines of the internally focused fire service world.

Introduction

The career development of fire chiefs has been described as fragmented and disorganized (Bennett, 2003; Onieal, 2003) and typically takes many years of progressive experience in a number of positions within a fire department. Its internal focus, supportive of the fire service culture, is less conducive to developing the strategic management and leadership competencies required of fire chiefs today. Recent research indicates that there are a number of specific career experiences that lead to improved individual learning agility (Davies & Easterby-Smith, 1984; Lombardo & Eichinger, 2000) and enhanced organizational performance. This article provides guidance to incumbent and aspiring fire chiefs on how to obtain the most from career experiences that can increase their ability to lead fire service organizations through change.

Preparation to assume administrative duties has been the subject of discussion in the fire service since the 1950s. These discussions, supported by the Wing-spread Conferences beginning in the 1960s and studies conducted at the National Fire Academy (NFA) in the 1970s and 1980s identified the need to provide incumbent and future fire chiefs with greater administrative and managerial skills (Athey, 1994). The skills that were seen as particularly lacking were personnel administration, budgeting and finance, and political awareness. In general, fire chiefs were not viewed as public administrators by administrative superiors, by political leaders, or within the fire service itself. While these discussions led to the establishment of a number of undergraduate programs in fire-service-related disciplines, it has been within the last 10 years that higher education programs have shifted away from the technical aspects of fire fighting. These programs now place a greater emphasis on administration, management, and leadership. More recent studies (Athey, 2004; Haverty, 2003; Hoover,

2003) have explored the role that experience plays in learning managerial skills and, more importantly, building adaptive leadership behaviors that help fire chiefs lead during times of external and internal change. This linkage between experience and adaptive change, however, is mentioned only briefly in the most recent studies (Wakeham, 2003) and fire service career-development literature (IAFC, 2003; USFA, 2004).

This article examines how developmental experience influences the ability of fire chiefs to lead and manage more effectively (also see Jones, 2007). The following questions frame the research.

1. What do successful fire chiefs describe as critical experiences that are their strongest developmental experiences?
2. What learning and change in leadership and management behaviors do they describe as a result of these developmental experiences?
3. What developmental experiences provide the most powerful experiential learning?

Executive Development

Management and leadership development efforts, called *executive development programs*, fall into two broad categories: competency driven and change driven. Competency-based programs are the most common and provide for the current and consistent production of an organization's product or service. Change-based programs are intended to prepare leaders and managers for the uncertainties of the future. Most contemporary authors concede that competency-based executive development programs are necessary but also believe change-type programs offer the best opportunity for ensuring positive organization performance today and in the future where environmentally imposed change has

become and will continue to be the norm (Cranton & King, 2003; Hall, 1995; Mailick & Stumpf, 1998; McCall, 1992; Paauwe & Williams, 2001).

Important to any executive development effort is the recognition of organizational culture as both an ally and impediment to executive development (Bal & Quinn, 2001). Schein (1985) defines organizational culture as "a pattern of basic assumptions, invented, discovered or developed by a given group as it learns to cope with problems of external adaptation and internal integration that worked well enough to be considered valid and therefore taught to new members as the correct way to perceive, think and feel in relation to these problems" (p. 4). At its most visible level, organizational culture can be observed in the rituals, logos, symbols, totems, and stories told by members (Kamoche, 2000). At a deeper level organizational culture influences how members decide what is important and how they ultimately react to customer and client needs (Rothwell, 2002). In its most extreme manifestation, it can control the relationships between members and in some cases impair the ability of an organization to adapt to new environments. In a recent study of the sexual misconduct at the United States Air Force Academy, Callahan (2005) observed that the overwhelmingly male-oriented "warrior" culture may influence dysfunctional sexual behavior as a function of their training system that inculcates new members into a strict and controlling internal culture. A similar culture exists within the fire service.

Fire Chief Career Development

Driven almost entirely by local conditions and culture, there is a lack of consensus on what a nationwide fire-service career-development system should include and how it should operate. Advancement and promotion systems, including those used for the selection of fire service managers, use a variety of civil service tests, demonstration of technical competency, experience, and seniority (Athey, 1994). The career-development journey of a fire chief typically takes many years of progressive experience in a number of positions within a fire department. These positions almost always include first-line supervision of fire companies and management of major organizational units and may also include technical specialty and staff positions. This career progression is often accompanied by formal education, specialized training, and the attainment of professional certifications.

Like executive development in general, a fire chief's career is also heavily influenced by organizational culture (Bal & Quinn, 2001; McCall, 1988). Fire departments are relatively closed and internally focused. Adherence to the values of public service is paramount but so is maintenance of internal norms of behavior, beliefs, and attitudes. These norms are driven by a rich tradition of self-sacrifice combined with an unique work environment within a historically male-dominated culture (Chetkovich, 2001). The career of a fire chief almost always begins as an entry-level firefighter and

stays within the confines of the fire service. Career fire chiefs seldom serve in management positions in other public organizations or the private sector. This internal focus can greatly inhibit development of the strategic management skills required by fire chiefs as they confront increasingly complex issues ranging from changing demographics to terrorism.

Developmental Experience

Developmental experience is defined as those on-the-job experiences that provide the opportunity to learn skills and behaviors in situations where results really matter (McCauley, Ruderman, Ohlott & Morrow, 1994). Developmental experiences also provide two important ingredients of a learning situation, opportunity and motivation (McCauley, Eastman & Ohlott, 1995). Since research on executive development finds that the 75 percent of new learning for managers and leaders occurs on the job, understanding how developmental experience builds executive capacity is important to using developmental experience as an executive-development strategy (Brown & Posner, 2001).

Davis and Easterby-Smith (1984) identify three essential components of developmental experience: (1) novelty, (2) action and (3) self-initiation. For an experience to be developmental it must be new to the person experiencing it. An essential ingredient in novelty is that a person must acquire a new set of skills to solve a problem (Lombardo & Eichinger, 2000; McCall, 1988). It is not a developmental learning experience if a person applies only current and past skills (Davies & Easterby-Smith, 1984). Novelty often requires not only learning new skills but also accepting new and different perspectives. For an experience to be truly developmental, it requires critical thinking and reflective learning (Bartunek & Louis, 1988; Brookfield, 1987; Daudelin, 1988; Dechant, 1994). The second component is action. It is not enough to observe others or to gain a greater awareness or appreciation for the complexity of a problem. For an experience to be developmental, a person must actually grapple directly with a new task and apply new skills (McCall et al. 1988). They must directly face uncertainties and take personal risk to address their new responsibilities. Lombardo and Eichinger (2000) take this even further by requiring a person to be fully responsible for the outcomes thereby inducing the possibility of failure and subsequent learning from hardship. The third component is self-initiation. In their study, Davies and Easterby-Smith (1984) found that the majority of managers who described developmental experiences initiated the experiences themselves and were not part of a structured executive development process.

Similar to Davis and Easterby-Smith's three components of developmental experience, Morgan McCall, Jr., while at the Center for Creative Leadership, investigated the importance of overcoming adversity as a developmental experience. McCall (1988) describes the impact unresponsive superiors, incompetent and resistant subordinates, high-stakes problems, business adversity,

and major changes in the scope of responsibilities as particularly challenging experiences. He also believes that personal responsibility for results and action are central elements of a successful developmental experience, not just exposure. In their studies, Lombardo and Eichinger (2000) at Lominger Inc. found that successful executives have twice the number and variety of challenging experiences as unsuccessful executives.

In the early 1980s, Esther H. Lindsey, Virginia Homes, and Morgan McCall Jr. at the Center for Creative Leadership conducted a study of developmental experience in the lives of successful executives. This study was titled *Key Events in Executives' Lives*. The findings of this study were that the major events in the lives of the 191 executives interviewed fell into three major categories: (1) assignments, (2) hardships, and (3) other people (Lindsay, Homes, & McCall, 1981). Each major category included the demands of the category and the lessons learned. This original Center for Creative Leadership study and its results later became the basis of the book *The Lessons of Experience: How Successful Executives Develop on the Job* by Morgan McCall Jr., Michael Lombardo, and Ann Morrison. This book confirmed the definitions of developmental experience investigated earlier and extended the developmental-experience concept into a more defined model. This model confirmed the following qualities of developmental experience.

The first quality is that there are timing parameters associated with developmental experiences. McCall et al. (1988) found that it took 10 to 20 years for a manager to fully develop and have sufficient opportunities to engage in developmental experiences. They also found that successful executives had at least one developmental experience early in their management career, usually before the age of 30. Second, they found that there were distinct differences between how individuals reacted to developmental experiences. Those who used developmental experience as a catalyst for change were ultimately more successful in their leadership career. Those who did not use similar experiences as change opportunities were not as successful. They later developed these differences into the concept of "derailed" executives (McCall, 1988). Third, developmental experience teaches people that executive behavior is more about relating to and with people than the application of technical skills. Fourth, it helps developing executives understand that dealing with change, ambiguity, and risk are inherent in any leadership situation. Lastly, developmental experiences build the confidence that leaders need to survive even the most daunting challenges.

Other important considerations in the application of developmental experience are (1) an understanding that not all jobs are developmental even if they are difficult, (2) that different experiences have differing levels of developmental potential, (3) that not all people learn equally from developmental experiences, and (4) that the availability of developmental experiences is

driven to some extent by the culture and functions of an organization. Jobs that are within the expertise of an individual, that use past knowledge and well-developed technical skills, and where past experience can be used as a guide are not developmental. Many, possibly even most, managerial jobs fit this definition and while they may be critical to an organization's mission, they do not necessarily have developmental potential. When faced with a job that has developmental characteristics, i.e. novelty and challenge, individuals will take away varying levels of learning. People have different learning styles and may be blocked from learning due to a mismatch between the potential developmental learning available and their personal learning styles as well as distraction in their work and personal situations (Williams, 1997; Lombardo & Eichinger, 2000). When used as an executive-development strategy, attention must be paid to the matching of the experience, the individual, and the timing to maximize the value of the experience in producing personal change. Davis and Easterby-Smith (1984) observed that stable organizations in monopoly and dominant positions with strong norms of organizational behavior provided fewer developmental opportunities. They found the characteristics of these organizations were clear rules and procedures, slow managerial maturity, gradual acquisition of experience, and rigid career ladders. These are certainly defining characteristics of many fire service organizations.

In the early 1990s the Center for Creative Leadership developed the *Developmental Challenge Profile* (McCauley et al. 1994) intended to assess the developmental components of managerial jobs. They constructed a number of components and scales based on the previous research on the experiences that McCall et al. (1988) described in their study of successful executives. These components and scales were then tested and retested with two large samples of managers in a number of different organizations and at different levels of management responsibility. Through their analysis, they were able to identify 15 distinct scales that represent components of developmental jobs. These 15 scales were further grouped into three categories of (1) job transitions, (2) task-related characteristics, and (3) obstacles. These 15 scales in the three categories are shown in Table 1.

Research Methods

In order to investigate how developmental experiences influence the ability of fire chiefs to lead and manage more effectively, a qualitative study using a multiple case study (Yin, 2003) was conducted. The cases, or participants, were purposely selected from fire chiefs who had been awarded the Fire Chief of the Year Award by *Fire Chief* magazine. This award was given each year to one professional and one volunteer fire chief who had demonstrated outstanding leadership and commitment to the fire service. The selected cases were 14 fire chiefs who had received the Fire Chief of the Year award from 1996 through 2005.

Table 1: Developmental Challenge Profile Categories and Scales

Job Transactions
Unfamiliar responsibilities
Proving yourself
Task-Related Characteristics
Creating change/developing new directions
Inherited problems
Problems with employees
High level of responsibility/high stakes
Managing business diversity
Handling external pressure
Nonauthority relationships/influencing without authority
Obstacles
Adverse business conditions
Lack of top management support
Lack of personal support
Difficult boss

McCauley, C. D., Ruderman, M. N., Ohlott, P. J. & Morrow, J. E. (1994). Assessing the developmental components of managerial jobs, *Journal of Applied Psychology*, (79)4, 544-560.

The case selection was purposive because of the participant's ability to contribute to the evolving theory (Creswell, 1998). It was also a convenience selection due to the need for the participants to be accessible at a specific time and location (Gliner & Morgan, 2000).

Individuals who were nominated for this award must have demonstrated a career of progressive leadership in the fire service. Specific selection criteria for this award emphasized leadership, innovation, professional development, integrity, service to the public, and contributions to the fire service as a whole (*Fire Chief*, 2005). It is important to note that selection was not based solely on a single event such as command of a major emergency incident.

