2023

Heart Attack Related Firefighter Fatalities and Compliance With NFPA 1582

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Abstract

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by

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MPA, American Public University, 2012

BS, University of Maryland University College, 2010

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Policy & Administration

Walden University

February 2023

Abstract

Heart attacks have been the leading cause of on-duty firefighter fatalities for many years. Firefighters are subjected to health risks due to occupational practices and exposure to hazards. Firefighter fatality investigative reports suggest that comprehensive medical screenings consistent with the National Fire Protection Association (NFPA) 1582 standard would reduce deaths from heart attacks. The purpose of this study was to explore the extent to which fire departments comply with the NFPA 1582 standard. Using contextual interaction theory and a generic qualitative inquiry design, data were collected from fire departments that had a heart attack-related firefighter fatality incident. Semistructured interviews were conducted with twelve fire chiefs and relevant documents were reviewed. Data analysis was performed using an inductive approach to thematic analysis. The findings revealed that most fire departments were not fully compliant with NFPA1582. Firefighter fatality incidents did not improve compliance in fire departments that were partially or noncompliant with the standard. Fiscal resources, medical resources, and fire chief lack of autonomy to implement policies were among the challenges and barriers to compliance with NFPA 1582. Recommendations to improve compliance with NFPA 1582 include seeking grant-funding opportunities, establishing collaborative relationships with parties with shared responsibility, and providing guidance to members and healthcare professionals on NFPA 1582. The findings of this study have potential implications for positive social change by improving or enhancing the health, safety, and well-being of firefighters to help protect the lives of these first responders.

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Dedication

I dedicate this research to my mother, Florence Lindqvist (deceased), who taught me the value of education and constantly reminded me that I can achieve anything in life, regardless of the challenges. I also dedicate this research to the men and women of the fire service who risk their lives every day to save the lives and property of others.

Acknowledgments

I would like to express my sincere appreciation to Dr. Bruce Lindsay and Dr. Lori Demeter. Your unconditional support and guidance through this challenging process gave me the encouragement to continue this academic journey. I also wish to thank my sisters Elizabeth Rhymaun and Sharon Rhymaun-Croyle for the motivation and support provided through this process.

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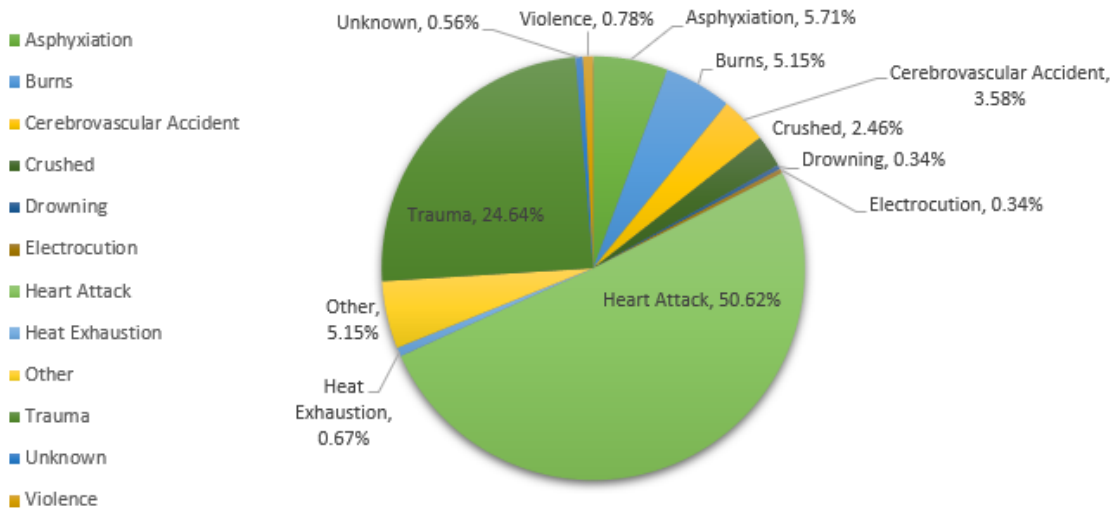
Chapter 1: Introduction to the Study

Introduction

Firefighter fatalities occur every year because of a variety of problems ranging from fatal injuries to severe medical issues. Many of these firefighter fatalities are avoidable. An analysis of firefighter fatalities between 2010 and 2019 revealed heart attacks as the consistent leading cause of firefighter fatalities, followed by trauma. Heart attacks accounted for an average of 50.62% of on-duty firefighter fatalities over that 10-year period among the 12 categories of nature of fatal injuries used by the U.S. Fire Administration (USFA). In contrast, trauma accounted for an average of 24.64%. Other causes, such as asphyxiation, burns, cerebrovascular accidents, drowning, execution, and violence accounted for the remaining on-duty firefighter fatalities (USFA, 2021). Figure 1 illustrates the percentage distribution of firefighter fatalities by nature of fatal injuries between 2010 and 2019.

Figure 1

Percentage Distribution of 2010-2019 Firefighter Fatalities by Nature of Fatal Injuries



Note. Figure 1 presents the percentage distribution of firefighter fatalities by nature of fatal injuries between 2010-2019 and illustrates heart attacks accounting for most firefighter deaths, followed by trauma. From "Firefighter fatalities in the United States," by USFA, [Custom reports], Copyright 2021.

Annual line-of-duty deaths among firefighters have remained relatively consistent, but a shift in the nature of fatal injuries and the interconnected areas have created significant concern. Some of these interconnected areas have contributed to additional cardiovascular disease risk and psychological distress, thus increasing the incidence of injuries. Most preventive strategies such as risk screening may help to reduce firefighter fatalities (Ali, 2020). Safety initiatives, including better safety standards, equipment, and firefighting practices, have slightly reduced traumatic fatal injuries of firefighters (Waters, 2014). Evidence still suggests that heart attacks continue

to be the leading cause of on-duty firefighter fatalities, and while important, the safety issues do not address heart attacks. Although firefighters may engage in healthy lifestyle behaviors such as good nutrition and regular exercise to reduce the risk for cardiovascular disease or heart attacks, stressors of the job pose additional risks that may be a prudent cause for comprehensive and routine occupational medical monitoring of firefighters. Firefighters are often subjected to frequent sympathetic nervous system activation, intense physical work, heat stress, dehydration, and severe environmental conditions (Smith et al., 2013).

In this study, I focused on the implementation and compliance of an industry standard developed by a consortium of experts at the National Fire Protection Association (NFPA). The standard, known as the *NFPA 1582, Standard on Comprehensive Occupational Medical Programs for Fire Departments*, is designed to identify potential medical issues among firefighters that would have a direct impact on their safety, health, and well-being and that of other firefighters on their crew (NFPA, 2017). NFPA standards are not bound by any laws or regulations, and compliance by fire departments is not mandatory or enforceable. Fire departments may opt to fully comply with a specific standard or partially comply with provisions of a standard most pertinent and feasible for their organization. Despite the standard's intent, organizational barriers may affect implementation or compliance at various levels.

NFPA 1582 is a comprehensive document that outlines the medical screening requirements of firefighters by various body systems and specific evaluation of various medical conditions. For this study, full compliance with NFPA 1582 refers to whether a

fire department provides candidates initial medical evaluations and current member periodic annual medical evaluations, as well as adheres to the heart and vascular medical limitations and diagnostic screening requirements of the standard. In this study, I was focused on heart attack-related firefighter fatalities.

In 2007, the National Institute for Occupational Safety and Health (NIOSH) conducted firefighter fatality investigations and found that of 131 fire departments where a cardiovascular disease fatality took place, 71% conducted initial candidate medical evaluations and 31% conducted annual or periodic member medical evaluations (NIOSH, 2007). The annual firefighter fatality statistics from the USFA and information from the most current NIOSH firefighter fatality reports suggest no significant change since the 2007 report. These findings indicate that continued noncompliance with NFPA 1582 could lead to more firefighter fatalities in the future.

Background

Firefighter Fatalities

The *Analysis Report on Fire Fighter Fatalities* for the year 1992 revealed heart attacks accounting for over half of on-duty firefighter deaths, while the remaining fatalities were divided among asphyxiation, burns, trauma, and stroke (USFA, 1993). In 2018, sudden cardiac death from heart attacks continued to account for the largest portion of on-duty firefighter deaths (Fahy & Molis, 2019). This finding is supported by my analysis of firefighter fatalities for a 10-year period between 2010 and 2019, revealing that this problem has consistently existed for over two decades. Table 1 shows heart attacks accounting for the largest percentage of firefighter deaths every year for that 10-

year period. A death and injury survey conducted by the International Association of Firefighters (IAFF) in 2000 indicated that job-related fatalities for firefighters were almost three times higher than those in the private sector. Among the fatalities, the leading cause of line-of-duty deaths for firefighters is heart attacks (IAFF, 2000).

Table 1

Statistics of Firefighter Fatalities in 2010–2019 by Nature of Fatal Injuries

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010-2019
Nature of Fatal Injuries	# %	# %	# %	# %	# %	# %	# %	# %	# %	# %	# %
Asphyxiation	6 6.74%	5 5.49%	5 5.81%	7 6.36%	8 8.42%	6 6.74%	5 5.49%	1 1.09%	7 8.14%	1 1.56%	51 5.71%
Burns	0 0.00%	8 8.79%	0 0.00%	23 20.91%	2 2.11%	3 3.37%	1 1.10%	2 2.17%	3 3.49%	4 6.25%	46 5.15%
Cerebrovascular Accident	5 5.62%	1 1.10%	5 5.81%	1 0.91%	2 2.11%	6 6.74%	4 4.40%	2 2.17%	3 3.49%	3 4.69%	32 3.58%
Crushed	4 4.49%	3 3.30%	2 2.33%	2 1.82%	2 2.11%	3 3.37%	2 2.20%	0 0.00%	3 3.49%	1 1.56%	22 2.46%
Drowning	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	1 1.12%	2 2.20%	0 0.00%	0 0.00%	0 0.00%	3 0.34%
Electrocution	0 0.00%	0 0.00%	0 0.00%	1 0.91%	1 1.05%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	1 1.56%	3 0.34%
Heart Attack	51 57.30%	50 54.95%	42 48.84%	39 35.45%	59 62.11%	54 60.67%	41 45.05%	52 56.52%	32 37.21%	32 50.00%	452 50.62%
Heat Exhaustion	0 0.00%	1 1.10%	1 1.16%	0 0.00%	1 1.05%	0 0.00%	1 1.10%	0 0.00%	0 0.00%	2 3.13%	6 0.67%
Other	3 3.37%	7 7.69%	4 4.65%	5 4.55%	2 2.11%	1 1.12%	6 6.59%	6 6.52%	10 11.63%	2 3.13%	46 5.15%
Trauma	20 22.47%	16 17.58%	25 29.07%	31 28.18%	17 17.89%	15 16.85%	27 29.67%	29 31.52%	23 26.74%	17 26.56%	220 24.64%
Unknown	0 0.00%	0 0.00%	0 0.00%	0 0.00%	1 1.05%	0 0.00%	0 0.00%	0 0.00%	4 4.65%	0 0.00%	5 0.56%
Violence	0.00%	0.00%	2 2.33%	1 0.91%	0 0.00%	0 0.00%	2 2.20%	0 0.00%	1 1.16%	1 1.56%	7 0.78%
Grand Total	89 100.00%	91 100.00%	86 100.00%	110 100.00%	95 100.00%	89 100.00%	91 100.00%	92 100.00%	86 100.00%	64 100.00%	893 100.00%

Note. This table illustrates the number and percentage of firefighter fatalities by nature of fatal injuries between 2010 and 2019. From "Firefighter fatalities in the United States," by USFA, [Custom reports], Copyright 2021.

NIOSH established a Fire Fighter Fatality Investigation and Prevention Program (FFFIPP) to conduct independent, on-site, voluntary investigations of firefighter line-of-duty deaths. The main goals of its program are to define characteristics of these

firefighter fatalities, develop recommendations to prevent deaths and injury, and to disseminate information of prevention strategies within the fire service industry. In its report, *Leading Recommendations for Preventing Fire Fighter Fatalities, 1998–2005,* 372 firefighter fatalities were investigated. From these investigations, sudden cardiac death or heart attacks were the leading cause of death despite the existence of NFPA 1582. The report also emphasized the implementation of medical screenings and fitness and wellness programs as its recommendations for preventing firefighter fatalities from medical conditions (NIOSH, 2008).

Heart Attack Risks Among Firefighters

Heart disease accounts for 1 in every 4 deaths in the United States. In 2015, approximately 735,000 people suffered a heart attack and 610,000 people died of heart disease (Mozaffarian et al., 2015). Updated statistics provided by the Centers for Disease Control and Prevention (CDC) now reveal approximately 805,000 people die from heart attacks and 647,000 people die from heart disease annually. These statistics show a growing nationwide epidemic in which the general population is at risk for heart attacks or sudden cardiac death (CDC, 2020).

Controlling the risk factors for heart disease can significantly contribute to preventing deaths from heart attacks. The American Heart Association identified risk factors for heart disease and classified them as modifiable and nonmodifiable risks. Controlling the modifiable risk factors through lifestyle and behavioral changes while being consciously aware of the nonmodifiable risk factors can reduce the development of heart disease or the chances of death from a heart attack (American Heart Association,

2021c). Li et al. (2008) indicated there will be an increase in the number of people affected by multiple risk factors over the years that will cause an increase in mortality rates. A study on the prevalence of risk factors for heart disease in firefighters revealed that many firefighters are not able to identify risk factors specific to them or are unaware of health conditions that place them at risk for heart attack (Risavi & Staszko, 2015). The lack of awareness of the risk factors and the ability to initiate treatment or changes to reduce the risk places firefighters, and the general population in the United States, at increased risk for morbidity or mortality because of heart disease. Comprehensive occupational medical programs, such as NFPA 1582, offer routine medical screening that could identify these risk factors so appropriate treatment or lifestyle changes could be made to reduce the risk for heart attacks.

Firefighters face additional health risks due to occupational practices and exposure to hazardous conditions. Intense physical demands over long durations of time and repeated exposure to superheated and toxic environments create increased health concerns. These occupational risks, in addition to having multiple risk factors for heart disease, significantly increase the risk for mortality among firefighters. A study of firefighter medical physicals indicated higher rates of obesity, hyperlipidemia, and hypertension among firefighters than the general population (Byczek et al., 2004). Another study found that a significant number of firefighters develop cardiomegaly (enlargement of the heart) and left ventricular hypertrophy, which both contribute to sudden cardiac death (Smith et al., 2019). Routine medical screening for firefighters is extremely important to reduce firefighter fatalities from heart attacks.

NFPA 1582

The NFPA is an international nonprofit organization with the mission of reducing the burden of fire and other hazards through the development of consensus standards and codes. The first edition of NFPA 1582 was published in 1992 as *Standard on Medical Requirements for Firefighters*. Since the inception of this standard, there have been seven revisions, with each subsequent revision being more comprehensive. The NFPA 1582 standard was developed by a technical committee of experts on fire service occupational safety and health (NFPA, 2017).

NFPA 1582, *Standard on Comprehensive Occupational Medical Programs for Fire Departments*, addresses medical screenings and fitness for duty evaluations for firefighters. This standard provides a comprehensive guideline for medical evaluation procedures to be conducted by a qualified physician for firefighter candidates and current firefighters. A list of medical conditions is included in NFPA 1582 that would preclude hire for candidates due to the significant risks to health and safety in being able to perform essential job tasks. The guideline also includes medical conditions that could preclude hire for candidates based on severity and degree if despite the condition the candidate is able to perform the essential job tasks without posing significant risk to health and safety. For current firefighters, the standard offers some flexibility based on the severity or degree of medical conditions found within a medical evaluation and upon their specific job functions (NIOSH, 2007).

Problem Statement

The firefighter fatality investigative reports from NIOSH suggest that compliance with the NFPA 1582 standard would reduce firefighter fatalities from heart attacks. However, many fire departments are not in compliance with the standard. This was highlighted in a study that analyzed the recommendations from NIOSH's FFFIPP for on-duty firefighter death investigations between 2006 and 2014. The study revealed that medical screening was the top recommendation made in the fatality investigative reports (Hard et al., 2019). Additionally, the report *Firefighter Fatalities in the United States in 2019* indicated heart attacks as the most common cause of firefighter deaths (USFA, 2020). A retrospective study that relied on autopsy and medical examiner reports for heart attack-related firefighter fatalities between 1999 and 2014 found that 80% of these firefighters had evidence of coronary heart disease and increased heart size. These conditions could have been discovered in targeted annual medical screening as outlined in NPFA 1582 to prevent or reduce duty-related cardiac deaths among firefighters (Smith et al., 2019). An extensive review of the literature provided no evidence of reasons that policy implementation or compliance with NFPA 1582 is lacking. Furthermore, the challenges or barriers to compliance of the standard were unclear. Without identifying these challenges or barriers, significant reductions in heart attack-related on-duty firefighter fatalities are unlikely.

Purpose of the Study

The purpose of this qualitative research study was to analyze the implementation and compliance of NFPA 1582 as policy through the perceptions and experiences of fire

chiefs of fire department organizations with a previous incident of a heart attack-related on-duty firefighter fatality. This study was conducted to help determine challenges or barriers to policy implementation or compliance with the standard. Using the contextual interaction theory as the theoretical framework for this study, the motivations, information, and power of the fire chiefs from fire department organizations was explored. Incidents of on-duty heart attack-related firefighter fatalities were examined and fire chiefs from fire departments were interviewed on their experiences with policy implementation and compliance with NFPA 1582. NIOSH has recommended that annual medical evaluations and fitness screenings be implemented to reduce on-duty firefighter deaths in each of its firefighter fatality investigations (NIOSH, 2008). The goal of this qualitative research study was to determine what policy implementation and compliance problems exist with NFPA 1582 among fire department organizations to determine why the United States has been unable to break the consistent trend of heart attacks being the leading cause of on-duty firefighter fatalities.

Research Questions

Compelled by concerns that heart attacks have consistently been the leading cause of on-duty firefighter fatalities for over a decade, the main research question for this study was:

RQ: What is the compliance with NFPA 1582 to prevent heart attack-related firefighter fatalities among fire departments?

The following subquestions were also addressed in this study:

SQ1: How is NFPA 1582 implemented in fire departments and what improvements can be made to ensure healthy and safe firefighters?

SQ2: What actions or events have influenced the implementation or compliance of the NFPA 1582 standard?

SQ3: What challenges exist to compliance with the NFPA 1582 standard and what can be done to address these challenges?

Theoretical Framework

In this research study, the contextual interaction theory was used as the theoretical framework. Bressers (2007) conceptualized policy implementation as an interaction process among policy actors using the contextual interaction theory. This theory places emphasis on the characteristics of policy actors, focusing on factors of their motivation, information, and power. According to contextual interaction theory, the motives of the policy actors are elements that drive their actions. Information refers to knowledge held to be true and how a situation is interpreted. Power encompasses capacity and control, including resources of the policy actors to provide the necessary action to achieve results. Motivation, information, and power are the core factors that serve as the ultimate driving force of the policy implementation process (O'Toole, 2004). How the factors of their characteristics blend formulate a productive or nonproductive setting for policy implementation. The framework postulates that interactions between the policy actor and target actors foster or inhibit policy implementation processes (Bressers, 2007). The contextual interaction theory serves as a predictor of implementation results based on the combination of actor characteristics (Owens & Bressers, 2013).

In fire departments, the fire chief is responsible for implementation of policies and procedures that guide the administrative and operational elements of the organization. The authoritative role of the fire chief makes them the policy actor and the firefighters the target actors. In this research study, I explored the characteristics of the fire chiefs on their implementation or adherence to NFPA 1582. Using the contextual interaction theory as the theoretical framework for this study, I analyzed the core factors of policy implementation based on the motivation, information, and power of the policy actor. Data regarding the in-depth experiences of the fire chiefs were collected primarily through interviews. The interviews involved open-ended questions regarding the three core factors and correlated to the research questions of this study. Additional questions also focused on the interactions between the fire chief and firefighters. Interactions may be summarized as cooperation or opposition to describe the facilitating or inhibiting stance played by actors in the policy implementation or compliance process, thereby leading to action or inaction. I presumed that positive attributes to motivation, information, and power aligned with cooperative interaction would result in successful policy implementation or adherence of NFPA 1582. Conversely, negative attributes to the core factors or opposition within interaction of the actors would identify challenges and barriers to implementation or compliance.

Nature of the Study

This study used a generic qualitative research design. This approach was best suited for this study because the research problem, purpose, or questions were not bound to any specific philosophical assumptions. The flexibility of this design allowed for

examination of multiple heart attack-related firefighter fatalities in various types of fire departments. Fire department organizations are classified as career, volunteer, or combination departments. Firefighters in these organizations are typically classified as career, volunteer, paid-on-call, or wildland firefighters. The goal of this study was to gain an in-depth understanding of the challenges and barriers to implementation of NFPA 1582 involving different classifications.

The maximum variation strategy to purposeful sampling was used to select 10 to 12 firefighter fatalities and their associated fire departments for this research study. Consideration was given to the different types and sizes of fire departments and the classification of the deceased firefighter to gain multiple perspectives. The samples selected for this research study were heart attack-related firefighter fatalities found in the USFA database and those that had a completed firefighter fatality investigative report by NIOSH. Both can be accessed publicly via the internet. The variation in sampling allowed for the depth of information to be sought given the time constraints and resources for this research study. The firefighter fatality investigative reports were a critical component of this research study as it provided information on the level of compliance with NFPA 1582 before the fatality incident occurred. A semistructured interview was conducted with fire chiefs from the fire departments where these firefighter fatality incidents occurred to collect extensive detail on their experiences with implementation or compliance with NFPA1582. Additionally, available documents, such as the fire department policies and procedures for comprehensive occupational medical screening

programs for firefighters and any investigative reports on firefighter fatalities, were collected.

Analysis of the data included examination of the firefighter fatality reports and transcripts from the interviews with the fire chiefs, medical screening policies, and investigative reports. Thematic analysis was employed using QSR International's NVivo qualitative analysis software. Through this analysis, common themes or patterns among the firefighter fatalities and the compliance with NFPA 1582 among the fire departments were explored. Similarities and differences were identified and compared. At the conclusion of the analysis, a generalization was made of the policy implementation and compliance issues of NFPA 1582 and why heart attacks continue to trend as the number one killer of firefighters annually.

Definition of Key Terms

Terminology used commonly in the fire and emergency services industry is included in the literature and throughout this research study. Commonly used terms are defined as follows:

Candidate: A person who has applied to become a member of the fire department (NFPA, 2017).

Essential job task: Task or assigned duty critical to successful performance of the job (NFPA, 2017).

Fire department physician: A licensed doctor of medicine or osteopathy who has been designated by a fire department to provide professional expertise in the areas of occupational safety and health as they relate to emergency services (NFPA, 2017).

Functional capacity evaluation: An assessment of the correlation between an individual's capabilities and the essential job tasks (NFPA, 2017).

Heart disease: Also called *cardiovascular disease* or *coronary artery disease*, a disease related to the buildup of plaque in the walls of the arteries or atherosclerosis, which can interrupt the flow of blood in the heart and increase the risk of heart attack or stroke (AHA, 2021a).