Personal interviews were the primary means of data collection with a small element of document review. The participants, or cases, were purposively selected because they had an intimate knowledge of the research subject but more importantly because they had a rich and lived experience with the phenomena in their own lives. The within-case data analysis used the holistic-content perspective described by Lieblich, Tuval-Mashiach, and Zilber (1998) to identify critical career-development experiences and specific developmental-experience themes. The participant interviews produced detailed and rich narrative data, and the analysis strategy identified common emergent themes in the form of critical career and later developmental experiences.

Fire Chief Interviews

Each participant who agreed to participate was interviewed in person at the International Association of Fire Chiefs conference in August, 2005 in Denver, Colorado, and again during one follow-up telephone

interview. The interview procedure for this two-cycle data collection process followed what Fontana and Frey (2000) describe as unstructured interviewing. Each participant was asked the same set of questions. The three primary questions were all open-ended and allowed participants the ability to move in any direction they felt best illustrated their experience. The questions in sections two and three were more definitive and open-ended. Interviews were conducted by the first author whose experience as a fire service officer enhanced rapport with the participant's interpretation of the vocabulary and culture.

Document Review

In addition to the interviews, the biographical article published in *Fire Chief* magazine on each participant was reviewed. If available, other documents on the participants also were reviewed. The purpose of this document review was to provide insight from another perspective into the lived experiences of the participants, in this case the actual words of the participants and interpretations of another interviewer (Hodder, 2000). Analysis of this document followed the same analysis procedures described in the following section for the interview data.

Analysis

The analysis consisted of three phases that generally corresponded to the first three research questions. Consistent with the holistic-content perspective, each narrative was read multiple times with the intent of determining the explicit features of each participant's unique experience. Generally these experiences included what happened, when it happened, who was involved, how each participant reacted, how each participant experi-

enced change in their leadership and management behaviors, what was learned, and what environmental and cultural factors influenced the situation. In this phase, one or more major themes of experience emerged from each participant's narrative. For each theme a qualitative value of the strength — weak, moderate or strong — was assigned. The cross-case analysis developed a set of common themes and critical career experiences across all 14 cases. This analysis was straightforward using the general cross-case analysis techniques described by Stake (2006).

Trustworthiness

For this study the trustworthiness strategies described by Creswell (2003) of triangulation of data sources, member-checking for the accuracy of data and interpretation from the participants, rich and thick description of the data, and clarification of researcher biases were used. Stake (1995) described four triangulation protocols: data source, investigator, theory, and methodological. This study uses data-source and methodological triangulation. The data-source triangulation used the two interviews approximately six months apart as well as the document review. The second interview asked the participants to elaborate on information provided in the first interview. The information provided by the participants on the same experiences at two different times was consistent. Information found in the document review on the same experiences was also consistent.

Findings

The findings were derived directly from the narratives of the 14 fire chiefs, 13 males and 1 female. The average age was 56 and the average time of service in the fire service was 35 years. The average tenure as a manager was 25 years with 19 years as fire chief. At the time of interview, all were well into their professional careers with several nearing retirement. One was retired from active service. Within this group, 8 were professional fire chiefs in that they were full-time employees of their jurisdictions. The other 6 were volunteers. Of the volunteer chiefs all but one had professional careers related in some way to fire protection and safety. Of the total participants all but two reported having formal higher education experience with 9 possessing associate degrees, 10 holding bachelor's degrees, and 7 holding master's degrees. One has a Ph.D. With the exception of one, all of the participants held at least one professional fire service management certification or had attended one prestigious management-development program.

From the large number of career experiences related by the 14 participants, nine experience themes emerged that most strongly met the definition of developmental experience across the 14 cases. The themes were (1) first fire chief/CEO position, (2) early experience, (3) relationships, (4) politics, (5) hardships, (6) observations of leaders, (7) first assistant chief/man-

agement position, (8) new program development, and (9) working without authority. Within these nine themes, personal learning was displayed in seven. These were (1) first fire chief/CEO position, (2) early experience, (3) politics, (4) hardships, (5) observations of leaders, (6) first assistant chief/management position, and (7) working without authority. Personal learning was defined as instrumental, confirmatory, and technical experiential learning. Within the nine developmental experience themes, changes in leadership and management behavior occurred in four: (1) first fire chief/CEO position, (2) hardships, (3) first assistant chief/management position, and (4) early experience. This filtering through the analysis process demonstrated that while these 14 people had many important career experiences, only a few contributed to significant changes in leadership and management behaviors.

Strongest Developmental Experiences

The fire chiefs described three developmental experience themes that stood out as particularly strong. These are the first fire chief/CEO position, hardships, and developing new programs. In their first experience as a fire chief/CEO, participants described unfamiliar responsibilities with a high degree of responsibility and accountability that differed from the scope, responsibility, and accountability of previous positions. They reported being affected by and having to react to strong external pressures, business diversity, and adverse business conditions as fire chief/CEO. In this regard, the participants who were senior managers in private-sector organizations reported a higher degree of external and environmental pressures.

Experiences involving professional and personal hardship also fit the definition of developmental experience well. Adverse business conditions, external pressure, problems with employees, and difficult superiors figured prominently in participant stories of hardship. An important subset of the hardship stories that more strongly illustrates developmental experience were the experiences some participants had with downsizing and reorganization. For them, these experiences were particularly painful and ultimately involved much personal learning and change. Another subset was stories of personal hardship involving cancer. These situations seemed to serve as catalysts for personal learning and change that affected both personal and professional lives.

The third strongest developmental experience involved developing and implementing new programs. Like the first fire chief/CEO position and hardships, these stories often included developing new organizational directions with high responsibility under adverse business conditions and external pressure. Some participants related stories of unsuccessful new programs that exposed them to significant personal and professional risk, in some cases prompting a career crisis and later recovery. Those who told stories involving unsuccessful new initiatives seemed to learn the

most. In most cases, experiences with new programs were imbedded within the first fire chief/CEO or first assistant chief/management experiences, although some occurred in premanagement phases.

The fourth strongest developmental experience was related to politics and in the participant's first role as an assistant chief or other midmanagement position. Both had aspects of unfamiliar responsibilities, high responsibilities, and business diversity management. It is in these roles that most participants described their first major responsibilities in developing and implementing new policy initiatives. Political experiences sometimes included external pressure and in the first assistant chief position, significant problems with employees.

The least strong developmental experience theme across the participants involved early experience, relationships, observation of other leaders, and working without authority. While individual participants related powerful individual stories of personal development, these themes did not rise to the level of others across a greater number of participants. However, some of these experiences were very important to individual participants. One participant's early experience with special assignments where he worked without formal authority and a second participant's naval experience very early in his career were examples.

Personal Learning and Leadership & Management Behavior Changes

The participants reported 32 examples of personal learning (Table 2) and 23 examples of changes in leadership and management behaviors (Table 3). Common personal learning cited by the participants included administrative and political skills and specific competencies in communication and presentation. Acquiring a greater appreciation for the impact of organizational actions on others was particularly strong in the first fire chief/CEO, first assistant chief/management roles, and hardship situations. Unique to the first fire chief/CEO and first assistant chief/management positions were a greater appreciation for process over product and how organizational policy affects people. Learning during early career experiences also was strong. In many cases participants described acquiring and refining technical and, in some cases, administrative skills. The very specific experience of working without authority described by two participants provided early acquisition of administrative and, more importantly, presentation and political skills. This early learning of administrative and technical skills is consistent with the concept of "platform skills" described by McCauley, Lombardo, and Usher (1989). There also seemed to be important learning by participants who had been involved in hardship situations that was primarily centered on the appreciation of relationships. For some, this involvement included a specific appreciation for the suffering of others in similar situations.

Change in leadership and management behaviors requires critical thinking and reflection. The four developmental experience themes where leadership and management change was most displayed were the (1) first fire chief/CEO position, (2) hardships, (3) first assistant chief/management position, and to a smaller degree (4) early experience. In these experiences the behaviors of listening, patience, and reflection seemed to have increased. When asked what leadership and management behaviors they had changed over time, participants described slowing down and increased patience with both people and processes. Specific leadership and management actions that improved include a greater focus on processes, building consensus, increased collaboration and negotiation, building relationships, and networking. Two changes that appeared strongly in the first fire chief/CEO position, first assistant chief/management position, and hardships were displaying greater respect for the needs of others and the ability to incorporate an in-depth understanding of fire service organizational culture in policy making.

Most Powerful Experiential Learning

Definitions of experiential learning suggests that the strongest experiential learning must have included instrumental, confirmatory, and technical learning as well as produced changes in behaviors and actions. Within analysis of the 14 participant interviews, the strongest experiential learning appeared in two developmental experience themes. The first developmental experience was that of serving in the fire chief/CEO position and the second was experiencing a hardship that resulted in personal or professional loss and pain. In their first fire chief/CEO positions, all but one of the participants told strong and consistent stories of a vastly increased scope of responsibility, accountability, and personal risk. The first fire chief/CEO experience was heavily represented in both the personal learning and change in leadership and management behavior examples. In this role the participants reported personal learning in 14 of the 32 examples shown in Table 2. Hardship experiences did not evidence a high degree of personal learning but did seem to precipitate strong personal changes in leadership and management behaviors. This evidence indicates that there may be something unique about a hardship experience that triggers personal change quickly.

For participants who described significant first fire chief/CEO position experiences and endured painful hardship situations, the learning and change seemed particularly strong. Six of the participants who related passionate stories of learning and change in their first fire chief/CEO position and in their hardship stories seemed to confirm the experience.

Recommendations for Incumbent and Aspiring Fire Chiefs

Findings from Jones' (2007) study offer four significant insights about how developmental-experience-based

Table 2: Personal Learning Examples

Positive observation of behavior: foresight, dedication, commitment, wisdom	Negative observations of behavior: low trust, poor communication skills, meanness	Appreciation for impact on people
Technical skills	Responsibility	Independence
Communications skills	Accountability	Value of hard work
Vision	Contributions of others	Focus on big picture
Independence	Importance of culture	Persistence
Self-interest of others	Expectations management	Confidence
Collaboration skills	Personal focus	Visibility
Negotiation skills	Conflict resolution skills	Uncertainty
Political skills	Process orientation	Administrative skills
Coping with disappointment	Appreciation of family	Presentation skills
	Working without superior support	Loyalty

strategies can be integrated into the career development of future fire chiefs. The experiences described by the 14 participants highlight the importance and value of providing early developmental experience opportunities, increasing the focus on early management and leadership opportunities, increasing the learning from hardship experiences, and increasing political awareness.

Provide Earlier Developmental Experience Opportunities

By far the most powerful and frequent developmental experiences did not appear until individuals had already reached the position of fire chief. This time period seems to put fire chiefs, especially new chiefs, into a very steep learning curve, essentially having to learn while doing when the results really count. The shock of ultimate responsibility, personal accountability, and interaction in the external political environment was relayed by many participants when they assumed their first fire chief position. Many told of not having adequate preparation for this role. It would make sense that this shock could be reduced by better preparation in not only technical, organizational, and relationship skills but in flexibility and adaptability.

The two developmental-experience themes that show promise to provide better management preparation were experiences at the first assistant chief/management position and working without authority. Two participants related stories in their first assistant

chief positions that prepared them somewhat for their later ascent to fire chief. Both told of being granted significant discretionary authority with a high degree of personal risk in developing and implementing major organizational policies. Both also described a hands-off approach by their superiors, which seemed to instill greater independence and self-reliance. While both appreciated the preparation these experiences provided, they also stated that it was not enough for the actual demands when they became fire chief. Most of the participants did not relate stories of significant risk and independent responsibility in their assistant chief roles. This fact is not surprising because within most fire departments, mid-level managers (such as assistant chiefs) are often responsible for implementing clearly defined policies, procedures, and directives with little discretionary authority.

The other experience that has potential for better management and leadership preparation is working without authority. Of the 14 participants, only 2 told of such experiences. In his early career one participant worked in a number of special assignments that required him to influence others without formal position authority and to build political and communication skills far in excess of what he needed within the normal career-development progression. Included here was also direct access to high-level managers and leaders who served as mentors. This executive-development strategy appears prominently in the executive-development literature. The emphasis on progressive position

Table 3: Change in Leadership and Management Behavior Examples

More patient	More flexible	Better listening
Evaluate gain/loss	Less angry	Bigger view
Build consensus	Focus on process	Redefine issues
Educate others	More documentation	Negotiation
More persistent	Greater collaboration	Greater reflection
Deal with disappointment	Respect needs of others	Adapt to environment
More responsibility for self in relationships	Incorporate cultural awareness	Involve external stakeholders
	Build relationships	Tolerance for uncertainty

experience common in the fire service is quite conducive to instrumental, confirmatory, and technical learning but not to stretch assignments that build flexibility and adaptability. The fire service culture seems adverse to any career-development actions that are outside these normal hierarchical rank progression systems.

Increase Focus on Early Management and Leadership Opportunities

The developmental-experience literature indicates that many successful executives are promoted into senior leadership and management roles early in their total careers, generally by their early 30s. They have likewise already had one or more developmental experiences. This pattern seems to hold true for the 14 participants in Jones' (2007) study but is not common in many fire service organizations where conformity and longevity are culturally rewarded. Even for the participants who were not in formal leadership positions early in their careers (at least assistant chief or midlevel managers in other organizations), all were involved in jobs that required independent action and significant organizational influence. This situation seems to indicate that there may be value to providing development experiences to individuals who display promise early in their careers. Within the stories related by the participants, none indicated that they had been specifically groomed by senior management. In fact, most seemed to be in the right place at the right time and took advantage of opportunities when they were presented.

One tenant expressed in the executive-development literature was that the development of future leaders should not be left to chance, that organizations should be more aggressive in identifying and preparing future leaders. Providing and supporting developmental experiences early in a promising person's career is one such strategy. The experiences of these 14 people seem to reinforce this strategy. In fact, most seemed to transcend their technical training quickly and rapidly moved on to acquiring administrative and political skills. One way to jump-start executive development in the fire service may be to focus more on the early career and provide developmental experiences earlier than they occur in the normal fire service promotional progression. Like providing more developmental experiences in general, the fire service culture is not conducive to providing early leadership and management opportunities.

Increase Learning from Hardships

Only a small number of the participants told stories of serious hardships. However, for them these were powerful and pivotal experiences rich with learning and most important changes in leadership and management behaviors. As indicated in the developmental experience literature, if this is such a powerful experience, it would make sense to find better ways of discovering and sharing the lessons of hardship. While there may already exist informal avenues of transferring learning from hardship, it does not appear to be strong in fire-

service executive-development programs. Adding some component of learning from hardship could not only allow others to learn from the experiences of others but may also reduce the stigma that may limit the value of hardship experience.

Increase Political Awareness

A constant theme that emerged across many participants was learning to exist and function productively within the political environment. Like most other developmental experiences, this was not something one learns until it really matters, usually in the position of fire chief. Many participants related strong stories of working with political officials and within the political system that were unsatisfactory. While some seemed to have become very adept, and now even relish it, others seemed to recoil from it. However, all acknowledged it as a set of skills required to be a successful fire chief.

Given the importance of developmental experience within the political environment, it seems to make sense to provide opportunities to learn and practice these skills before they are needed and to be able to learn them quickly as the situation requires. Early career developmental experience in special assignments with strong external components can provide this preparation. Unfortunately below the fire chief, most positions are almost entirely internally focused and these skills are not learned.

Concluding Comments

Each of the participants told engaging stories of their careers with some displaying a great amount of reflection. Personal learning was strong in the early career stages and first management experiences. This learning was consistent with the fire-service career-development model where much of a person's career is devoted to acquiring and refining technical, organizational, and relationship skills within a tightly defined and regulated culture. While changes in leadership and management behaviors were displayed throughout their careers, the most powerful changes in leadership and management behaviors were in the later stages of their career where they actively applied their executive application skills.

Overall, the findings indicate that developmental experience played an important role in preparing these 14 fire chiefs for the rigors of their current fire chief positions. Even though most of these experiences came parallel with doing the actual job, they appear to have improved the success of at least these participants. The experiences of these 14 people indicate that the five parameters associated with developmental experience described by McCall et al. (1988) are important to the development of these fire service executives. These are (1) that it took 10 to 20 years for them to fully develop and to have sufficient opportunities to engage in developmental experiences; (2) that they had at least one developmental experience early in their manage-

ment careers, usually before the age of 30; (3) that they learned that executive behavior is more about relating to and with people than the application of technical skills; (4) that dealing with change, ambiguity, and risk is inherent in any leadership situation; and (5) that developmental experiences built the confidence needed to survive even the most daunting challenges.

Central to the developmental experience model is the concept of challenge. Many of the experiences

described by the 14 participants clearly were significant challenges that required new leadership and management behaviors. For some of the fire chiefs these were critical stretch experiences. To those seeking the challenge of serving in the role of fire chief, an investment in strategic career development activities and experiences can return rich rewards. Incumbent and aspiring fire chiefs deserve them, and the increasingly dynamic nature of fire science demands it.

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Depressive Symptoms, Self-Rated Mental Health, Daily Functioning, and Job Satisfaction Among Firefighters

Abstract

Evidence exists that there is a negative psychological toll on firefighters from the repeated exposure to trauma. This article examines rates of depressive symptoms and how depression relates to self-rated mental health (SRMH), daily functioning and job satisfaction. A survey was completed using a sample of firefighters in the Midwest (N = 132). On the depression measure, 15.6% of respondents were within the range of clinical depression, and depression was related to other measures described.

Introduction

Emotional distress can have a negative and lasting impact on health, life satisfaction, and occupational functioning. Research indicates that fire fighting is a stressful occupation with stressors coming from a variety of sources (Corneil, Beaton, Murphy, Johnson & Pike, 1999; Murphy, Beaton, Pike & Johnson, 1999). A report by the International Association of Fire Fighters (1995) found that 8.0% of firefighters leaving the fire service due to disability were leaving because of mental distress. In a study of traumatic stress and depressive symptoms among new recruits and more experienced firefighters, Regher and colleagues (2003) found that more senior individuals reported higher rates of both traumatic stress and depression than new recruits. Similarly, Dean, Gow, and Shakespeare-Finch (2003) found that years of service was the most strongly associated risk factor for symptoms of psychological distress. Stress and depression among firefighters appear to be chronic conditions; a prospective study by Murphy et al. (1999) found increased scores on traumatic stress and depression measures to be relatively consistent across time. Stress and depression seem to be intimately related among firefighters. A prospective study by Roy and Steptoe (1994) found that self-reported scores of stress were significant predictors of later depression among firefighters.

The nature of the profession makes fire fighting a physically and mentally demanding occupation. The psychological distress firefighters experience as a result of the trauma they witness in their roles as first responders is receiving an increasing amount of attention within the fire service and health research literature (e.g., Marmar et al., 1999; Regehr & Glancy, 2000; Weiss, Marmar, Metzler & Ronfeldt, 1995). It has been posited that there is an extremely negative psychological impact to being a first responder at a traumatic

event. Dean et al. (2003) found that 11.3% of those firefighters sampled reported mild distress and 12.7% reported severe psychological distress.

While literature exists about firefighters' mental health as it relates to distress, there is limited information about other mental health measures among this population. The impact of what firefighters experience on the job may manifest itself in a variety of ways, including symptoms of depression. While a cross-sectional survey of firefighters cannot imply causation about the links between fire fighting as a profession and mental health, it can provide an important foundation for understanding depressive symptoms among this population and how depressive symptoms are related to other factors such as self-rated mental health (SRMH), impact of mental health on functioning, and job satisfaction. It is hypothesized that, similar to other occupational groups, greater depressive symptoms will be related to lower SRMH, poorer daily functioning, and lower job satisfaction.

Methods

Surveys

Two Midwestern metropolitan fire departments participated in data collection. Surveys were delivered to the departments and were distributed either by the project staff or departmental personnel. An introductory letter was provided with each survey. Respondents anonymously and confidentially completed the survey and returned them in sealed envelopes to the designated department staff person. Participants received a gift card to a local retailer as appreciation for their consideration. A total of 72.0% of those initially sent surveys responded (Graham et al., in press), and 132 provided complete data for the current analysis.

Instrumentation

Mental health was assessed through three different sets of questions. First, the Center for Epidemiological Studies Short Depression Scale (CES-D 10) was used to assess depression (Radloff, 1977). This survey includes questions about the frequency of both feelings and behaviors during the past week. Response options included:

- Rarely or none of the time (<1 day)
- Some or a little of the time (1-2 days)
- Occasionally or a moderate amount of time (3-4 days)
- All of the time (5-7 days).

Total scores are computed by adding the points for each question. Those scoring 10 or more are considered to be in the range of depression. The CES-D 10 has been found to be highly reliable among the general population (Spearman-Brown, split halves $r = 0.85$) and in patient samples ($r = 0.90$; Radloff, 1977).

A single-item SRMH question asked: "Would you say your overall mental health is ...?" Response options included *poor, fair, good, very good, or excellent*. The question was adapted from a self-rated physical health question that is commonly used in epidemiological surveys and has been found to be related to several health outcomes such as morbidity and mortality (Krause & Jay, 1994).

To assess the degree to which mental health interfered with their daily living, participants were asked: "Thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your

mental health not good?" Participants also were asked to rate:

- "... how often have you felt that you were unable to control the important things in your life?"
- "... how often have you felt that you were confident about your ability to handle your personal problems?"
- "...how often have you felt that things were going your way?"

Response options were *never, almost never, sometimes, fairly often, and very often*.

Firefighter job-satisfaction questions were adapted from common employee satisfaction questions and included:

- "I am optimistic about my future success with this fire department."
- "I am satisfied with my job in the fire department."
- "My work with the fire department gives me a sense of accomplishment."

All job-satisfaction items were answered with the response options of *strongly disagree, disagree, neutral, agree or strongly agree*.

Results

On the CES-D 10, 15.6% of respondents were within the range of clinical depression. Table 1 presents the frequency of responses for each of the individual CES-D 10 questions. Reports of restless sleep occasionally (22.0%) or all of the time (7.1%) was by far the most endorsed. The next most commonly endorsed item was "I had trouble keeping my mind on what I was doing,"

Table 1: Percent of Responses for Each Item on the CES-D 10

Below is a list of some of the ways you may have felt or behaved. Please indicate how often you have felt this way during the past week:	Rarely or None of the Time (<1 day)	Some or a Little of the Time (1-2 days)	Occasionally or a Moderate Amount of Time (3-4 days)	All of the Time (5-7 days)
I was bothered by things that usually don't bother me	66.9	22.3	10.0	0.8
I had trouble keeping my mind on what I was doing	50.0	32.5	14.3	3.2
I felt depressed	78.9	14.8	4.7	1.6
I felt that everything I did was an effort	58.1	29.8	8.1	4.0
I felt hopeful about the future*	8.7	11.4	39.4	40.2
I felt fearful	85.7	11.1	2.4	0.8
My sleep was restless	36.2	34.6	22.0	7.1
I was happy*	6.3	10.2	43.8	39.8
I felt lonely	80.5	14.8	2.3	2.3
I could not "get going"	62.5	31.3	5.5	0.8

* Items are scored in reverse order with higher frequency scores contributing fewer points.

with 14.3% reporting experiencing this occasionally and 3.2% reporting experiencing this all of the time. Of those responding, 8.7% reported rarely feeling hopeful about the future and 11.4% reported that they felt hopeful some or little of the time. The least endorsed item was "I felt fearful" with only 2.4% reporting this feeling occasionally and 0.8% reporting this feeling all of the time. Overall, those in the depressed range tended to be older ($t = -2.7, p = 0.008$).

Because sleep disturbances are relatively common in firefighters, it should not be assumed that reported sleep disturbance is related to emotional issues. To determine whether the high prevalence of scores in the "clinically depressed" range was related to sleep problems, CES-D 10 scores were recalculated without the reported sleep disturbance problems. Even with this recalculation, 12.5% of respondents scored in the clinical range for depression. Removing the sleep question was done solely for exploratory purposes. All remaining analyses are based on the full CES-D measure.

On the single-item SRMH question, 0.8% of the total sample reported their mental health as *poor*, 3.1% rated their mental health as *fair*, 17.2% rated their mental health as *good*, 53.1% as *very good*, and 25.8% as *excellent*. Of those who scored in the clinical range for depression, 75.0% rated their mental health as *good*, *very good*, or *excellent*. Among those not depressed, everyone rated their mental health as either *good* (14.4%), *very good* (55.8%), or *excellent* (29.8%).

Using CES-D depression scores, we next divided the sample into two groups, those in the depressed range and those in the nondepressed group, and compared responses between the two groups across the other mental-health questions. All comparisons between those in the depressed range and those not in the depressed range show statistically significant differences on the various mental-health measures (see Table 2).