Hometown heroes: A classification for firefighter fatalities that became an inclusion criterion for firefighters who became fatally ill as a result of a heart attack or stroke within 24 hours of a training activity or emergency response after the Hometown Heroes Survivors Benefit Act of 2003 was enacted into law on December 15, 2003 (USFA, 2020).

Hyperlipidemia: A condition in which there are too many lipids (fats) in the blood, commonly associated with high cholesterol (AHA, 2021a).

Hypertension: Blood pressure that is consistently above the normal range that increases the heart's workload, putting a person at a greater risk for heart attack, angina, stroke, kidney failure, and peripheral artery disease (AHA, 2021a).

Immediately dangerous to life and health (IDLH): Any condition that would pose an immediate or delayed threat to life, cause irreversible adverse health effects, or interfere with an individual's ability to escape unaided from a hazardous environment (IAFC, 2014; NFPA, 2017).

Medical evaluation: Analysis of information to make a determination of medical certification; includes a medical examination (NFPA, 2017).

Medical examination: An examination performed or directed by a fire department physician (NFPA, 2017).

Medically certified: A determination by the fire department physician that a candidate or current member meets the medical requirements of the standard (NFPA, 2017).

Member: A person currently involved in performing the duties and responsibilities of a fire department under the auspices of the organization (NFPA, 2017).

On duty: Refers to being involved in emergency operations; responding or returning from an incident; performing officially assigned duties such as training, inspections, public education, or investigations; or being on call, under orders, or on standby duty except at an individual's home or place of business (USFA, 2020).

Rehabilitation: An intervention designed to mitigate against the physical, psychological, and emotional stress of firefighting to sustain a member's energy, improve performance, and decrease likelihood of on-scene injury or death (IAFC, 2014; NFPA, 2017).

Risk factors: Habits or conditions that increase the chances of developing a disease (AHA, 2021a).

Sudden cardiac death: A condition that occurs when the heart's electrical system malfunctions and the heart suddenly stops beating (AHA, 2021a).

Assumptions

In this research study, I took into consideration a few assumptions. The first assumption was that the firefighter fatality investigative reports made available through

NIOSH for the most recent year at the time of this study were sufficient to provide information that establishes the relationship of common patterns relevant to the consistent trend in heart attack-related firefighter fatalities and NFPA 1582. Second, I assumed that prevention and reduction of heart attack-related on-duty firefighter fatalities were major concerns of fire service leaders in the United States. This assumption reflects the importance of participation in this research study and places emphasis on participant willingness to respond to interview questions accurately, honestly, and expansively. Another assumption was that the participants in this research study would be actively involved in their fire department's health, safety, and risk management programs and would be familiar with the requirements of NFPA 1582. Because the sample of fire departments used in this research study have all experienced an incident of a heart attack-related on-duty firefighter fatality, the last assumption was that the selected incidents for this research study similarly reflected the most common issues with policy implementation and compliance of NFPA 1582.

Limitations

A few potential limitations exist in this research study. One of these limitations is that the results may not be generalized over the entire fire service industry. Fire departments in the United States vary considerably in structure, size, and type. As a result, challenges to implementation and compliance of NFPA 1582 may differ among these variations. Another limitation was the time required to participate in the interviews to provide in-depth and accurate responses to the interview questions. The length of time to participate in the interview may have discouraged busy fire chiefs from providing full,

in-depth responses due to time constraints. This may have presented a likelihood of inaccurate information being interjected that could influence the accuracy of data. Lastly, because the incidents selected were from various fire departments across the United States, the interviews were conducted either by video conferencing platform or via telephone. As the researcher, I did not have control over the setting or environment where the interview was conducted.

Scope and Delimitations

In this research study, I focused on fire departments within the United States that experienced an incident of a heart attack-related on-duty firefighter fatality. The incidents were selected from the database of the USFA and were included in this study only if a firefighter fatality investigation report was completed and published by NIOSH. I only examined incidents of cardiac-related deaths and not deaths categorized as trauma or other medical related events. In this study, I placed emphasis on implementation and compliance of the components of NFPA 1582 pertinent to preventing and reducing heart attack-related firefighter fatalities. NFPA 1582 includes other components of a comprehensive occupational medical program for firefighters that may be irrelevant to preventing heart attack-related deaths.

The 2019 published report of the USFA on firefighter fatalities indicated 32 incidents of firefighter deaths due to heart attacks (USFA, 2020). To include all these incidents in one qualitative research study would be a major undertaking and too large of a sample given the time constraints and resources for this study. Opportunities exist for future research studies to examine policy implementation and compliance with NFPA

1582 among other fire departments that have experienced a firefighter fatality or among fire departments that have not experienced a heart attack-related firefighter fatality. I applied this research study only to fire departments that have experienced an incident of a heart attack-related firefighter fatality and where a firefighter fatality investigation was conducted and completed by NIOSH.

Significance of the Study

This research study contributes to the body of knowledge to positively impact firefighter health, safety, and wellness. Research within the fire service and emergency management industry continues to emerge but remains in its infancy stages. This research study bridges the gap in the literature regarding policy implementation and compliance with NFPA 1582 among fire departments in the United States. NIOSH (2007) indicated that barriers that may exist to comprehensive medical programs for fire departments are an area that needs to be researched and identified.

Another significance of this research study was that it provides critical information necessary to advocate for mandatory comprehensive occupational medical and fitness programs to ensure the safety and well-being of firefighters. The findings of this study may lead to viable solutions to address the challenges or barriers to implementation and compliance of the NFPA 1582 standard among fire departments. Discussions sparked by this process may also enhance interest in public policy initiatives to assist fire departments with full compliance with NFPA 1582 to ensure optimal health, safety, and well-being among firefighters and to reduce heart attack-related on-duty firefighter fatalities.

This research study has the potential to inform future legislation that will enhance firefighter safety and health and reduce firefighter fatalities. In March 2009, Rep. Ed Perlmutter (CO) and Sen. Sherrod Brown (OH) introduced a bill cited as the "Firefighter Fatality Reduction Act of 2009" to the 111th Congress. This bill was to direct the Secretary of Homeland Security to establish a task force that would survey career, volunteer, and combination fire departments in the United States on their compliance with national voluntary consensus standards for staffing, training, safe operations, personal protective equipment, and fitness. The surveys were to determine the extent of compliance and identify the barriers to achieving compliance with these national voluntary consensus standards. The task force would have been charged with making recommendations for the federal government, states, and other localities to promote, encourage, or require compliance with the standards to enhance firefighter safety and reduce firefighter fatalities. This bill was referred to Committee and was never enacted (Govtrack.us, 2019).

This research study could have several positive social change implications. The findings may address ways fire departments can enhance the safety, health, and well-being of firefighters through compliance with NFPA 1582. By assessing the level of compliance with the standard and identifying the barriers to implementation and continued compliance, policy implementation issues can be addressed. The results could be an overall reduction in annual firefighter fatalities and a break in the continued trend of heart attacks being the leading cause of firefighter deaths. This research study can provide a direction to achieve on a smaller scale the goals the Firefighter Fatality

Reduction Act of 2009. Enhancing the safety, health, and well-being of firefighters will help protect the lives of these first responders.

Summary

Heart attacks are the consistent leading cause of on-duty firefighter fatalities. Although a national consensus standard provides guidelines for medical screening for firefighters, this problem persists. NFPA 1582 requires routine comprehensive medical screenings and fitness for duty evaluations for firefighter candidates and current firefighters. In this qualitative research study, I explored the extent to which fire departments comply with the NFPA 1582 standard. I also sought to determine what challenges or barriers exist to policy implementation or compliance with the standard and to gain an understanding of how these contribute to this ongoing problem.

In Chapter 2, I present a review of the literature relating to firefighter fatalities, risks for cardiovascular disease, health risks for firefighters, and the NFPA 1582 standard. I provide an account of the research conducted on these topics and offer a greater understanding of this ongoing problem. Nonetheless, research on compliance with NFPA 1582 by fire departments is limited.

Chapter 2: Literature Review

Introduction

Heart attacks have been the consistent cause of on-duty firefighter fatalities for over a decade despite the existence of NFPA 1582 *Standard on Comprehensive Occupational Medical Programs for Fire Departments*. In this study, I aimed to explore the extent to which fire departments follow NFPA 1582 and determine barriers or challenges to policy implementation and compliance. In this chapter, I present a review of the literature on firefighter fatalities, heart attack risk among firefighters, and the NFPA 1582 standard. This literature review establishes the foundation to analyze the implementation and compliance of NFPA 1582 among fire department organizations, an understanding of potential barriers and challenges to compliance, and the reason heart attacks continue to be the leading cause of on-duty firefighter fatalities. The theoretical framework of this research study is also explained in this chapter. This chapter is organized based on key topics of the research, including firefighter fatalities, heart attack risks for firefighters, and literature on NFPA 1582. I also position this study with the theoretical literature on policy implementation and provide the rationale for selecting contextual interaction theory as the framework for this study.

I experienced challenges in identifying literature on firefighter fatalities, the NFPA 1582 standard, and the policy process in fire department organizations. Although there are significant trade journal articles on these topics, empirical research by scholarly practitioners is lacking within the fire service industry. The lack of empirical research on these topics does not take away from the importance of this research problem. Rather,

this dearth presents opportunities for scholarly research that focuses on first responders. All efforts were made to include the most recent literature in this study. However, to present a comprehensive understanding of this research, I needed to include literature that was published longer ago than 5 years.

Literature Search Strategy

I conducted an extensive search for peer-reviewed articles using the Walden University's online library, including databases such as EBSCO Host, ProQuest, and Thoreau. I also made additional searches on Google Scholar to locate scholarly peer-reviewed articles not available through the Walden University online library. Several key words were used to refine the searches: *firefighter fatalities, firefighter heart attacks, firefighter deaths, NFPA 1582,* and *fire service medical evaluations*. The searches yielded numerous articles; however, few were peer-reviewed articles, and others were not applicable to this research study. The search became exhaustive when there were repeated occurrences of the same authors and article titles.

Theoretical Framework

Contextual Interaction Theory

Contextual interaction theory was used as the theoretical framework for this research study. O'Toole (2004) exerted the application of implementation theory as a logical approach to policy analysis and to inform practice. Implementation theories contribute to the efficacy of policy action by emphasizing points to address practical implications. The contextual interaction theory aligns with O'Toole's assertions and was used as the theoretical framework for this research study. Hans Bressers developed this

model and conceptualized policy implementation as an interaction process. The model focuses on the policy actor's motivation, information, and power as the key constructs that drive and facilitate the policy implementation process (Bressers, 2004). These key constructs and the interaction process consider several factors, including policy instruments and vital interactions between the individual responsible for policy implementation and the target group affected by the policies over extended periods of time (O'Toole, 2004). Contextual interaction theory has been used to examine public policies in several areas of study, including water management (Bressers, 2007; Hophmayer-Tokich, 2013), international health (Bakari & Frumence, 2013; Spratt, 2009), environmental air quality (Gunawan et al., 2017; Subramanian & Abdulrahman, 2017), and domestic violence (Javakhishvili & Jibladze, 2018).

Policy implementation is complex and requires consideration of multiple factors and multiple actors within varying environments. Policy implementation studies have frequently been limited by focusing on the policy instruments in both top-down and bottom-up implementation models while neglecting the factors associated with the influences of the policy actors (O'Toole, 2004). Bressers (2004) supported this argument indicating that policy results do not depend policy instrument characteristics alone, but mostly on the characteristics of the actors involved in policy implementation. Contextual interaction theory acknowledges the possibility of multiple factors that can influence the implementation process but focuses more importantly on the policy actor's influences, which are understood through their motivations, information, and power (Bressers, 2007). These key constructs will generally expose the facilitating factors and barriers to policy

implementation (Bressers, 2004). The fire chief is usually the authoritative figure in fire departments responsible for the implementation and compliance of policies and procedures for the organization. In this research study, I explore the motivations, information, and power of fire chiefs as the policy actor with regards to implementation and compliance with the NPFA 1582 standard.