When asked to report the frequency of days in the last month that their mental health was not good, participants reported an average of 3.3 days ($SD = 6.3$ days) of poor mental health. Those in the depressed range reported significantly more days of poor mental health (11.0 days, $SD = 9.7$) than those not in the depressed range (1.9 days, $SD = 4.3$ days; $t = -6.8, p < 0.001$). Overall, 5.0% of participants reported no days of "not good" mental health. Approximately one-third (31.3%) reported between 1 and 9 days where their mental health was "not good" and the remaining 13.8% reported between 10 and 30 days of "not good" mental health. Of those in the clinically depressed range, 10.0% reported no days of "not good" mental health, 40.0% reported between 1 and 9 days of "not good" mental health and the remaining 50.0% reported between 10 and 30 days of "not good" mental health. Of those not in the clinically depressed range, nearly two thirds (62.6%) reported no days of "not good" mental health. Very few reported 10 or more days of "not good" mental health (6.4%).

For the question about frequency of feeling out of control, 28.7% reported feeling out of control *sometimes*, 6.2% reported feeling that way *fairly often* and 0.8% reported that feeling *very often*. The majority of participants reported feeling out of control *never* (30.2%) or *almost never* (34.1%). Among those who scored as clinically depressed, 55% reported feeling out of control *sometimes* and 35% reported feeling out of control *fairly often* or *very often*. Only 10.0% of those in the clinically depressed range reported feeling out of control *never* or *almost never*.

With regard to the question about confidence in their ability to handle personal problems, 50.0% reported they feel that way *very often*, 33.1% reported feeling that way *fairly often*. Very few people reported feeling they *never* (1.5%) or *almost never* (3.1%) have confidence. When considering only the people who were in the depressed range, very few (15.0%) reported lacking confidence to solve personal problems *never* or *almost never*. Most felt they lacked confidence *sometimes* (45.0%) or *fairly often* (35.0%).

Overall, the sample was positive about the way their lives were going with 71.7% reporting feeling that things were going their way either *fairly often* or *very often*. Only 2.4% reported *almost never* feeling that things were going their way. When considering those in the depressed range, none felt that things *very often* went their way while less than a third (31.6%) reported feeling things were going their way *fairly often*. The majority (57.9%) reported feeling that things only *sometimes* go their way while 10.5% reported feeling things *almost never* go their way.

In general, firefighters surveyed reported having a good deal of job satisfaction. When asked whether they were optimistic about the future success with their department, 73.3% *agreed* or *very much agreed* that they were optimistic. Those not in the depressed range reported more optimism than their depressed peers ($t = 3.9, p < 0.001$). Of those who were surveyed, 75.0% agreed that they were satisfied with their job at the fire department with those in the nondepressed range reporting more satisfaction ($t = 3.6, p < 0.001$). More than three quarters (76.2%) reported that their work with the fire department gave them a sense of accomplishment. Those not in the depressed range reported more of a sense of accomplishment than their depressed peers ($t = 2.8, p = 0.006$).

Discussion

In keeping with previous literature citing increased rates of mental health disturbances among firefighters, the current study found nearly 16.0% of participants to be within the clinical range of depression. This rate is higher than the national average of depression with prevalence rates of around 7.0% in males (NIMH, 2005; Riolo, Nguyen, Greden & King, 2005).

SRMH is a common one-item assessment of mental health that has been found to be related to mental-health service use, depression, and distress and,

Table 2: Responses to Mental Health Questions, Percent in Each Category, and Average Score

Question	NonDepressed n = 105	Depressed n = 20	t test (p value)
Would you say your overall mental health is:			
Poor (1)	0.0	5.0	5.45 (<0.001)
Fair (2)	0.0	20.0	
Good (3)	14.4	30.0	
Very Good (4)	55.8	40.0	
Excellent (5)	29.8	5.0	
	(M = 4.2, SD = 0.7)	(M = 3.2, SD = 1.0)	
In the last month, how often have you felt that you were unable to control the important things in your life?			
Never (1)	34.3	5.0	-6.6 (<0.001)
Almost Never (2)	40.0	5.0	
Sometimes (3)	23.8	55.0	
Fairly Often (4)	1.9	30.0	
Very Often (5)	0.0	5.0	
	(M = 1.9, SD = 0.8)	(M = 3.3, SD = 0.9)	
In the last month, how often have you felt that you were confident about your ability to handle your personal problems?			
Never (1)	1.9	0.0	5.8 (<0.001)
Almost Never (2)	0.9	15.0	
Sometimes (3)	5.7	45.0	
Fairly Often (4)	34.0	35.0	
Very Often (5)	57.5	5.0	
	(M = 4.4, SD = 0.8)	(M = 3.3, SD = 0.8)	
In the last month, how often have you felt that things were going your way?			
Never (1)	0.0	0.0	4.7 (<0.001)
Almost Never (2)	1.0	10.5	
Sometimes (3)	20.2	57.9	
Fairly Often (4)	56.7	31.6	
Very Often (5)	22.1	0.0	
	(M = 4.0, SD = 0.7)	(M = 3.2, SD = 0.6)	
Thinking about your mental health ... for how many days during the past 30 days was your health not good?	M = 1.9 days, SD = 4.3	M = 11.0 days, SD = 9.7	-6.8 (<0.001)

therefore, is thought to be a useful general gauge of mental health in population studies (Fleishman & Zuvekas, 2007; Katz et al., 1997; Vega, Kolody & Aguilar-Gaxiola, 2001; Albizu-Garcia et al., 2001). SRMH scores in this sample were somewhat more positive than typical in U.S. samples. In general, 70.0% of those in the U.S. National Comorbidity Survey reported their overall mental health as *very good* or *excellent*, while 75.9% of the current sample reported *very good* or *excellent* mental health (Katz et al., 1997).

More than three-quarters of those who scored in the depressed range rated their overall mental health as *good*, *very good*, or *excellent*. While firefighters en-

dorsed specific problem questions related to behaviors, beliefs, and experiences related to their mental health at a high rate, they might not identify these, overall, as "mental-health problems" when asked directly about them. At a minimum, a single-item question about SRMH might not be a valid assessment of firefighter mental health.

There are several reasons that likely account for the elevated level of depressive symptoms. Firefighters respond to a wide variety of "calls to service." Simply put, what they see on these calls may be influencing their mental health. In addition, sleep-related problems are being paid an increasing level of attention in the

fire service community as the effects of sleep deprivation are being increasingly recognized (Elliot & Kuehl, 2007). Sleep difficulties are particularly salient to mental health as chronic sleep disturbance has been related to increased feeling of depression and stress (Pilcher & Huffcutt, 1996; Poissonnet & Veron, 2000; Spark et al., 1997). Those who work shift schedules that interrupt normal sleep/wake cycles report higher rates of sleep disturbance (Bos et al., 2004; Murphy et al., 1994). Sleep disturbance has been rated as one of the most common occupational stressors of both male and female firefighters (Murphy, Beaton, Cain, & Pike, 1994). It is possible that these sleep problems are related to the elevated levels of reported emotional disturbance among firefighters.

Attention to the prevalence of depressive and traumatic stress-related symptoms is important for the fire service. High rates of symptomology have been related to other health-behavior concerns. For instance, Murphy et al. (1999) found that increased job-related stressors was positively correlated with alcohol consumption and drinking problems. Understanding the symptoms firefighters display is key to understanding the relationship between depression and other health behaviors.

For fire service management, the findings highlight the importance of attending to the psychological health of firefighters. Rates of depression in this sample were high compared to the general population, which may be related to the unique psychological stressors of the fire fighting profession. It is important that departments educate their personnel about the signs, symptoms, and treatment resources for depression and remind them that resources are available to assist firefighters when they experience symptoms of depression.

While the current study is limited in its generalizability because of a small sample size from a restricted geographic region, the results point to important factors that deserve more attention in the fire service. It is important to quantify the rates of mental-health symptoms among firefighters in order to target intervention efforts that affect health. Because mental-health functioning has such a strong and significant effect on overall physical health, it is important to understand the impact of being on the job and how the experiences of firefighters relates to mental-health functioning.

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Contributing Factors to Firefighter Line-of-Duty Injury in Metropolitan Fire Departments in the United States

Abstract

The objective of this study was to analyze retrospective data from a group of geographically diverse metropolitan fire departments for the years 2005-2006 (two years) to identify and quantify the major factors that contribute to firefighter line-of-duty (LOD) injury. The identified contributing factors were examined for frequency of occurrence and clustering with other factors. Results should be used to (1) alert participating fire department leaders of the primary factors that contribute to firefighter injuries in their respective departments and to identify clustering patterns of those factors and (2) develop or enhance risk management programs within the participating and similar departments. A retrospective study was conducted using data compiled from nine geographically diverse metropolitan fire departments throughout the United States. Source departments included Richmond, Virginia; Worcester, Massachusetts; Charlotte, North Carolina; Miami, Florida; Memphis, Tennessee; Shreveport, Louisiana; Kansas City, Missouri; Phoenix, Arizona; and Contra Costa County, California. For each LOD injury, factors contributing to the injury were recorded from internal departmental reports including official injury reports, victim statements, and officer and eyewitness reports. Once compiled, the contributing factors were analyzed for frequency of occurrence and clustering with other factors. No factors were excluded from the cluster analysis. Factors and clusters were stratified according to firefighter age, gender, type of injury, body part injured, location where injury occurred, firefighter years of service, medical treatment required, and postinjury status. There were 3,450 injury cases with sufficient information to be included in the study. Frequency analysis revealed that the dominant contributing factors to LOD injury are lack of situational awareness (37.35%), lack of wellness/fitness (28.57%), and human error (10.65%). Cluster analysis was performed revealing contributing factors frequently occurring together. Four main clusters were identified with these contributing factors. Cluster 1 included equipment failure, lack of training, structural failure, act of violence, civilian error, horseplay, and lack of teamwork. Cluster 2 included crew size, lack of wellness/fitness, firefighter fatigue, and weather/act of nature. Cluster 3 included protective equipment (SCBA or seatbelt) not worn and dangerous substances. Cluster 4 included decision-making error, lack of communication, standard operating guideline/procedure breach, protocol breach, human error, and lack of situational awareness. Cluster 4 alone (regardless of other clusters) was shown to be responsible for more than 30.0% of all firefighter-on-duty injuries during the years studied while Cluster 2 was responsible for an additional 26.2%. Ninety-four and one-half percent of firefighter LOD injuries occurring in 2005-2006 in the departments studied are attributable to an identifiable cluster of contributing factors. Approximately one-third of the firefighter LOD injuries studied are attributable to a cluster of factors that are under the direct control of the individual firefighter and chief officers. The information revealed in this study imposes a considerable burden on fire service leaders as well as firefighters themselves. It offers substantial explanation for the LOD injury occurring within metropolitan departments studied thus providing direction for shaping local fire department policy decisions and operational priorities in those departments.

Introduction

The provision of fire suppression and emergency medical services entails sporadic high levels of physical exertion, uncontrolled environmental exposures, and psychological stress from observing intense human suffering. Firefighters experience inordinate numbers

of line-of-duty (LOD) injuries, injuries due to occupational diseases, and forced retirements (Moore-Merrell et al., 2008). The National Fire Protection Association (NFPA®) estimates that there were approximately 1,140,900 firefighters in the U.S. in 2006. Of the total

number of firefighters, 316,950 or 28% were career firefighters. Most of the career firefighters (76%) are in communities that protect 25,000 or more people (Karter, 2007a). A large percentage of these firefighters are employed by fire departments in metropolitan areas.

Year after year, there are notable advancements in the fire service industry. These advancements range from building code improvements to sprinkled buildings to better personal protective gear to technologically advanced apparatus. Many profound advances have also been made in both laws and programs designed to improve worker safety and health for all workers in the U.S. In spite of these laws and the improvements mentioned, scores of firefighters are injured in the line of duty each year. NFPA® estimates that 80,100 firefighter injuries occurred in the line of duty in 2005, an increase of 5.6% from the year before. Almost half of all firefighter injuries occurred during fireground operations. An estimated 13,325 occurred during other on-duty activities, while 12,250 occurred at nonfire emergency incidents. The leading type of injury received during fireground operations was strain, sprain, or muscular pain (Karter & Molis, 2006). This study specifically examines contributing factors leading to firefighter LOD injury in metropolitan fire departments. Results can be compared with similar studies to hone knowledge and thereby provide opportunities for intervention through departmental training, practices, and policy to prevent firefighter injuries.

Literature Review

Currently, there is a dearth of published information on firefighter injuries. Government and industry publications, which rely on voluntary incident reporting and annual survey projections, presently offer the broadest scope of information regarding fireground injuries (Karter, 2007b). Academic interest in firefighters' occupational risks and hazards has increased in recent years, but many of these papers analyze contributing factors outside the context of specific fireground incidents and individuals' past fire fighting experience and training. The most in-depth studies to date identify key areas of risk for firefighter injuries, but many findings suffer from limited predictive value due to small sample sizes. If LOD injuries are to be comprehensively evaluated and risks of firefighter injury minimized to the fullest, future investigation must look both in finer and greater detail at the particular events unfolding at fire and emergency scenarios as well as overarching trends across geographic regions.

The U.S. Fire Administration's (USFA) voluntary-enrollment National Fire Incident Reporting System (NFIRS) comprises the largest information database used for analysis in most academic and government publications on firefighter injuries and fatalities. Module 5 of the current NFIRS Version 5.0, the Fire Service Casualty Module, includes a firefighter injury reporting form (NFDC, 2008). However, the majority of papers using data from this system examine firefighter fatali-

ties and the risk of death associated with coronary heart disease, structure-related trauma, and the risk differences for a variety of factors between career and volunteer firefighters (CDC, 2006; Hodous, 2004; Kales, 2003). Few studies to date have attempted to quantify incident-level risk factors for firefighter injury using NFIRS data (Fabio, 2002). The NFPA® Survey of Fire Departments for U.S. Fire Experience is the industrial counterpart to NFIRS annual data and projects responses from 2,500 to 3,500 departments into national figures by weighting the results to adjust for the proportion of U.S. population represented by community size. NFPA® reports provide annual national estimates of injuries by cause, type of duty, and number of injuries per department by population of community protected (Karter, 2007b). Conclusions drawn from either of these datasets are confined by study designs that by necessity exclude certain fire incidents. Thus, NFIRS' voluntary reporting system and NFPA®'s survey projections give the most extensive accounts of U.S. firefighter injuries, but these estimates are still only partially complete.

Presently, academic literature that attempts to identify and assess factors contributing to firefighter LOD injuries tends to focus on broad risk categories that can be studied using a general knowledge of firefighters' physical duties and potentially hazardous fireground exposures. These papers, which usually address overall firefighter fitness or equipment use, emphasize the fact that public safety depends on the general health of firefighters and medical first responders and that effective equipment use can prevent certain types of injury (Soteriades, 2005). Reduced firefighter fitness and cardiovascular health have so far received the most attention as contributing factors to "adverse employment events" including on-duty injury and disability (Kales, 2002; Soteriades, 2002-2008; Sothmann 2004). A few studies of firefighter equipment and ergonomics have confirmed the use of specific uniforms and vehicle restraints in preventing LOD burn and motor vehicle injuries as well as identified emergency rescue tasks that cause the most musculoskeletal strain (Becker, 2003; Lavender, 2000; Prezant, 2000). Likewise, several smaller analyses have affirmed the role that the close-knit structure of a fire company plays in shaping various health promotion attitudes (Elliot, 2004, 2007; Moe, 2002). By addressing issues such as hearing loss, eating habits, and psychological stress in the context of unit-level resources and outcomes, such papers come closer to realizing the occupational experience of many firefighters. Nevertheless, they are still somewhat removed from LOD incidents (Bacharach, 2008; Beaton, 1998; Hong, 2008; Kales, 2001; Tak, 2007). Studies of breathing apparatus use during overhaul come nearest to documenting the risks of lung injury during specific incident conditions, but these, like the majority of academic papers, examine a highly localized sample population (Austin, 2001; Burgess, 2001).

If the risks and contributing factors for firefighter LOD injuries are to be fully understood, greater study must

be given toward the sequences of events unfolding at and around particular fire incidents and emergency situations. While long-term prevention, health promotion, and technological advancements certainly equip firefighters with individual and sometimes unit-level tools to reduce on-duty risks before an incident occurs, far less research has examined the influence that the interaction of these factors and more dynamic, situation-specific elements have on firefighter LOD injuries during fire operations. A review of the current literature suggests a pressing need for information and analysis that synthesizes diverse populations and incorporates the ways in which individual firefighter fitness, fatigue over time, equipment performance and use, staffing, strategic protocols, incident command, teamwork, and changing environmental factors contribute to situations that protect firefighters or make them more vulnerable to LOD injuries.

Methods

Study Design

Injury data analyzed in the study were compiled from nine geographically diverse metropolitan departments in the U.S. Data were limited to firefighter LOD injuries occurring during the years of 2005-2006 with sufficient information for analysis. Injury data were contributed from metropolitan fire departments in Richmond, Virginia; Worcester, Massachusetts; Charlotte, North Carolina; Miami, Florida; Memphis, Tennessee; Shreveport, Louisiana; Kansas City, Missouri; Phoenix, Arizona; and Contra Costa County, California. Data compiled included case information for each LOD injury as well as known contributing factors to the injury including one or more of the following:

- Officer/incident command,
- Crew size,
- Decision-making equipment failure,
- Lack of training,
- Lack of wellness/fitness,
- Firefighter fatigue,
- Lack of communication,
- Standard operating guidelines/procedures breach,
- Protocol breach,
- Structural failure,
- Act of violence,
- Weather/act of nature,
- Human error,
- Civilian error,
- Lack of situational awareness,

- “Horseplay,” or
- Lack of teamwork.

Data for each LOD injury and associated contributing factors were compiled from reports profiling the incident leading to the injury as communicated by the victim, peers, and officers and as recorded by each respective department’s injury-tracking mechanism. Methods for data collection, recording, and reporting varied between departments. Though similar, none of the departments collected or reported firefighter injury in the same way. Therefore, data compilation was conducted on a case-by-case basis to assure proper transfer of information and an accurate transfer of data element definitions to the master database used for analysis. A total of 3,450 cases had sufficient information available for inclusion in the study.

Data Synthesis

This study was based on data extracted from nine metropolitan fire department’s injury files for the years 2005-2006. These data were cross-referenced with data elements and definitions used in the Near Miss Reporting System to assure industry consistency in use of terms recognized in the fire service industry.

The term *on-duty* refers to a firefighter being involved in operations at the scene of an emergency, whether it is a fire or nonfire incident, responding to or returning from an incident, or performing other officially assigned duties such as training, maintenance, public education, inspection, and investigations.

Study Protocol

Descriptive data for each LOD injury and associated contributing factors were compiled from reports profiling the incident leading to the injury as communicated by the victim, peers, and officers and as recorded by each respective department’s injury-tracking mechanism. Data were submitted using a standard template¹ and compiled into a master database for analysis. Data tables were prepared with all-study relevant information.

Data were analyzed to assess the frequency of identified contributing factors and the circumstances in which the injury occurred. As injury-relevant circumstances and contributing factors were documented, a variable key was constructed containing each variable name and the definition as referenced in data source reports. Frequency analysis as well as cluster analysis were performed on the overall database. Cluster analysis was used to organize the data into meaningful structures or develop taxonomies or groups of contributing factors that occur together. The aim of cluster analysis was to sort different factors into groups in a way that the degree of association between two factors is maximal if they belong to the same group and minimal otherwise. Clustering is typically used to discover structures in data without providing an explanation or interpretation as to why they exist. Clusters provide a springboard for

future research to better identify why relationships exist between various factors.

Data Analysis

Initial analysis identified the overall dominant contributing factors as well as the dominant factors in each of five strata. Strata included firefighter age, gender, rank, years of service, and scene type. Next, data were analyzed for clustering between contributing factors and the frequency of that cluster. Four oblique clusters of the contributing factors were identified using the VARCLUS Procedure using the SAS software (Version 9.1, SAS Institute). All contributing factors were included in the cluster analysis. A binary score was calculated for each cluster based on presence/absence of any of its constituent contributing factors. Finally, these contributing factor clusters were evaluated for the significance of their contribution to firefighter LOD injury in the departments studied. The relative contribution of these clusters was also evaluated within each stratum identified previously. All data analyses were conducted using SAS software.

Results

There were 3,450 cases identified with sufficient information for inclusion in the study. Firefighter LOD injury characteristics are shown in Table 1. Age information was not available for fourteen of the cases, and gender was not identified in three cases. Additionally, the years of service and rank were not identified in eight and two cases, respectfully. Stratified analyses were limited to cases with sufficient strata specific data.

As is expected, based on the composition of the fire service, the majority of LOD injury cases are male (94.9%). For the years and cases included in the study, more firefighter LOD injury occur in firefighters with less than 6 years of service (30.7%) and in those with between 11-20 years of service (31.9%). The majority of firefighters injured are between the ages of 36-45 (39.4%). According to rank, more firefighter LOD injury occurs in the rank of firefighter (72.1%) than in any other rank.

Characteristics of the injuries incurred were also assessed. Data were compiled on various aspects of each injury including type of injury, body part injured, medical treatment, and number of days off duty or on light duty. As for circumstances surrounding the injuries, most occur on the fireground (30.5%), and the most common injury is a fracture or muscle sprain (61.7%). For the cases studied, more than half required medical aid (62.7%), and the most common body part injured was an extremity (42.0%). See Table 2.

Contributing factors were identified for each injury. The factors identified were compiled from reports profiling the incident leading to the injury as communicated by the victim, peers, and officers and as recorded by each respective department's injury-tracking mechanism. Each factor identified was defined or described and assigned a variable name for the study. The

contributing factors, definitions and variable names are listed as follows:

- **Incident Commander (IC)** — Individual responsible for the combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure with responsibility for the management of assigned resources to effectively accomplish stated objectives pertaining to an incident or training exercise (NFPA® 1670 and 424).
- **Crew Size (CREW SIZE)** (Fire Crew or Company) — Group of members: (1) Under the direct supervision of an officer; (2) Trained and equipped to perform assigned tasks; (3) Usually organized and identified as engine companies, ladder companies, rescue companies, squad companies, or multifunctional companies; (4) Operating with one piece of fire apparatus (engine, ladder truck, elevating platform, quint, rescue, squad, or ambulance) except where multiple apparatus are assigned that are dispatched and arrive together, continuously operate together, and are managed by a single company officer; (5) Arriving at the incident scene on fire apparatus (NFPA® 1710). An organized group of firefighters under the leadership of a crew leader or other designated official (NIFC, 2006).
- **Lack of Training (TRAIN)** — Deficiency of instruction and hands-on practice in the operation of equipment and systems that are expected to be used in the performance of assigned duties (NFPA® 600 and 601).
- **Lack of Communications (COMM)** — Deficiency of radio, telephone and messenger service networks throughout the emergency response system necessary to facilitate direct communication from the incident commander to officers, firefighters, and emergency providers in tactical operations (NFPA® 130, 502, and 1221).
- **Standard Operating Procedure (Guideline) Breach (SOP/SOG)** — Breach of written organizational directive that establishes or prescribes specific operational or administrative methods to be followed routinely for the performance of designated operations, actions, or administrative functions (NFPA® 1521).
- **Protocol Breach (PROTOCOL)** — Breach of organizational directive that establishes a common practice or course of action during tactical operations. A protocol aims to streamline particular processes according to a set routine. By definition, protocol is a term for a mandatory procedure. In the EMS arena, a protocol is intended to guide

Table 1: Characteristics of Firefighter LOD Injury Cases Included in the Study (N = 3,450)

Characteristic	Number	Percent
Age:		
Less than 26	185	5.4
26-35	1,041	30.2
36-45	1,358	39.4
46-55	740	21.4
Greater than 55	112	3.2
Unidentified	14	0.4
Gender:		
Female	174	5.0
Male	3,273	94.9
Unidentified	3	0.1
Rank:		
Chief	77	2.2
Civilian	11	0.3
Firefighter	2,489	72.1
Investigator	13	0.4
Recruit	84	2.4
Captain	774	22.4
Unidentified	2	0.1
Years of Service:		
Less than 6	1,058	30.7
6-10	627	18.2
11-20	1,100	31.9
Greater than 20	657	19.0
Unidentified	8	0.2
Scene Type:		
Not Specified	37	1.1
Fireground	1,053	30.5
Nonfire Emergency	862	25.0
In-Transit	200	5.8
Training	344	10.0
Other On-Duty	954	27.7

decisions regarding assessment, management, and treatment of patients.