Motivations

A policy actor's desire to act on policy initiatives may be fueled by several factors or influences. Bressers (2004) indicated that internal or external sources may influence a policy actor's motivation. Perceptions of the problem, its level of priority, and the extent to which it aligns with a policy actor's goals and objectives may differ, resulting in different approaches to implementation (Bressers, 2007). If a policy actor has no interest in advancing a policy, implementation efforts are likely to fail. In the context of this study, motivations as a key construct may include a fire chief's perceptions on the importance of routine occupational medical screenings to address health issues before they become fatal on the job. The level to which this policy aligns with the fire chief's personal values on health and safety also bears weight on their motivation. Additionally, motivation may be due to external factors such as political pressures or pressures from labor unions or other organizations representing firefighters.

Information

Effective policy implementation hinges on policy actors having adequate information and understanding that information. Policy actors must have full knowledge and understanding of the problem and how a policy addresses the problem. Information

also includes an actor's cognition and not only refers to the sufficient level of technical information required to execute the practices for policy implementation, but also the actor's information processing capacity, frames of reference, and interpretations of reality (Bressers, 2007; de Boer & Bressers, 2011). Budd et al. (2012) stressed the important relationship and critical nature of adequate technical information and its understanding by policy actors to effective policy implementation. Sanchez et al. (2014) reported similar results, indicating inadequate information and limited understanding of policies creates barriers to effective and successful implementation.

Fire chiefs need to develop a collective knowledge and understanding of the problem and the state of their fire department. Additionally, fire chiefs need to have technical knowledge regarding NFPA 1582 and understand the relationship of its components to essential job tasks of their firefighters. For example, NFPA 1582 outlines specific essential job tasks that fire chiefs need to match against the types and levels of emergency services provided by their fire departments and determine whether these tasks apply to their department members and candidates. Determining whether a member or candidate passes a comprehensive medical evaluation based on identification of medical conditions found is determined by their ability to safely perform essential job tasks. Kales et al. (2007) found significant increases in risk for cardiovascular disease based on emergency duties performed by firefighters. Within the context of this research study, cardiovascular health is essential to longevity and safely performing all essential job tasks outlined in NFPA 1582 and to prevent on-duty firefighter fatalities by heart attacks.

Power

For an individual to effectively implement policies, they must have the authority and access to appropriate resources. Bressers (2004) explained *power* as having capacity and control. Capacity refers to resources that can facilitate policy implementation, such as time, finances, and personnel. Control refers to both designated roles within an organization and ability to exert influence in policy implementation (Bressers, 2007). In many cases, policy actors may depend on the resources provided by other actors, which impacts the balance of power. Resources are essential for policy action and determine the capacity of policy actors (de Boer & Bressers, 2011). The fire chief has formal power by virtue of their position of authority as the leader of the fire department. Consequently, power may be influenced informally by others such as political figures, safety experts, or collective bargaining organizations. Because a fire department organization is hierarchal, informal power may also be derived internally by other command officers who may be accountable for implementation or compliance with departmental policies. The perception of power can impact a fire chief's actions and may suggest whether authority support exists or is lacking. To implement and comply with NFPA 1582, a fire chief will need to depend on resources external to the fire department, thus depending on the power of others. These resources may include funding and access to healthcare systems.

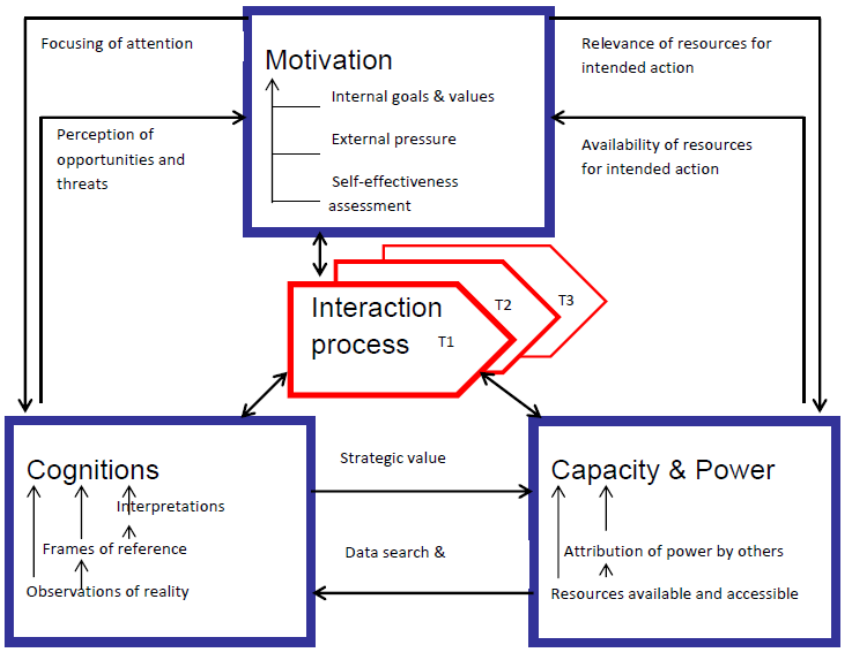
Interactions

A policy actor's motivation, information, and power are not independent of each other, but have a mutual relationship on their impact to policy implementation. Changes to one of the key constructs affect the other two. There is a dynamic interaction that

drives the social processes on these key constructs among policy actors. Figure 3 illustrates this dynamic interaction process between the key policy actor characteristics, which takes place over time. This mutual relationship configures the activities of policy implementation and the interaction among all actors involved in the process (de Boer & Bressers, 2011). As evidenced in a study on international health regulations, Bakari and Frumence (2013) cited that for policy implementers to achieve desired goals, all the key factors of the contextual interaction theory and how they relate to each other must be considered and addressed. For example, fire chiefs may have significant motivation, understanding of all the technical information, and authoritative power to implement and comply with NFPA 1582, but if power in terms of capacity is limited by lack of resources, the implementation and compliance of the policy may be challenged. Additionally, communication and other interaction between the fire chief and firefighters as the target group may impact the degree of cooperation or opposition experienced, which can either facilitate or further challenge implementation or compliance.

Figure 2

Dynamic Interaction Process Between Key Policy Actor Characteristics



Note. There are mutual influences between the key policy actor characteristics of motivation, cognitions, and power that contribute to the interaction process. From "Contextual interaction theory as a conceptual lens on complex and dynamic implementation processes," by C. de Boer and H. Bressers, 2011, [Paper presentation], Research Conference COMPACT Work: Challenges of Making Public Administration and Complexity Theory Work. Copyright 2011.

Literature Review

Firefighter Fatalities

The USFA conducts a study every year on firefighter fatalities and publishes an annual report. In these reports, statistics and an analysis of the findings are presented. the report provides a breakdown of the firefighter fatality statistics by organizational type,

type of duty, cause of fatal injury, nature of fatal injury, firefighter age, and state or region. I conducted a review of firefighter fatalities annual reports for the past 10 years. In each of these reports, heart attacks accounted for the highest percentage of firefighter deaths each year. The published report for the year 2019 reported 33 firefighter deaths due to heart attacks. This accounted for 51.6% of the total firefighter fatalities for that year, and the highest among the 10 nature of fatal injury categories used by the USFA in that report (USFA, 2020). Similarly, the findings in the report for the year 2010 presented 50 firefighter heart attack-related deaths and cited heart attacks as the leading cause of firefighter fatalities. This accounted for 57.5% of the total firefighter fatalities among the fatal injury categories (USFA, 2011). In all 10 years examined, heart attacks consistently accounted for most firefighter deaths. These statistics show the trend of this problem extending over a decade with little improvement. A death and injury survey conducted by the IAFF in 2000 confirmed this problem has existed for decades. The survey indicated that job-related fatalities for firefighters were almost three times higher than those in the private sector and that the leading cause of line-of-duty deaths for firefighters was heart attacks (IAFF, 2000).

The CDC has also further analyzed the data from the USFA to understand the nature of the problem. In the CDC analysis, heart attack-related firefighter fatalities were characterized among career and volunteer firefighters. Firefighter fatalities between 1994 and 2004 were analyzed, and during that period, 50% of deaths reported among volunteer firefighters were from heart attacks. Conversely, 39% of deaths attributed to heart attacks were reported among career firefighters (CDC, 2006). Recent published annual reports on

firefighter fatalities from the USFA fail to provide a breakdown of heart attack-related fatalities between career and volunteer firefighters. However, this information is available through a searchable database on the USFA website.

The latest available information for a ten-year period between the years 2010-2019 indicated an average of 56.54% of the heart attack related firefighter deaths were among those classified as volunteers in comparison to 32.59% for those classified as career firefighters (USFA, 2021). In comparison to the CDC's analysis for the years 1994 through 2004, heart attack related deaths among volunteer firefighters have increased but career firefighter deaths have slightly decreased. Overall, heart attacks remained the consistent leading cause of firefighter deaths. These statistics represent a consistent problem and very little improvement in heart attack related firefighter fatalities.

The annual reports on the studies of firefighter fatalities by the USFA provided an excellent source for statistical analysis based on the categories of information that are collected. Although this is an excellent resource to verify trends among the firefighter fatality statistics, it does not provide the necessary in-depth analysis among other variables that may positively or negatively impact these statistical numbers. Additional information such as participation in health and wellness programs or comprehensive medical evaluations are vital to further define the root of this problem.

NIOSH established FFFIPP to conduct independent, on-site, voluntary investigations of firefighter line-of-duty deaths. The main goals of its program are to define characteristics of these firefighter fatalities, develop recommendations to prevent deaths and injury, and to disseminate information of prevention strategies within the fire

service industry. In its report, *Leading Recommendations for Preventing Fire Fighter Fatalities, 1998-2005*, 372 firefighter fatalities were investigated. From these investigations, sudden cardiac death or heart attacks were the leading cause of death despite the existence of NFPA 1582. Firefighters from career fire departments accounted for most of these fatalities. The report also emphasized the implementation of medical screenings and fitness and wellness programs as its recommendations for preventing firefighter fatalities from medical conditions (NIOSH, 2008). Contrary to the findings in that report, a search of firefighter fatalities database on the USFAs website, since 2010 firefighters from volunteer fire departments accounted for most on-duty firefighter fatalities (USFA, 2021). It is important to note that not all on-duty firefighter fatalities are investigated by NIOSH, but all are reported to the USFA thus causing this discrepancy in the statistical numbers.

Trauma trails behind heart attacks as the second leading cause of on-duty firefighter fatalities. The 2019 annual firefighter fatalities report indicated 15 firefighters died as a result of trauma. This accounted for 24.2% of the total firefighter fatalities for that year (USFA, 2020). This trend has also been consistent among all 10 years examined for this research study. In an analysis of firefighter fatality investigations by NIOSH between 2004 and 2008, 63 of the 143 investigations involved traumatic fatal injuries as compared to 80 involving medical related fatalities (DeJoy et al., 2010). Although NIOSH firefighter fatality investigations are voluntary, this illustrates that the consistency of this issue has extended for over a decade.

Firefighter fatalities by trauma is extremely broad since there are multiple variables that may contribute to the root cause of injury. Fahy and Molis (2019) provided some insight on trauma related firefighter fatalities in 2018. Firefighter deaths from traumatic injuries sustained on the fireground included those involved in a structural collapse, detonation of an explosive device, and a fall through a collapse floor. Firefighter trauma related deaths involving vehicles included motor vehicle crashes while responding to or from an incident, being struck by a vehicle on an incident, and one which a firefighter fell from a moving vehicle. Another trauma related fatality included a firefighter who was shot and killed while responding to an incident. DeJoy et al. (2010) found that the recommendations in most trauma related firefighter fatality investigations were associated with various factors involving staffing, incident command, operational tactics, and equipment. Specific issues were found in areas of readiness, training, accountability, and standard operating procedures. The job tasks of firefighters predispose them to inherent risks and hazards. Therefore, prevention strategies to reduce traumatic firefighter fatalities will need to focus on performing those job tasks safely and efficiently given specific circumstances or situations. Unlike heart attack related firefighter fatalities in which routine comprehensive medical screenings can reduce the risk of death, trauma related firefighter fatalities require a more extensive assessment of multi-dimensional areas to determine where prevention efforts should be directed to reduce fatal traumatic injuries.

Emerging statistics through several studies have shown an increase in incidence of cancer among firefighters leading to an increase in firefighter mortality rates. A multi-

year study initiated by NIOSH examined 30,000 firefighters from the Chicago, Philadelphia, and San Francisco Fire Departments. This study compared the type of cancer and cancer rates of firefighters to the general U.S. population. The study revealed that firefighters had a 9 percent higher number of diagnoses of specific cancers and a 14 percent higher cancer-related death rate (Daniels et al., 2014).

Jalilian et al. (2019) evaluated several studies involving cancer incidence and mortality among firefighters. They argued that the results of these studies were inconsistent. They also found no statistically significant association between firefighter occupations and the incidence or mortality risks of overall cancers. However certain types of cancers did present with significantly elevated risk. Increased mortality rates for firefighters were more specific to rectal cancer and non-Hodgkin's lymphoma.

Pinkerton et al. (2020) provided an update to the multi-year study initiated by NIOSH and confirmed the findings that non-Hodgkin's lymphoma did increase the mortality rates among firefighters. Their study also noted an increase in mortality rates for lung cancer, leukemia, and chronic obstructive pulmonary disease as compared to the general population. All other cancers were described as having modestly elevated mortality rates. Even the slight increase in incidence of cancer and mortality rates for firefighters compared to the general population emphasizes the significant risks and inherent dangers of the firefighter occupation.

Currently, the USFA does not have a category for cancer as the cause or type of fatal injury to account for these in its annual report on firefighter fatalities. This creates a significant challenge in accounting for firefighter deaths related to cancer. This

information is currently limited to several research studies which associates the occupational exposures of firefighters to cancer risk and mortality. However, alike heart disease, early screening, and detection for cancer through comprehensive occupational medical programs could potentially reduce the risk of firefighter deaths from cancer.

On July 7, 2018, the Firefighter Cancer Registry Act of 2018 was passed in Congress. This law directed the CDC to create a National Firefighter Registry (NFR) to track and analyze cancer trends and identify occupational risk factors for cancer among firefighters in the United States (CDC, 2019). Although participation in the NFR is voluntary, it provides the first official database which information can be collected and used to monitor the incidence and trends of cancer among firefighters. This information has the potential to advance further research on occupational cancer among firefighters and provide better tracking of firefighter deaths related to the disease.

Risks for Cardiovascular Disease

Cardiovascular disease, also known as heart disease, is the leading cause of death for both men and women in the United States. Heart disease, if untreated, may lead to heart attacks or sudden cardiac death. The CDC indicated that one in every four deaths occur because of heart disease. This equates to approximately 647,000 people that die every year (CDC, 2020). Globally, an estimated 17.9 million people die from heart disease. This represents 31% of all global deaths (World Health Organization, 2021). These statistics present a global and nationwide epidemic that has initiated many risk reduction and prevention initiatives from the health community.

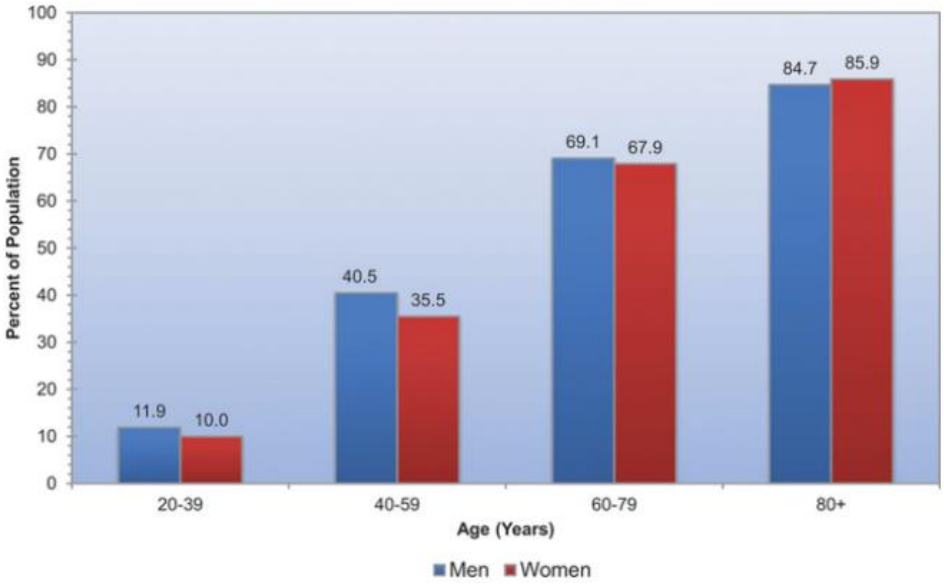
Heart disease is primarily caused by risk factors that may be controlled, treated, or modified. Being cognizant of these risk factors and taking the necessary steps towards prevention is necessary in reducing deaths from heart attacks. Major risk factors for heart disease include hypertension, diabetes, hyperlipidemia, obesity, physical inactivity, tobacco use, and unhealthy diet. Arrebola-Moreno et al., (2020) indicated that the burden of heart disease may be dramatically reduced through prevention efforts with lifestyle and behavioral changes. By eating healthy foods, not smoking, exercising regularly, not consuming large amounts of alcohol, and reducing stress, an individual could prevent and control hypertension, high cholesterol, diabetes, and obesity which are the modifiable risk factors for heart disease. Rosenstock and Olsen (2007) emphasized that modifiable risk factors for heart disease in firefighters should be managed aggressively, regardless of whether it is related to the occupation or not.

Non-modifiable risk factors include those which are beyond a person's control such as age, gender, and hereditary (American Heart Association, 2021c). The American Heart Association (AHA) has projected that by the year 2030, there will be a significant increase of at least 43.9% of all Americans will suffer from some form of heart disease. Generally, the prevalence for heart disease is higher in males compared to females. However, at ages 80 and older, the number of females prevalent to having heart disease is slightly higher than males. The risk for heart disease increases with age and becomes most prevalent in adults ages 40 and older (Mozaffarian et al., 2015). Figure 2 shows the prevalence of heart disease in adults 20 years of age and older by age and gender. The number of people with multiple risk factors has increased over the years, leading to a

decrease in health-related quality of life and an increase in the risk of mortality (Li et al., 2008). A comparison of statistics provided by Mozaffarian et al. (2015) which cited 610,000 deaths from cardiovascular disease annually to the current CDC statistics confirms this increase in mortality. Without more people recognizing their risk factors and taking proactive steps in the prevention of heart disease, it is unlikely that these statistics will improve.

Figure 3

Prevalence of Heart Disease by Age and Gender



Note. Figure 2 shows the prevalence of heart disease in adults 20 years of age and older by age and gender. From "Heart Disease and Stroke Statistics – 2015 Update, A Report from the American Heart Association." By Mozaffarian et al, Copyright 2015.

An unfavorable trend in the statistics show that younger adults between the ages of 20 to 45 are affected at an alarming high rate. This prevalence of the development of heart disease in younger age groups from older adults call for early risk factor

modification and prevention efforts at a younger age (Page II et al., 2011). These statistics are important within the fire service industry since many firefighters are within this age range. It emphasizes the significant and ongoing need for comprehensive medical evaluations among firefighters to address these risk factors and institute preventative measures.

In a study to determine the prevalence of risk factors for heart disease in firefighters, Risavi (2015) indicated that firefighters over the age of 45 had a six-fold increase for risk of death. Many of the firefighters had significant risk factors for heart disease such as hypertension, obesity, and hyperlipidemia. In addition, many did not adhere to a diet and exercise regimen conducive to reducing their risk. The study drew reference to the increasing challenge with controlling, treating, or modifying risk factors as firefighters increase in age. The report, *Firefighter Fatalities in the United States in 2019* reflected this issue by highlighting the number of firefighter fatalities related to heart attacks and stroke by age groups. Table 2 provides the data expressed in this report which shows an increase in fatalities as the age group increased.

Table 2

Firefighter Fatalities by Age and Nature of Fatal Injury (2019)

Age	Number of firefighter fatalities who died of trauma/asphyxiation/ other	Number of firefighter fatalities who died of heart attack/CVA
Under 21	0	0
21 to 25	2	1
26 to 30	2	1
31 to 35	3	0
36 to 40	5	3
41 to 45	3	4
46 to 50	7	4
51 to 60	3	5
61 and over	2	17

Note. This table shows the relationship of the number of firefighter fatalities in specific age groups to the nature of fatal injury. From "Firefighter fatalities in the United States in 2019," by USFA, Copyright 2020.

A study conducted by the NFPA revealed that half of the firefighters in the United States that died of a heart attack or sudden cardiac death were known to have an existing cardiovascular condition and at least 75% of those had heart conditions which could have been detected through simple medical evaluations (Murphy, 2008). Farioli et al. (2014) confirmed these findings in another study that sudden cardiac death was more prevalent in firefighters with a premorbid history of cardiovascular conditions. In the study, traditional risk factors such as hypertension, obesity, and smoking contributed to arteriosclerosis and cardiac hypertrophy resulting in sudden cardiac death of young firefighters less than 45 years of age. While many firefighters start their careers within this younger age group, it becomes even more imperative for fire departments to initiate

and adhere to comprehensive occupational medical programs such as the NFPA 1582 standard.

Additional Health Risks for Firefighters

The health risks for firefighters are generally higher than those for the public due to occupational practices and exposure to hazardous conditions. The occupational challenges involved in firefighter job tasks places them at considerable risk for injury or disease. Studies on cardiovascular risks for firefighters taken from firefighter annual physicals revealed a high prevalence of obesity based on measures of body mass index compared to the population at large. In these studies, large samples had hyperlipidemia and hypertension (Byczek et al., 2004; Geibe et al., 2008; Kales et al., 2003). Smith et al. (2019) found these findings in another study but added the development of cardiomegaly and left ventricular hypertrophy which may contribute to heart attacks. Coupled with occupational stressors and consistent with having multiple risks as documented in these findings, these significantly increase the risk of mortality for firefighters. The results of these studies recommended a proactive approach to target cardiovascular risks among firefighters through fire department health and wellness policies and programs.

A firefighter's job duties command intense physical demands over long periods of time. In a study, Albert et al. (2000) found an association between sudden cardiac death during unusually high frequency or shortly after vigorous exertion. A prevalence of sedentary lifestyles and obesity places firefighters at increased risk, especially when intense work conditions and physical exertion increases myocardial oxygen demand (Murphy, 2008). It is suggested that many firefighters lack adequate physical fitness and

may have underlying cardiovascular risk factors for which 70% of fire departments are insufficient in providing programs that promote fitness and health (Kales et al., 2007).

Firefighters face impeccable exposure to toxic environments and repeated exposures to byproducts of combustion such as hydrogen cyanide, carbon monoxide, and smoke particulate matter. This exposure increases cardiovascular mortality and have been associated with heart attacks (NIOSH, 2007). Within the atmosphere, short term exposure to elevated particulate matter from ambient air pollutants has been linked to increased cardiovascular mortality, especially in people with pre-existing cardiovascular or respiratory conditions (Brook et al., 2004). A study indicated by Paton (2017) pointed out an increased risk for firefighters due to decreased blood vessel function and blood clotting caused by a combination of heavy physical exertion and exposure to extreme high temperatures and toxic gases.