- **Protective Equipment Not Worn/SCBA or Seat-belt (PE)** — Not wearing equipment provided to shield or isolate personnel from infectious, chemical, physical, and thermal hazards (NFPA® 1670) and physical injury.
- **Lack of Wellness/Fitness (LWF-WELLNESS/FITNESS)** — State of uniform personnel signifying a deficiency or absence of physical, mental, or emotional capability to withstand the stresses or strains of living and functioning in the workplace. This adverse state results from cumulative fac-

tors including job exposures, stress, and personal behavior, including poor diet and general lack of exercise.

- **Act of Violence (VIOL)** — Exertion of physical force to injure, abuse, or cause death.
- **Dangerous Substance (DS)** — Substances that are explosive and/or flammable such as petroleum products and gunpowder. It includes radioactive substances and products such as aerosol cans that can explode when heat or pressure is applied. It also includes “hazardous substance” that includes substances used or produced by industries that have the potential to cause mass disaster to

Table 2: Characteristics of Injuries Included in the Study (N = 3,450)

Characteristic	Number	Percent
Number of Days Injured (off normal duty):		
0 days	2,585	74.9
1-10 days	546	15.8
11-20 days	105	3.0
21-30 days	59	1.7
30+ days	144	4.2
Did not return	11	0.3
Number of Days on Light Duty:		
0 days	3,102	89.9
1-10 days	176	5.1
11-20 days	58	1.7
21-30 days	26	0.8
30+ days	87	2.5
Unidentified	1	0.0
Medical Treatment:		
No Aid	1,287	37.3
Yes Aid	2,163	62.7
Type of Injury:		
Not Specified	46	1.3
Fire, Chemical Burn	189	5.5
Inhalation, Respiratory	188	5.4
Wound, Cut, Bleeding	509	14.8
Fracture, Sprain, Muscle	2,128	61.7
Heart Attack, Stroke	150	4.3
Skin Exposure	225	6.5
Any Combination	15	0.4
Body Part Injured:		
Not Specified	50	1.4
Extremity	1448	42.0
Head/Face/Neck	367	10.6
Trunk/Abdomen/Groin	490	14.2
Back	741	21.5
Heart/Respiratory	261	7.6
Heat Exhaustion	21	0.6
Any Combination	72	2.1

people and the environment. Examples of hazardous substances are chlorine, polychlorinated biphenyl (PCB), chlorobenzene, pesticides, etc. Hazardous substances are listed and controlled under the Poisons Act and the Poisons (Hazardous Substances) Rules. The factor also encompasses toxic industrial waste that includes toxic waste from industries such as spent acids, alkalis, etchants, solvents, and waste oils. (NEA, 2008)

- **Weather/Act of Nature (WEA-WEATHER)** — Extraordinary and unexpected natural event such as

a hurricane, tornado, or earthquake or even the sudden death of a person.

- **Human Error by Firefighter or Officer (HE)** — Mistake made by a person rather than caused by a poorly designed process or the malfunctioning of equipment.
- **Civilian Error (CE)** — Persons who are members of the general public and are not fire service or other emergency services personnel (NFPA® 180) who in an act or condition of ignorant or

imprudent behavior unintentionally cause an adverse event.

- **Decision-Making Error (DM-DECISION MAKING)** — Outcome of mental processes (cognitive processes) leading to the selection of a course of action among several alternatives that results in an error. Every decision-making process produces a final choice. (Carnegie Mellon, 2008)
- **Structural Failure (SF)** — Structural collapse brought on by fire that precludes buildings or structural components from functioning as designed.
- **Emergency Equipment Failure (EF)** — Unacceptable difference between expected and observed performance of emergency equipment.
- **Firefighter Fatigue (FF-FATIGUE)** — Weariness caused by exertion. It can describe a range of afflictions, varying from a general state of lethargy to a specific work-induced burning sensation within one's muscles. It can be both physical and mental. Physical fatigue is the inability to continue functioning at the level of one's normal abilities, (Hawley, 1997)
- **Lack of Situational Awareness (LSA)** — Absence of knowledge and understanding of the environment that is critical to those who need to make decisions in complex areas such as fire-ground operations, air traffic control, and military command and control. Situational awareness has been formally defined as "the perception of elements in the environment within a volume of time and space, the comprehension of their

Table 3: Dominant Contributing Factors by Strata (Top 3 Percentages Shown)

Strata	Contributing Factor (Percent LOD Injury*)		
Overall	LSA (37.3)	LWF (28.5)	HE (10.6)
Age:			
Less than 26	LSA (39.5)	LWF (32.4)	PE (13.0)
26-35	LSA (39.2)	LWF (25.7)	DS (13.3)
36-45	LSA (37.1)	LWF (26.8)	HE (10.2)
46-55	LSA (35.1)	LWF (34.1)	HE (10.7)
Greater than 55	FF (36.6)	LSA (32.1)	COMM (13.4)
Gender:			
Female	LSA (48.3)	LWF (20.1)	HE (12.6)
Male	LSA (36.7)	LWF (29.0)	HE (10.5)
Rank:			
Chief	LWF (36.4)	LSA (29.9)	FF (9.1)
Civilian	LSA (54.6)	DM (27.3)	LWF (27.3)
Fire Fighter	LSA (38.4)	LWF (27.2)	HE (10.8)
Investigator	LSA (53.9)	WEA (38.5)	LWF (30.8)
Recruit	LWF (51.2)	LSA (38.1)	FF (17.9)
Captain	LSA (33.9)	LWF (29.6)	HE (11.0)
Years of Service:			
Less than 6	LSA (41.1)	LWF (23.5)	DS (11.9)
6-10	LSA (37.5)	LWF (27.1)	DS (10.5)
11-20	LSA (37.3)	LWF (29.4)	PE (10.0)
Greater than 20	LWF (36.5)	LSA (31.2)	HE (12.3)
Scene Type:			
Not Specified	LSA (29.7)	LWF (16.2)	HE (5.4)
Fireground	LSA (38.3)	LWF (25.4)	FF (13.9)
Nonfire Emergency	LSA (31.0)	LWF (24.1)	DS (21.4)
In-Transit	LSA (52.0)	LWF (16.5)	HE (16.0)
Training	LWF (44.2)	LSA (37.8)	FF (15.1)
Other On-Duty	LSA (38.9)	LWF (33.3)	HE (12.2)

*COMM = Lack of Communications, DS = Dangerous Substance, FF = Firefighter Fatigue, HE = Human Error, LSA = Lack of Situational Awareness, LWF = Lack of Wellness/Fitness, PE = Protective Equipment Not Worn, WEA = Weather/Act of Nature

Table 4: Composite Cluster Variables

Cluster	Variables
1	Emergency Equipment Failure, Lack of Training, Structural Failure, Act of Violence, Civilian Error, Horseplay, Lack of Teamwork
2	Crew Size, Lack of Wellness/Fitness, Firefighter Fatigue, Weather/Act of Nature
3	Protective Equipment Not Worn/SCBA or Seatbelt, Dangerous Substance
4	Decision-Making Error, Lack of Communications, Standard Operating Guidelines/Procedure Breach, Protocol Breach, Human Error by Firefighter or Officer, Lack of Situational Awareness

meaning, and the projection of their status in the near future” (Endsley, 2000).

- **“Horseplay” (HP)** — Rough or boisterous play.
- **Lack of Teamwork (TMWK)** — General lack of the mindset that aligns firefighters in a cooperative and selfless manner, towards a specific purpose; refers to an individual rather than group effort. A team player is one who subordinates personal aspirations and works in a coordinated effort with other members of a group or team in striving for a common goal.

Following contributing factor identification and definition, raw frequency scores were determined for each factor. Dominant contributing factors were identified by percentage for the overall dataset and in various categories as described in Table 3.

According to cluster analysis, four clusters of contributing factors were identified. All contributing factors were included in the cluster analysis. Composite cluster variables are listed in Table 4.

Although there is no exact pattern to the composition of the clusters, there seems to be identifiable categorization. For example, Cluster 4 appears to represent the “human factor” while Cluster 2 represents “crew size and physical fitness related issues.” Cluster 3 appears to represent “personal protective equipment” while Cluster 1, with the exception of lack of training/teamwork and horseplay, seems to represent “things that are out of the control of an officer or firefighter.” This categorization is beneficial in honing areas of risk management intervention in the departments studied.

The four clusters identified by the analysis are responsible for 94.49% of all LOD injuries in the departments studied. The remaining LOD injuries (5.51%) were not explained by any contributing factor cluster. Among the composite clusters, Cluster 4 alone, excluding its interaction with any other contributing factors, is responsible for about 30% of LOD injury, Cluster 2 alone is responsible for another 26%, Cluster 3 alone 11%, Cluster 1 alone about 8%, and about 11% were contributed by interactions between clusters as described in Figure 1.

The relative contribution of the clusters was evaluated within various strata in an attempt to hone con-

Figure 1: Overall Model of Composite Clusters for LOD Injury in Select Metropolitan Departments, 2005-2006