Repeated toxic chemical exposures considerably increase the risks for firefighters. In a study conducted in 2012 which evaluated the blood chemistry of firefighters who worked two active structural fires, a specific form of ether at high levels were found in their blood. These are compounds found in flame retardants and a wide array of materials. The Environmental Protection Agency (EPA) has classified these as potential human carcinogens (Stefani, 2017). Soteriades et al. (2019) indicated exposures to carcinogens and other toxins generated from a fire scene can initially cause acute effects, but in the long-term may cause chronic health problems such as respiratory disease, heart disease, and cancer.

Firefighters are often exposed to critical incidents, high-stress situations and duty-related trauma which increases their risk for mental challenges. Some of these challenges include stress, anxiety, depression, and post-traumatic stress disorder (PTSD). A firefighter's ability to cope with stressors of the job often depends on the intensity and persistence of the stressful events and their personal resilience to these stressors (Fraess-Phillips et al. (2017). In addition to stressful events, other precipitating factors may exacerbate mental challenges among firefighters. Long work hours, high rates of sleep disturbances, and sleep deprivation may cause fatigue and lead to increased risk of stress and personal injury (Carey et al., 2011).

In a study specifically examining PTSD among firefighters who responded to the World Trade Center (WTC) terrorist attacks on September 11, 2001, the rate of PTSD was cumulative over time. Within the first six months of the terrorist attacks, the rate of PTSD was 8.6 percent and within three years, it was 11.1 percent (Wisnivesky et al., 2011). Another study reported PTSD rates of 31.9 percent over nine years (Berninger et al., 2010). Mi-Ji et al. (2019) indicated that PTSD is often accompanied by other issues such as depression, anxiety, panic disorders, and alcohol or substance abuse. If untreated, progressive physical and mental disorders and social and occupational issues may develop. These were also evident in the study as the rates were also high in the incidence of depression and panic disorders. These were reported at a rate of 27.5 percent and 21.2 percent, respectively (Wisnivesky et al., 2011). These findings underscore how the severity of traumatic events impact firefighters and can lead to various types of stress and mental challenges.

Bacon (2019) suggested that mental disorders related to acute stress are linked to increased risk for the development and progression of heart disease. This was confirmed in a laboratory study in which induced mental stress contributed to myocardial ischemia and was evident by an electrocardiogram and echocardiogram. Patients in the study with mental stress had a double risk of adverse cardiac events than those without (Zhang et al., 2020). Stress may also lead to other behaviors and conditions which precipitates heart disease. These have been identified as risk factors such as high blood pressure, high cholesterol, physical inactivity, overeating, and smoking (American Heart Association, 2021b). The considerable health risks for firefighters present a clear and convincing rationale for routine comprehensive occupational medical screenings consistent with NFPA 1582.

NFPA 1582

NFPA 1582, *Standard on Comprehensive Occupational Medical Programs for Fire Departments*, is the voluntary consensus standard that addresses medical screenings and fitness for duty evaluations for firefighters. Developed by the National Fire Protection Association (NFPA), it provides a consistent set of guidelines for medical evaluation procedures to be conducted by a qualified physician for candidates and current firefighters. NFPA 1582 requires a medical evaluation based on specific requirements for candidates being considered for training or participation in fire department emergency response activities. Additionally, for current firefighters, it requires medical evaluation meeting specific requirements at least annually (NFPA, 2017). A study conducted by NIOSH in 2007 revealed that only 71% of fire departments conducted initial candidate

medical evaluations and only 31% conducted annual or periodic evaluations for current firefighters consistent with NFPA 1582 (NIOSH, 2007). In a more recent study involving firefighter fatality investigative reports, Hard et al. (2019) found that the top recommendation was routine comprehensive medical screening for firefighters, revealing inadequate medical programs consistent with the NFPA 1582 standard. The results of these studies provide evidence that implementation and compliance with NFPA 1582 is lacking and may have contributed to firefighter fatalities.

The NFPA 1582 standard aims to reduce morbidity and mortality in the fire service and ensure firefighter candidates and current firefighters can perform the essential job tasks of the position without health and safety risks to themselves or others. For candidates, the standard lists several medical conditions that would either disqualify them from being eligible to perform the essential job tasks of a firefighter or allow them to perform based on the severity or degree of the medical condition. For current firefighters, the standard offers additional evaluation requirements and specific guidelines for conditions found in the medical evaluation. It also provides specific restrictions based on various essential job tasks (NFPA, 2017).

Specific to cardiovascular health and the prevention of heart attacks, NFPA 1582 requires the medical evaluation to include an electrocardiogram (ECG) and assessment based on the *American College of Cardiology/American Heart Association's* Heart Risk Calculator for atherosclerotic cardiovascular disease. This assessment considers the cardiovascular risk levels of firefighters based on age, gender, race, blood pressure, cholesterol levels, history of diabetes, smoking history, and treatment for hypertension

and hyperlipidemia (NFPA, 2017). Several studies have documented medical conditions found in routine medical evaluations of firefighters, particularly obesity, hypertension, and hyperlipidemia. These studies have also provided evidence of a lack of consistent routine medical evaluations leading to undertreatment or nontreatment of these conditions (Geibe et al., 2008; Kales et al., 2003). Risavi and Staszko (2015) pointed out that aggressive medical monitoring of firefighters seems to be inconsistent, thus resulting in inadequate awareness and treatment of risks associated with heart disease. All these studies concluded that routine medical evaluations and treatment would produce favorable health outcomes for firefighters and decrease the risk for sudden cardiac death by heart attacks. This stresses the importance of NFPA 1582 in reducing firefighter deaths.

Summary

In this chapter, I presented a review of the literature relating to firefighter fatalities, risks for cardiovascular disease, health risks for firefighters, the NFPA 1582 standard, and the contextual interaction theory. Heart attacks have consistently accounted for most on-duty firefighter deaths over the past 10 years. Firefighters, like the general population in the United States are at risk for heart disease. Controlling, treating, or modifying the risk factors for heart disease are successful strategies in preventing heart attacks. Health risks for firefighters are considerably higher than the general population due to occupational practices and repeated exposure to hazardous conditions. Routine comprehensive medical screening for firefighters is extremely important to identifying

risk factors for heart disease and other medical conditions to reduce firefighter fatalities from heart attacks.

NFPA 1582, *Standard on Comprehensive Occupational Medical Programs for Fire Departments*, addresses comprehensive medical screenings and fitness for duty evaluations for firefighters. The standard ensures firefighter candidates and current firefighters can perform the essential job tasks without health and safety risks to themselves or others. It also reduces the morbidity and mortality in the fire service through early recognition of health risks and other medical conditions.

The contextual interaction theory was used as the theoretical framework for this research study. This theory acknowledges multiple factors that can influence the policy implementation process but focuses more importantly on the policy actor's influences through their motivations, information, and power. These key constructs will generally expose factors that facilitate or obstruct policy implementation. Chapter 3 provides the research design and methodology of this research study to describe the process to be used to answer the research question and bridge the gap in the literature.

Chapter 3: Research Method

Introduction

The purpose of this qualitative research study was to analyze the implementation and compliance of NFPA 1582 as policy through the perceptions and experiences of fire chiefs of fire department organizations with a previous incident of a heart attack-related on-duty firefighter fatality. Contextual interaction theory was used as the theoretical framework to guide this research study. NFPA 1582 focuses on providing a comprehensive guideline for medical evaluations of firefighters. Despite the existence of the NFPA 1582 standard, heart attacks continue to be the consistent leading cause of on-duty firefighter fatalities in the United States (USFA, 2019). The primary research question addressed in this qualitative research study was:

RQ: What is the compliance with NFPA 1582 to prevent heart attack-related firefighter fatalities among fire departments?

The following subquestions were also addressed in this study:

SQ1: How is NFPA 1582 implemented in fire departments and what improvements can be made to ensure healthy and safe firefighters?

SQ2: What actions or events have influenced the implementation or compliance of the NFPA 1582 standard?

SQ3: What challenges exist to compliance with the NFPA 1582 standard and what can be done to address these challenges?

This chapter provides a description and explanation of the research design, selection strategy, data collection methods, analytical methods, and procedures to ensure

validity and reliability in this qualitative research study. Justifications for this approach and specific interview techniques are explained. Additionally, my role as the researcher, including experiences, philosophies, and relationships to participants will be discussed.

Research Design and Rationale

With respect to methodology, the answers sought in this research study fall within the scope of a generic qualitative inquiry. The primary unit of analysis in this research study was fire departments where a heart attack-related firefighter fatality incident occurred. For this study, fire departments were the units of analysis because I analyzed whether the fire departments used NFPA 1582 or not, and if so, how it was implemented or complied with. Variations to implementation or compliance would be on the fire department level, not the NFPA 1582 policy level. How a fire department implemented or complied with NFPA 1582 may be the reason firefighter fatalities have not significantly changed over decades. Key insights, including the experiences, perceptions, and attitudes of the primary decision maker and person responsible for the implementation of policies and procedures were explored to obtain this data.

In fire department organizations, the fire chief is the person responsible for this endeavor and is the head of the agency. Fire chiefs are the highest managerial individual within the organization. The implementation and compliance with NFPA 1582 and the potential barriers to compliance that may inhibit the fire service industry's ability to improve the health and well-being of firefighters and reduce heart attack-related firefighter fatalities was explored in this study by analysis of data collected through semistructured interviews.

The generic qualitative design was the most plausible choice in this study to achieve an in-depth understanding of the problem because it is not bounded by certain philosophical underpinnings or assumptions that would limit the nature of inquiry. Rather, it was flexible enough to use the strengths of the other qualitative designs to provide a more comprehensive understanding of the problem. Similar to the grounded theory approach, in which participant views are used for grounding a theory, in this study, I used the views of fire chiefs representing their fire departments on the compliance with NFPA 1582 to achieve the research objective of determining the level of compliance and challenges to compliance with the standard. Additionally, data analysis of significant statements, meaning units, and text in the phenomenology approach, as well as cross analysis or comparative analysis, was used in this study. These approaches taken together help develop a contextually rich narrative that improves the understanding of NFPA 1582 compliance.

I selected the qualitative method for this research study over quantitative methods. The primary consideration in this selection was the importance of gaining an in-depth understanding of the research problem versus achieving generalization over a larger population. I selected qualitative for this study because it hinges on the main point that there was a lack of understanding as to why and how heart attacks continue to be the leading cause of firefighter fatalities despite the existence of NFPA 1582. Rubin and Rubin (2012) pointed out that qualitative research provides answers to why, what, and how questions in an explanatory way, whereas quantitative research provides answers to the how much question by providing statistical results. Because the goal of this research

study was to achieve a deep understanding of the problem rather than statistically account for the reasons for heart attack-related firefighter fatalities, the qualitative method was the most suitable choice.

Quantitative methods often result in interpretations that can be generalized to a specific population. While quantitative methods could have been used for this research study, it would be impossible to achieve the depth of knowledge available using the qualitative method. Quantitative methods cannot provide the same level of complex and personal information to comprehend this research problem, including the motivations, experiences, its meaning, and the contexts of specific situations, circumstances, and decisions involved with implementation and compliance with NFPA 1582 to prevent heart attack-related firefighter fatalities. However, using qualitative methods in this research study provided for future research opportunities from the knowledge achieved from the in-depth understanding of this research problem. This knowledge can be used in future quantitative research studies to form generalizations over the fire service industry.

Role of the Researcher

In addition to my role as the researcher, I have had involvement with the fire service for over 30 years. I have served in the capacity of both firefighter and paramedic, and during my professional career, I held the position of assistant fire chief. I have participated in training and discussions on firefighter health and safety. As an advocate for firefighter health, safety, and wellness, the topic of this research study affects everyone involved with the fire service. Because of my background, I sought to remain neutral and unbiased during this research study. My obligations in this study were to

ensure the accuracy of the research. As the sole researcher, I strictly followed the processes described within on selecting the samples and participants, data collection, and interpretation and analysis of the data.

Being in the fire service profession provided membership within the industry or close ties to this research topic of interest. This provided advantages and disadvantages as the researcher. An advantage was that I understand many of the tasks and its demands on firefighters, as well as the terminology in the fire service. This allowed me to communicate more effectively with the participants and introduce greater depth of data into the study. A disadvantage was being in the fire service profession can be perceived as a bias that can sway interpretation of data toward a specific position. I ensured that I took every precautionary measure to set aside any biases in all steps of the data collection and analysis processes to ensure trustworthiness and credibility of this research study. Besides conducting this research study from an external perspective, another researcher peer reviewed this study, including its final conclusions.

Methodology

Participant Selection Logic

Firefighter fatalities are required to be reported to the USFA and are recorded in their searchable online database. Additionally, completed firefighter fatality investigative reports are made available by NIOSH in an online searchable database. A population for this study was developed by filtering all firefighter fatalities in both publicly available online databases by deaths where the nature of fatal illness was categorized as heart attack. This was cross referenced to generate a list of only on-duty heart attack-related

firefighter fatalities reported to the USFA where an investigation was completed by NIOSH. The fire departments where the firefighter fatalities occurred were the population for this study. This list included over 50 fire departments that met these criteria over the last 10 years. Each fire department is represented by a fire chief who was contacted to participate in this study. In essence, the population was derived by filtering only those firefighter fatalities in which the nature of fatal illness was categorized as heart attack in the last 10 years and had a fatality investigation completed by NIOSH. A sample of 12 was selected from this population.

I used purposeful sampling and the maximum variation strategy for this qualitative research study. Within the USFA's database, the type of fire department organizations is classified as career, volunteer, or combination fire departments. Firefighters from these organizations may be classified as either career, volunteer, paid-on-call, or wildland firefighters. The maximum variation strategy to purposeful sampling allowed for the inclusion of the variations in types of fire department organizations that may be comprised of firefighters in different classifications to gain a wider range of perspectives in this study. The implementation and compliance of NFPA 1582 and the firefighter fatality were unique across firefighter classifications or types of fire departments. This variation was important to achieving an in-depth understanding of the research problem.

Patton (2015) and Malterud (2016) indicated there are no strict rules for sample size in qualitative research. The validity, meaningfulness, and understanding achieved in qualitative inquiry depends more on information richness rather than sample size. A

sufficient sample size was necessary to address the research questions effectively but was also dependent on the population selected and how it aligned with the research questions to achieve data saturation (Anderson, 2014; Yin, 2014). Cleary et al. (2014) pointed out that in a qualitative research study, sample size may include fewer than 20 participants. Gentles et al. (2016) argued that data saturation could be achieved with a significantly smaller sample size when the same questions are asked to multiple participants and no new information emerges.

Patton (2015) indicated that qualitative research designs should specify minimum samples based on expected reasonable coverage of the purpose of the study but should be flexible and emergent. The need to increase or reduce the specified sample size depends on whether there are insufficiencies in the data or data saturation is achieved. In this qualitative research study, 12 heart attack-related firefighter fatality incidents were selected as samples, and I continued gathering data until there was redundancy or saturation of the data was reached. The focus on 12 incidents that have been purposefully selected yielded greater insights and in-depth understanding rather than empirical generalizations. Each firefighter fatality incident had its own unique set of circumstances. However, purposefully selecting the samples based on fire department classifications determined whether trends and patterns existed within or across these classifications. This sample size of 12 fatality incidents of firefighters from various fire departments was large enough to achieve data saturation while providing a diversity of options. Because a criterion for the population of this study was a completed NIOSH investigative report, this added to the value of the study by providing much more information on each incident

than what was available through the semistructured interviews alone, particularly the status of compliance with NFPA 1582 within the affected fire department before the incident. The multiple sources of information added to the credibility, validity, and meaningfulness of the research study.

One of the responsibilities for a fire department chief officer is the administration of a risk management plan including a comprehensive safety and health program for firefighters (International Fire Service Training Association [IFSTA], 2019). The fire chief represents the top chief officer of a fire department. The participants interviewed were fire chiefs of those fire departments that experienced firefighter fatality incidents. Only fire chiefs were interviewed. Line personnel were not participants. The fire chiefs were best suited as participants in the semistructured interviews because the overall responsibility of policy implementation and compliance within a fire department is within the scope of the fire chief's position. Invitation to participate in this research study was provided to prospective fire chiefs via email (Appendix A).

Data Collection

Data collection in this qualitative research study was derived from a variety of evidence sources and included semistructured interviews, documents, and archival records. The documents and archival records included the fire department's medical screening policy and investigative reports on firefighter fatalities. Yin (2016) emphasized that using multiple data sources is important to gaining insights from various perspectives and may provide opportunities to complement or corroborate the data. Additionally, it adds to the credibility of the study when multiple sources are used to triangulate the data

to ensure consistency (Patton, 2015). In this study, I placed emphasis on ensuring the data were collected adequately to address the purpose of the research study and answer the research questions, while obtaining diverse perspectives and strengthening the confidence in the study's conclusions.

Data collection for this research study began after receiving approval from Walden University's Institutional Review Board (IRB). From the population list generated for this study based on the inclusion criteria, 12 fire departments were selected, starting with those with the most recent incidence of heart attack related firefighter fatality. To ensure the maximum variation strategy to purposive sampling, four fire departments was from each of the three types of fire department organizations. To engage prospective participants, an email with an invitation to participate in the research study (Attachment A) and a consent form (Attachment B) was sent to fire chiefs of these fire departments. If there was no response or if the invitation to participate was declined, it was replaced with another fire department from the list with a similar organizational type. If there were additional positive responses to the invitations greater than the designated sample size of 12, those was also be included in this research study. Once invitations were accepted and signed consent forms were received from the fire chiefs, semistructured interviews were scheduled.

Semistructured Interviews

Semistructured interviews were the primary mechanism for data collection in this research study. The extent to which fire departments comply with the NFPA 1582 standard was explored through the experience, perspectives, and attitudes of the fire

chiefs. The impact of any actions or events in their fire departments that may have influenced implementation or compliance with NFPA 1582 was also explored. Using the semistructured interviews with the fire chiefs as the participants allowed rich data to be obtained as they elaborated on their experiences with NFPA 1582 and any actions or events that had a significant influence on the standard.

The semistructured interviews were conducted either by video conferencing platform or by telephone. Consideration was given to the use of face-to-face interviews, however the time and resources to conduct this type of interview were limited since the fire departments where the firefighter fatality incidents occurred were in various locations throughout the United States. As the world was experiencing a global coronavirus pandemic, face-to-face interviews were unsafe as the risk for exposure was considerably high. Using face-to-face interviews would have taken several months and would have been fiscally challenging. This made face-to-face interviews impractical and virtual interviews by video conferencing or telephone ideal for this research study.

The semistructured interviews were guided by an interview protocol (Appendix B). The interview protocol gathered basic information about the interview appointment and contained the basic series of open-ended questions that were asked of all the participants in the study. The interview protocol was an important tool that helps to keep focus on the research questions and enhances reliability, consistency, and accuracy in the research study. The questions were carefully worded to maximize comprehensive and meaningful responses from the participants and not to introduce any bias. An expert panel consisting of three members was convened to pilot test the interview protocol to ensure

the questions were relevant and that they aligned with the research questions and objectives. The composition of this expert panel was two fire department chief level officers and one researcher who was not affiliated with the fire service industry. Any necessary modifications based on recommendations from the expert panel was made before commencement of the semistructured interviews and data collection. Once the semistructured interviews began, if the participant responses were unclear, follow-up questions were asked for clarification. E-mail follow-ups were used for clarification when needed. Reducing ambiguity increases the value of the data collected and thus enhances the reliability of the research study.

Audio of the interviews was digitally recorded and transcribed. A digital audio recorder that is sensitive and effective to fully record the interview conversations was used. Additional audio recording equipment and batteries was available to ensure that technical issues did not affect the interview process. QSR International's NVivo qualitative analysis software was used to transcribe the interview audio files. Member checking was used for verification by sending the transcripts of the interview to the participant via email for review. Transcripts provided an effective way to conduct a meaningful analysis of the interview than repeated listening of the audio recordings. It also provided a way to validate notes taken during the interview session. All digital files of the interviews and transcripts are stored on the researcher's password-protected computer with a backup copy stored on an encrypted online cloud data storage service.

Documents and Archival Records

Documents and archival records were also be used for data collection in this research study. Documents and archival records provided a particularly rich source of information that can corroborate information achieved in interviews or provided new information that can strengthen an in-depth understanding of the research problem (Patton, 2015). Fire department policies and procedures for comprehensive occupational medical programs for firefighters and any internal investigative reports on the firefighter fatality were used if made available. Multiple sources were used such as the interviews and publicly available archival records if access to documents were limited or unavailable.

The archival records that were used in this research study were the firefighter fatality investigative reports from NIOSH. The firefighter fatality investigative reports were publicly available through a database on the NIOSH website. These reports provided critical information on the state of compliance with NFPA 1582 or similar policy leading up to the firefighter fatality in each of the samples selected in this study.

Data Analysis Plan

Data analysis in this qualitative research study involved a systematic process of organizing the data for analysis and condensing it into themes through a coding process. The data were organized by the fire departments in which the heart attack related on-duty firefighter fatality incident occurred. This allowed for each fire department's circumstances surrounding implementation and compliance with NFPA 1582 to be first analyzed independently using all the sources of evidence. The independent analyses were

followed by cross analyses to focus on trends and compare commonalities and differences across the fire service industry.

Throughout the data analysis process, large amounts of data needed to be organized and managed. The computer-based qualitative data analysis software, NVivo by QSR International was used for the organization, management, and analysis of the data in this research study. This software program was a useful tool for coding and categorizing data and it streamlined the process to identify patterns and themes more efficiently.

The thematic data analysis for this qualitative study followed the procedures suggested by Braun and Clark (2006) since it was flexible to be used across a wide range of epistemologies and research questions. Once the data were organized, the next step was to get familiar with the data by reading the interview transcripts and the data sources several times and begin coding the data using an inductive approach. Core information and its meanings relevant to the research objectives were identified in the text. The initial readings of the data focused on generating the initial codes and subsequent readings aimed at systematically developing the formal coding system and reducing errors. Notes were taken during each cycle of reading the data to discover major themes and patterns as they emerge. Codes were collated into the potential themes and were further categorized if necessary. The themes were reviewed and defined to verify its linkage to the research objectives. This inductive approach to qualitative data analysis allowed the codes and categories to emerge from the content of the raw data, thus established connections to the research questions or objectives (Patton, 2015). These procedures were used for each of

the data sources. The goal was to use the theoretical framework, contextual interaction theory, to answer the research questions through the underlying structure of the data analysis process.

Ayres et al. (2003) indicated that without integration of within-case and across-case analysis of the data, it is impossible to develop ideographic generalizations. Since the unit of analysis of this qualitative research study was the fire department which the heart attack related firefighter fatality occurred and there were three different types of these organizations, a cross analysis or comparative analysis was also conducted. During this process, special attention was paid to identify discernible themes and patterns in the codes within the same type of fire department organizations and across the other types of fire department organizations as well. Grouping the themes and patterns helped with conceptualization and establishing relationships. The objective in this step was to identify convergence and divergence in the data across all the samples while examining similarities and differences. Convergence provided a way to prioritize emerging classifications as the data were evaluated. Divergence allowed for careful examination and identification of data in the samples that did not fit within the dominant identified themes or patterns. Comparison of the data were critical to gaining an in-depth understanding of the research problem.