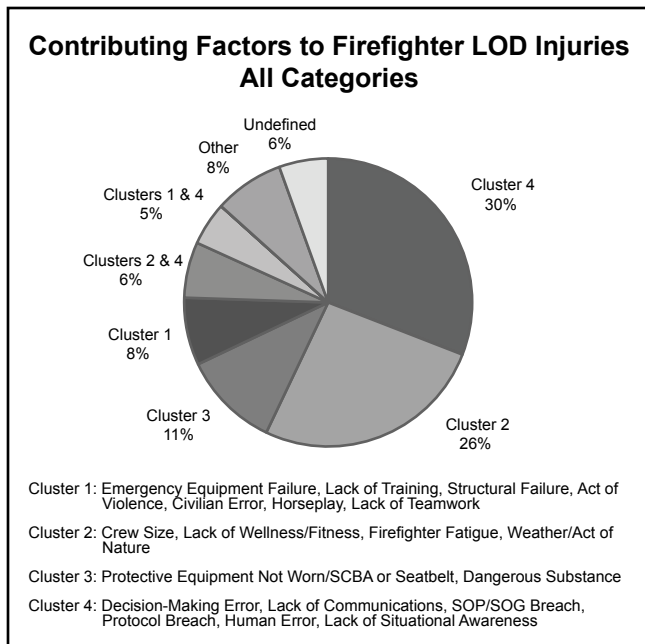


Figure 2: Age Group 25 and Under

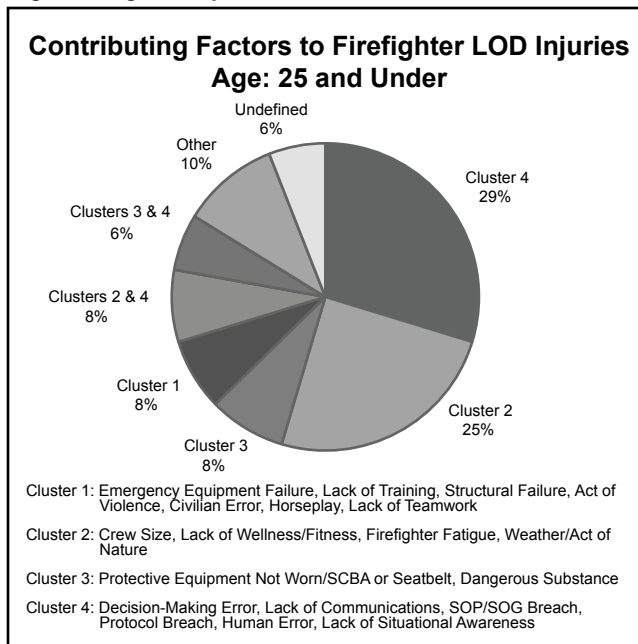


Figure 3: Age Group 26-35

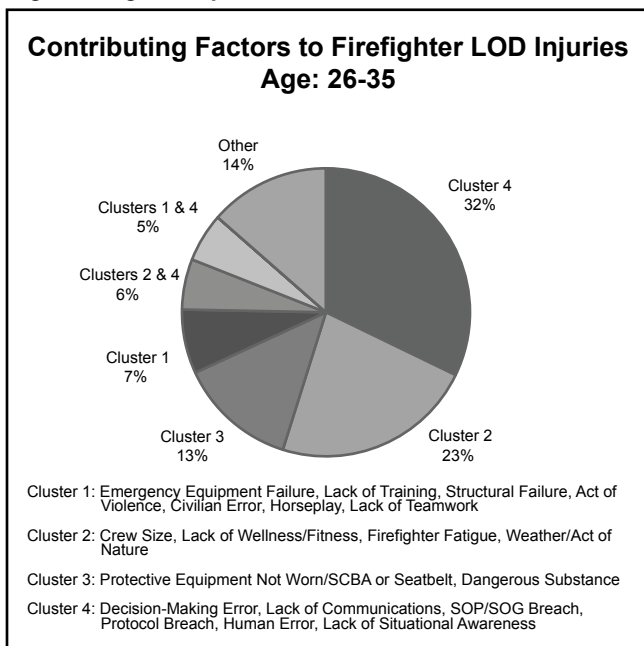


Figure 4: Age Group 36-45

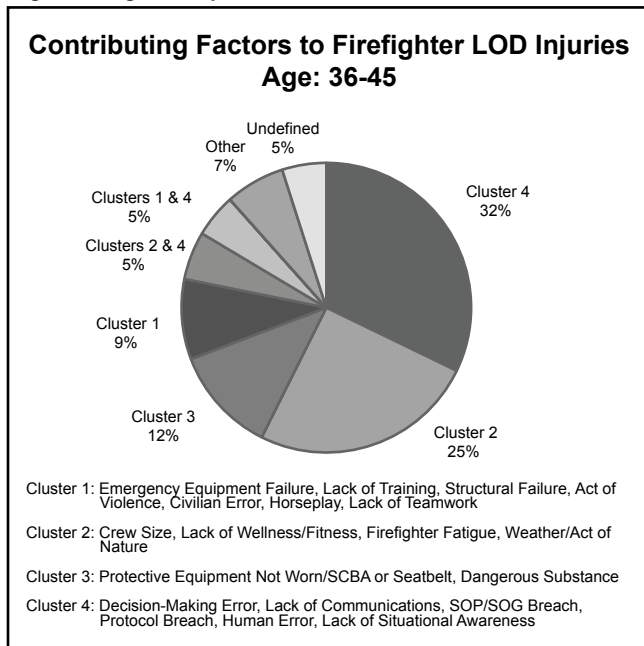


Figure 5: Age Group 46-55

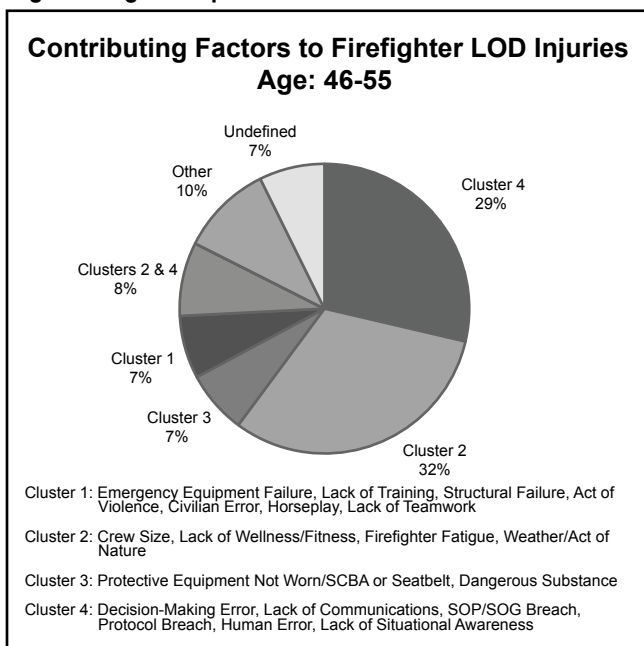
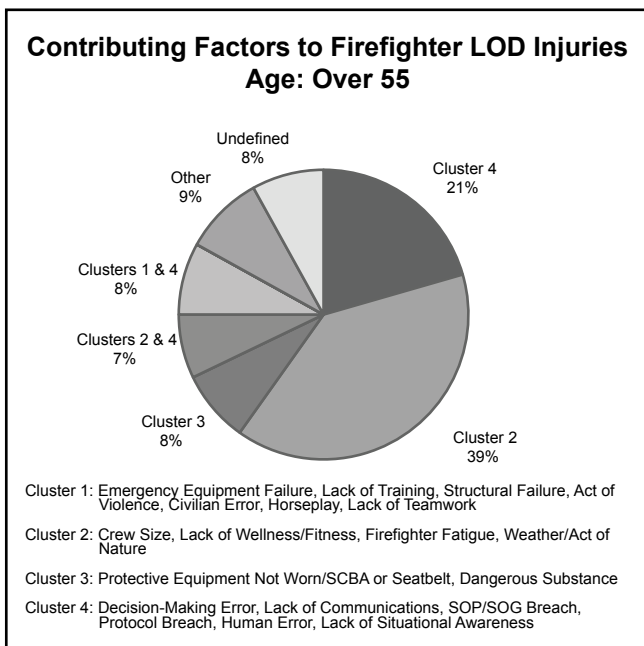


Figure 6: Age Group Over 55



tributing factor clusters to specific environments making risk-management efforts more direct and efficient. Strata evaluated included firefighter age, gender, rank, years of service, and scene type.

Firefighter age strata were defined as 25 and under, 26-35, 36-45, 46-55, and Over 55. Cluster 4 was responsible for more than 29% of LOD injury in firefighters 25 and under while Cluster 2 was responsible for an additional 25%. Cluster 4 was also responsible for the majority of injuries in age groups 26-35 and 36-45 (32%). However, Cluster 2 was responsible for the majority of injuries in age 46-55 and over 55 with the percentage of attributable injuries increasing with age. Figures 2 through 6 show contributing factor clusters by firefighter age group.

Data were also stratified by years of service to highlight experiential differences in contributing factor clusters. These differences are significant, however, reasons for the differences can only be assumed as time on the job and/or experience does not necessarily equal quality performance. Figures 7 through 10 show the contributing factor clusters most responsible for LOD injury in these strata. Cluster 4 is responsible for the majority of the LOD injuries in firefighters with fewer years on the job, particularly in the less-than-6-year strata and the 6-to-10-year strata, while Cluster 2 is responsible for the majority of LOD injuries in firefighters with greater than 20 years on the job.

Data were also stratified by scene type. The various scene types identified include fireground, non-fire

Figure 7: Service Less than 6 Years

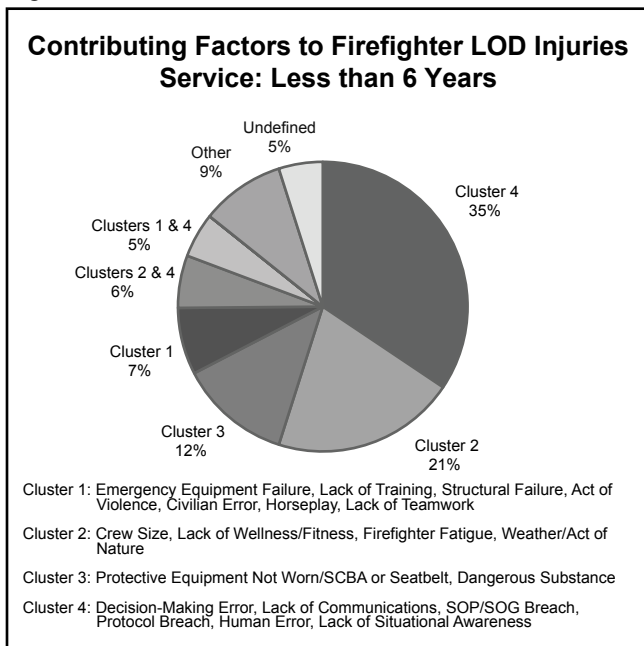


Figure 8: Service 6-10 Years

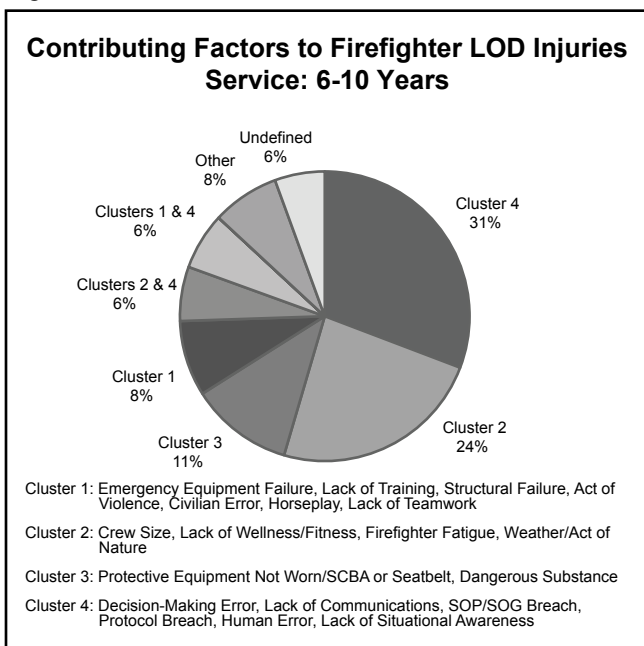


Figure 9: Service 11-20 Years

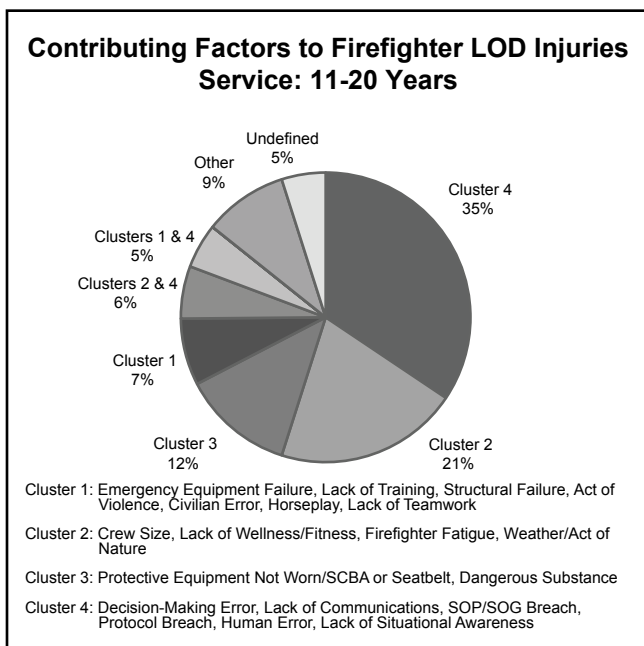
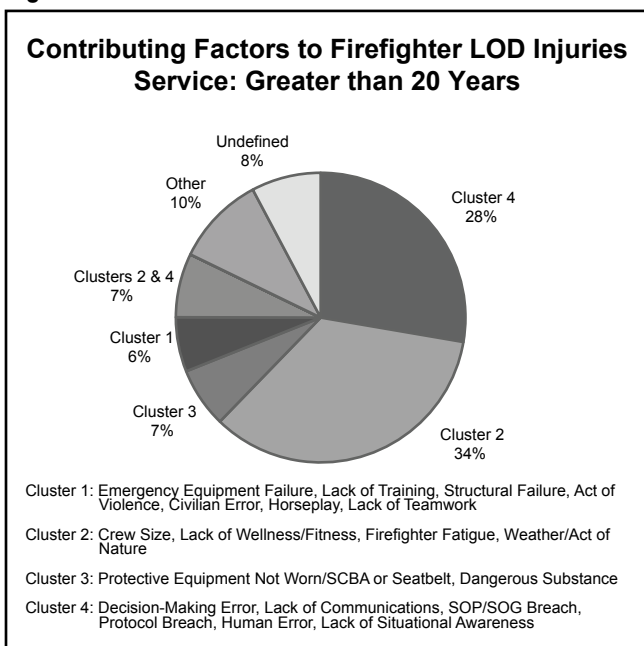


Figure 10: Service Greater than 20 Years



emergency, in-transit, training, and other on-duty activity. As noted in Figures 11 through 15, there were differences in the contributing factor clusters responsible for LOD injury between these strata. Analysis of contributing factor clusters for LOD injury occurring on the fire-ground shows that Cluster 4 is responsible for 31% of injuries while Cluster 2 is responsible for another 26%. In the stratum for nonfire emergency, Cluster 4 once again is dominant and responsible for 25% while Cluster 3 is responsible for another 22%. This result is not surprising as the nonfire emergency strata contain EMS calls. Cluster 4 is overwhelmingly responsible for LOD injury (50%) in the in-transit stratum. The next scene type evaluated is training. The training stratum shows Cluster 2 as dominant (39%) while Cluster 4 including

situational awareness is responsible for an additional 29% of injuries in this arena. The final stratum specifically evaluated was other on-duty activity including apparatus maintenance, station maintenance, meetings, investigation, and inspections. In this stratum, Cluster 4 was responsible for the majority of LOD injury (34%).

Finally, data were stratified by the “number of days injured,” defined as the number of days off normal/regular duty. This stratum was used as a proxy for injury severity, assuming that more severe injuries required more days off normal duty. Results show that injuries associated with Cluster 4 tended to be more severe, requiring longer terms of absence from normal duty, although injuries associated with Cluster 2 were a close second. For injuries requiring 1-10 days of leave, 41% were as-

Figure 11: Fireground Scene

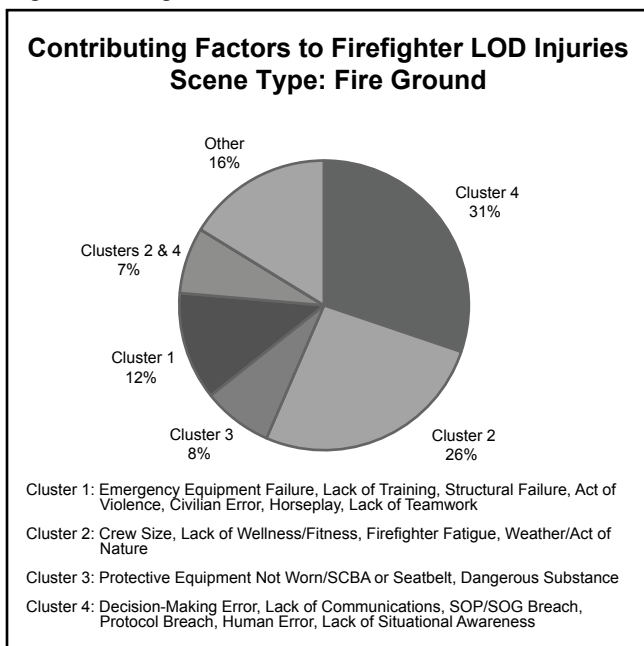


Figure 12: Nonfire Emergency Scene

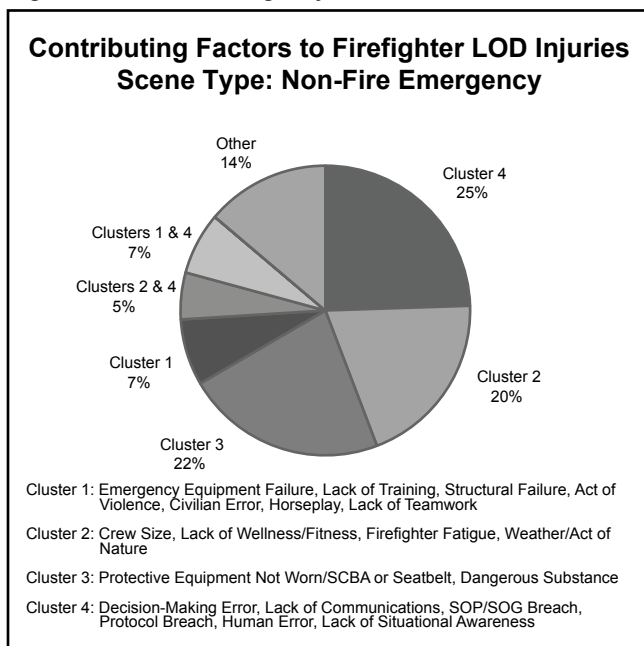


Figure 13: In-Transit Scene

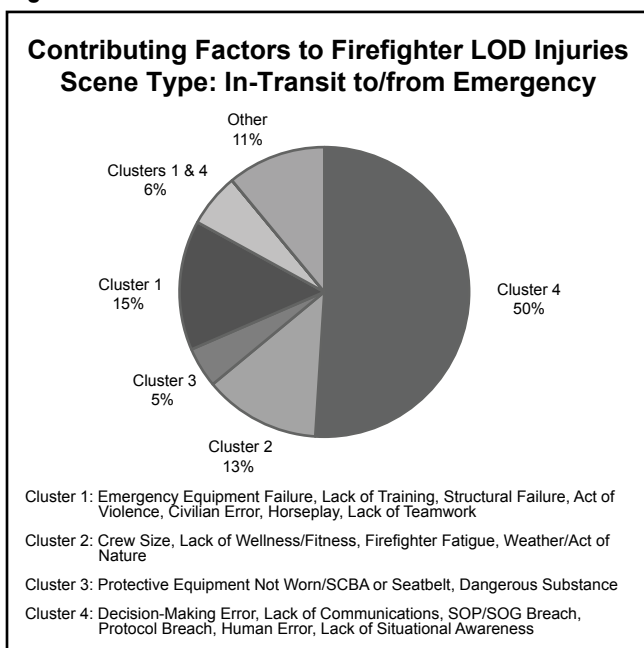
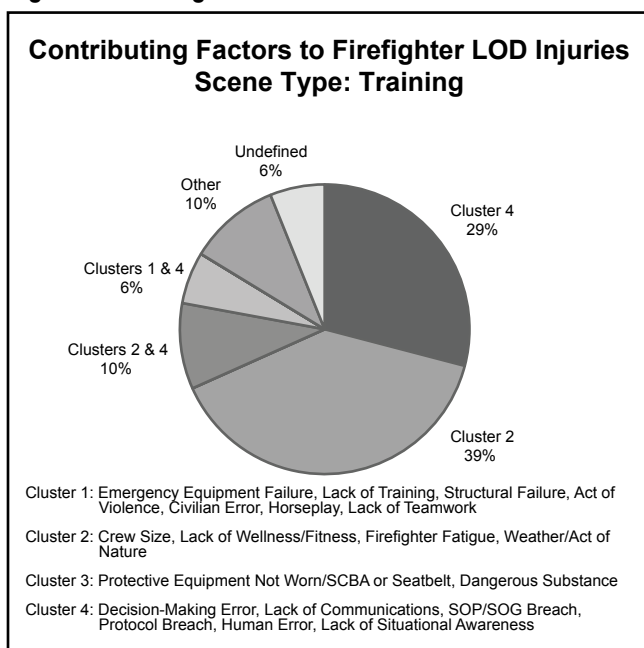


Figure 14: Training Scene



sociated with Cluster 4 while 14% were associated with Cluster 2. For those requiring 11-20 days of leave, 35% were associated with Cluster 4 while an additional 27% were associated with Cluster 2. Finally, the most severe injuries, those requiring leave of 21-10 days or greater than 30 days, 32% were associated with Cluster 4 while 25%-28% were associated with Cluster 2.

Discussion

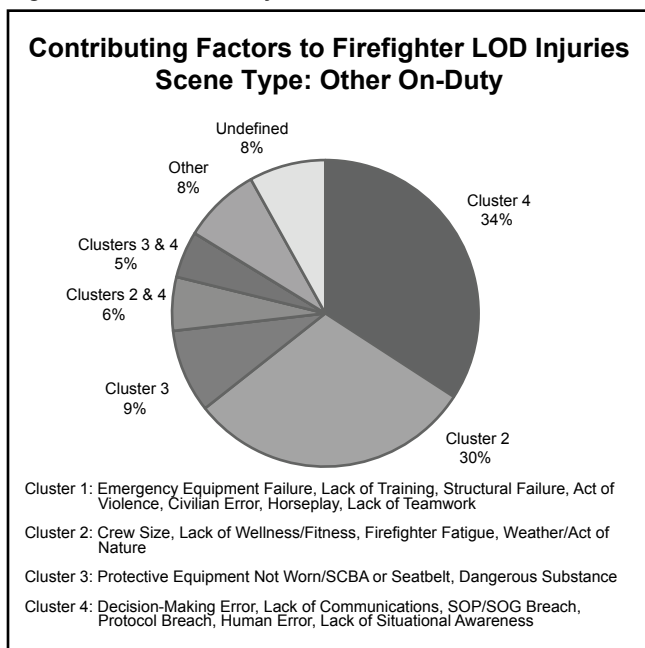
During the analysis, it was noted that the actual association between factors within a cluster could not be identified. Factors organized into the same cluster may act independently of each other or they may act synergistically with the interaction of factors presenting a greater total risk than the sum of their individual

effects (Moore-Merrell et al., 2008). Unfortunately, these effects could not be assessed in this study due to the lack of a control group. However, the cluster analysis does provide evidence of the consistency of factors with maximum association as seen in Table 5.

Limitations

There are a number of limitations to the study data, methodology, and findings. LOD injury cases were compiled from only nine metropolitan departments; and, therefore, results can only be specifically extrapolated to those departments. However, similar departments should consider benefiting from the results and “lessons learned” in this group. Additionally, the study only explains the factors contributing to LOD injury that have

Figure 15: Other On-Duty Scene



occurred. Predicting the odds of experiencing a LOD injury in departments where the identified contributing factors/clusters exist could not be completed since data for noninjured firefighters were unavailable. Likewise, trend analysis could not be completed due to the lack of data on firefighters who were not injured on the scenes where a LOD injury was experienced.

This study only examined LOD injury data that were available from nine large fire departments in the U.S. without regard to thousands of firefighter line-of-duty injuries that occur daily in a host of other departments of all sizes. Despite the limitations, the results of this study provide a sense of the relative impact of various factors on firefighter LOD injury in the U.S.

Conclusions

Analysis of the roles of various factors suggests that the most prominent contributing factors to firefighter line-of-duty injury in metropolitan fire departments in the U.S. are lack of situational awareness (37.3%), lack of wellness/fitness (28.5%), and human error (10.6%). When clustered according to contributing factors most often occurring together, the most prominent cluster is Cluster 4 including decision-making error, lack of communication, standard operating guidelines/procedure breach, protocol breach, human error, and lack of situational awareness. Contributing factor clusters identified

Table 5: Percent of LOD INJURY Contributed by Four Clusters

Cluster	#1	#2	#3	#4
#1	7.59%	1.57%	0.78%	4.87%
#2		26.17%	0.67%	6.26%
#3			10.87%	3.59%
#4				30.9%

Note: 5.51% LOD INJURY were due to none of these clusters and an additional 1.21% LOD INJURY were due to more than two clusters and are not listed in this table.

explain 94.49% of firefighter LOD injury in the departments studied between the years of 2005-2006. The results presented hold implications for fire department risk-management priorities. At the most basic level, they compel examination of the way departments track injuries. Most of the contributing factors identified in this study were based on those tracked in each department and those used in the “Firefighter Near Miss Reporting System.” Individual departmental tracking of injuries and accumulation of factors and definitions will be essential to quality data collection and analysis in future studies. Based on the results of this study, participating departments can make efforts to interrupt or eliminate factors leading to a firefighter LOD injury.

Policy Development/Alteration Process

It has been noted by fire service leaders that the reasons for firefighter injuries have not changed over time. In spite of the safety programs and practices that are implemented, firefighters’ beliefs, attitudes, and behaviors regarding safety have not changed. Many firefighters do not follow safety procedures, national standards, or departmental training doctrine. They do not wear assigned safety equipment. Some leaders also suggest that chief officers should be held accountable when it comes to firefighter safety. Leaders must not tolerate or accept safety misconduct, which can result in firefighter injury or death (Clark, 2008).

Year after year, an estimated 80,100 firefighter injuries occur in the line of duty (Karter & Molis, 2006). If heeded, the results of this study can reduce these on-duty firefighter injuries. This study specifically examines contributing factors leading to firefighter LOD injury in metropolitan fire departments. Results can be compared with similar studies to hone knowledge and thereby provide opportunities for intervention through departmental training, practices and policy to prevent firefighter injuries.

Future Policy Analysis Research

If a significant reduction in firefighter injuries is to be realized, fire service leaders must focus directly on the contributing factors as identified. Future research should include individual departments collecting and reporting data using the format created for this study. Establishing a standardized data-collection format for firefighter injuries inclusive of specifically defined contributing factors as well as other relevant information surrounding

individual injuries will provide invaluable information for individual departments to alter policy based on evidence thereby reducing injuries. Using a standardized data-collection device will allow departments to collect and report incidence and prevalence of firefighter injuries within their department and allow comparison to other departments. Through interdepartmental comparison, decision makers can network to share policy and procedures that prove to reduce overall injury rates. Additionally, standardized data collection will provide an opportunity for data compilation nationally to assist in reporting true rates of injury in the fire service.

Notes

¹The template is available on request. Please email the corresponding author at Imoore@iaff.org.

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