The final step in the data analysis process was interpretation of the data. Patton (2015) explained that during this step, significance to the findings is made, insightful meaning to the data is provided, explanations are offered, and conclusions are drawn. Interpretation of the data goes beyond presentation of descriptive data. It reports on the

findings through visual representation and narratives. Relationships are made clear between the categories, codes, patterns, and themes. Comparisons are made with the information gleaned from the literature and theoretical framework. Finally, reflective thoughts are interjected and supported with narrative explanations, tables, and figures.

Issues of Trustworthiness

All research bears the responsibility of convincing the researcher and its intended audience that the findings are based on critical investigation. The trustworthiness of qualitative research is likely judged by the introduction of evidence for methodological rigor (Rudestam & Newton, 2015). Authenticity is demonstrated by the researcher when the data collected is accurate and trustworthy (Yin, 2016). In this qualitative research study, triangulation, member checking, and peer debriefing were strategies used to ensure trustworthiness and credibility. Furthermore, trustworthiness was exhibited by assertion of any biases I may have as the researcher throughout the entire research study.

Triangulation strengthens qualitative research studies by using multiple sources to reveal diverse ways of looking at a phenomenon while enhancing credibility and strengthen confidence in the conclusions drawn (Patton, 2015). Patton further asserted that inconsistencies from different kinds of data should not be viewed as weakening the credibility of the research. It is just as important since it provides an opportunity to offer deeper insight into the relationship between the inquiry approach and the phenomenon under study. Fusch and Ness (2015) emphasized that reliability of the results is enhanced by correlating data using multiple collection and validation methods. Triangulation in this research study was achieved by obtaining data from the semi-structural interviews,

documents, and archival records. Triangulation of these three data sources created a cohesive substantiation for the patterns and themes.

Qualitative findings in this research study were validated by member checking. Harvey (2014) suggested that researchers should employ member checking procedures to enhance the dependability of their research studies. Member checking allows the participants to review and validate data collected from their interview responses and engages them in the data analysis process (Birt et al., 2016). The analysis, interpretations, and conclusions of the data collected in this research were disseminated to the fire chief participants to test for plausibility. Given an in-depth, and succinct description, the participants were able to decide on the value of the research findings and conclusions. Member checking decreased the chance of errors in the data collection, analysis, and interpretation of the information available.

Confirmability in a research study is achieved through a peer debriefing strategy by having another person review and validate the findings to ensure accuracy and trustworthiness (Anney, 2014; Birt et al., 2016). In this research study, another researcher was selected to serve as the peer reviewer. Another researcher familiar with the fire service industry was chosen because of their familiarity with specific terminology, the NFPA 1582 standard, and firefighter fatalities. The ability to articulate well about the research topic and inquire about the findings of the study would resonate with other people other than me.

To clarify my role as researcher and my frame of reference, I reiterated that I have 30 years' experience working in the fire service industry as a firefighter and paramedic.

Identifying my role as researcher and being mindful of my background and expertise helped to limit bias in this research. While this research study followed a theoretical framework, I do not have any preconceived conceptions beyond what was discussed in the literature or what was already known.

Ethical Procedures

This qualitative research study employed the use of informed consent forms to protect the rights of the participants. There were no anticipated physical, emotional, or other risks to human subjects in this research study. Participants were informed of the purpose of the research, its risks and benefits, data collection procedures (including advisement of a recorded interview), confidentiality, anonymity, future dissemination, and voluntary nature of participation. Participants were able to withdraw from this research study at any time. Before the informed consent forms were sent to participants and research was conducted, a proper request for approval to conduct research was submitted to Walden University's IRB. IRB approval was achieved on October 7, 2021 (Approval #10-07-21-0346863).

All efforts were made to protect the identity of all the participants and their associated fire departments. No participant or fire department names were used in this study. The only attribute that was used to align with each of the samples were the firefighter classification and type of fire department. All raw data collected, including research notes and transcripts, are stored in a locked filing cabinet at a secured site. Digital data, including NVivo files and other digital documents are stored on the researcher's password-protected computer with a backup copy stored on an encrypted

online cloud data storage service. All data will be kept for a period of 5 years and destroyed thereafter. All data will be made available only to Walden University staff as required or requested.

Summary

In this chapter, I provided a comprehensive description of the research study. The purpose of this research study was to analyze the implementation and compliance of NFPA 1582 as policy in fire department organizations. After careful consideration of other research methods, the qualitative collective case study approach was chosen for this study. The qualitative method was chosen because it was more important to gain an in-depth understanding of this research problem rather than achieving generalization over a larger population. The generic qualitative design using purposive sampling brought diversification and maximum variation to broaden perspectives to achieve a deeper understanding of the research problem.

Steps for data collection and analysis were described in detail within this chapter. This research study employed strategies to advance the highest regard for research quality. Strategies such as triangulation, member checking, and peer review were used to ensure trustworthiness and credibility in the study. Ethical considerations to protect the participants of the study were described. This methodology chapter presented a roadmap of this research study that may be replicated at any time. In the next chapter, I discuss details on data collection and data analysis from this research process. I will also present the research results and key findings of this study.

Chapter 4: Results

Introduction

The purpose of this qualitative study was to analyze the implementation and compliance of NFPA 1582 in fire department organizations that had a previous incidence of a heart attack-related on-duty firefighter fatality. Data were collected through interviews with fire chiefs, who hold the overall responsibility for policy implementation and compliance within their respective fire departments. Identities of participating fire chiefs and the fire departments they represent will remain anonymous. Guided by the contextual interaction theory as the theoretical framework for this study, the following research question was addressed:

RQ: What is the compliance with NFPA 1582 to prevent heart attack related firefighter fatalities among fire departments?

This study also addresses the following subquestions:

SQ1: How is NFPA 1582 implemented in fire departments and what improvements can be made to ensure healthy and safe firefighters?

SQ2: What actions or events have influenced the implementation or compliance of the NFPA 1582 standard?

SQ3: What challenges exist to compliance with the NFPA 1582 standard and what can be done to address these challenges?

Although NFPA 1582 exists to ensure comprehensive medical screenings and fitness for duty evaluations of firefighters, heart attacks continue to be the leading cause of on-duty firefighter fatalities annually. This chapter presents the results of the study and provides

details on the data collection and data analysis. In this chapter, I discuss trustworthiness and validity of the data.

Pilot Study

Because the data gathering instrument was researcher developed, I elected to have it evaluated by a panel of experts. The panel consisted of two fire chiefs and one doctoral researcher from a university. The panel met via video conferencing and was presented with highlights of the research proposal, including problem statement, purpose statement, research questions and subquestions, and explanation of the theoretical framework. The panel assessed the interview protocol and evaluated each interview question to ensure they were relevant and aligned with the research questions and objectives. The panel also ensured the interview questions were worded appropriately to solicit meaningful responses and not introduce bias. The panel provided valuable feedback and determined that the interview protocol was comprehensive to meet the data collection requirements of this study's objectives and no modifications were necessary.

Setting

The COVID-19 pandemic had a significant impact on the ability to have in-person social and physical interactions during this study's data collection. Risks for exposure for COVID-19 were considerably high with face-to-face interactions. As a result, semistructured interviews were conducted via video conferencing platform and telephone. Additionally, the fire departments where the firefighter fatality incidents occurred were in various locations throughout the United States, making it time consuming and fiscally challenging to conduct face-to-face interviews. Therefore, the

setting for semistructured interviews with the participants were limited to facial observations and discussions via video conferencing or telephone conversations only.

Demographics

The fire department organizations for this study were purposefully selected. This was necessary to capture different types of fire department organizations as classified by the USFA. Fire departments that had both an incidence of an on-duty heart attack-related firefighter fatality in the publicly available online database and a completed firefighter fatality investigative report by NIOSH met the participation criteria for this research study. After qualification cross-referencing for the criteria, four career, four volunteer, and four combination fire departments were selected and invited to participate in this study. Fire chiefs representing these fire departments provided consent and were the participants for the semistructured interviews. The fire department organizations varied in size and complexity. The fire chiefs also had a variety of years of experience in the fire service and tenure as fire chief within the organizations they represented. Table 3 provides the characteristics of the fire department organizations and the fire chief participants.

Table 3

Fire Department and Participant Characteristics

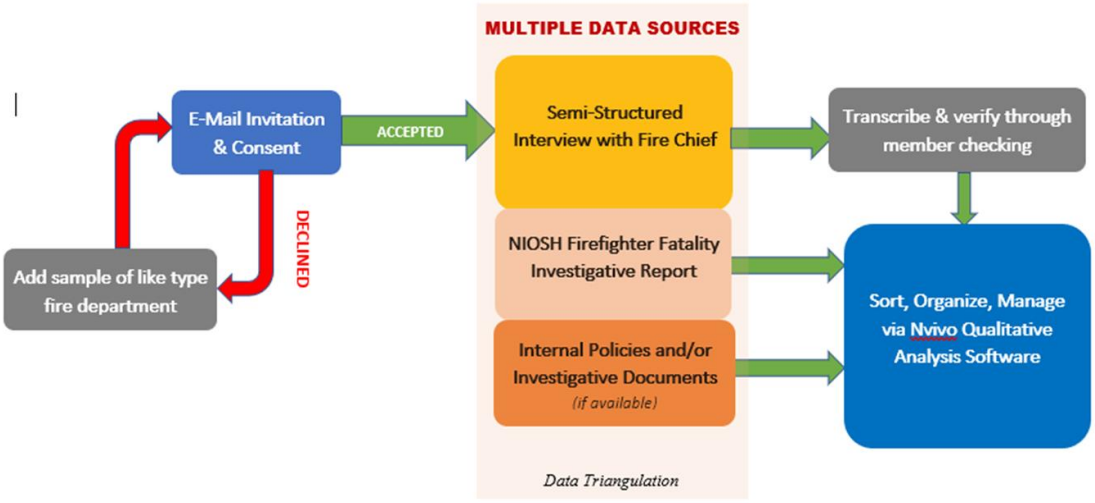
ID	Fire department type	Number of members	Number of fire stations	Sq. miles coverage	Participant tenure as fire chief (years)	Fire Chief's experience in fire service (years)
CAR01	Career	2,100	63	135	6	35
CAR02	Career	385	14	120	10	32
CAR03	Career	1,250	38	142	6	31
CAR04	Career	700	29	305	1	26
COM01	Combination	390	6	22	6	32
COM02	Combination	53	2	48	1	8
COM03	Combination	37	2	13	5	20
COM04	Combination	57	4	10	2	30
VOL01	Volunteer	18	1	60	3	6
VOL02	Volunteer	25	2	10	5	10
VOL03	Volunteer	120	2	5	1	15
VOL04	Volunteer	55	1	5	4	20

Data Collection

The process of data collection began after approval was received from the IRB on October 7, 2021. Approval #10-07-21-0346863 was issued by the IRB. Figure 4 illustrates an overview of the steps involved in the data collection process.

Figure 4

Overview of Data Collection Process



Twelve fire departments were selected consistent with my purposive sampling strategy from a population list that met the criteria for this research study. An invitation to participate in the study (Appendix A) and an informed consent form were sent to the respective fire chiefs via email. Within a 2-week timeframe, I received positive responses and consent from 10 fire chiefs. One fire chief from a volunteer fire department declined the invitation and there was no response from another fire chief of a volunteer fire department. To ensure maximum variation with this purposive sampling strategy, two additional volunteer fire departments were selected from the population list to meet the sampling complement. Within 1 week, fire chiefs from both these volunteer fire departments accepted the invitation and consented to participate in the study. Once consent was received by all fire chiefs in the sample, data collection began with semistructured interviews.

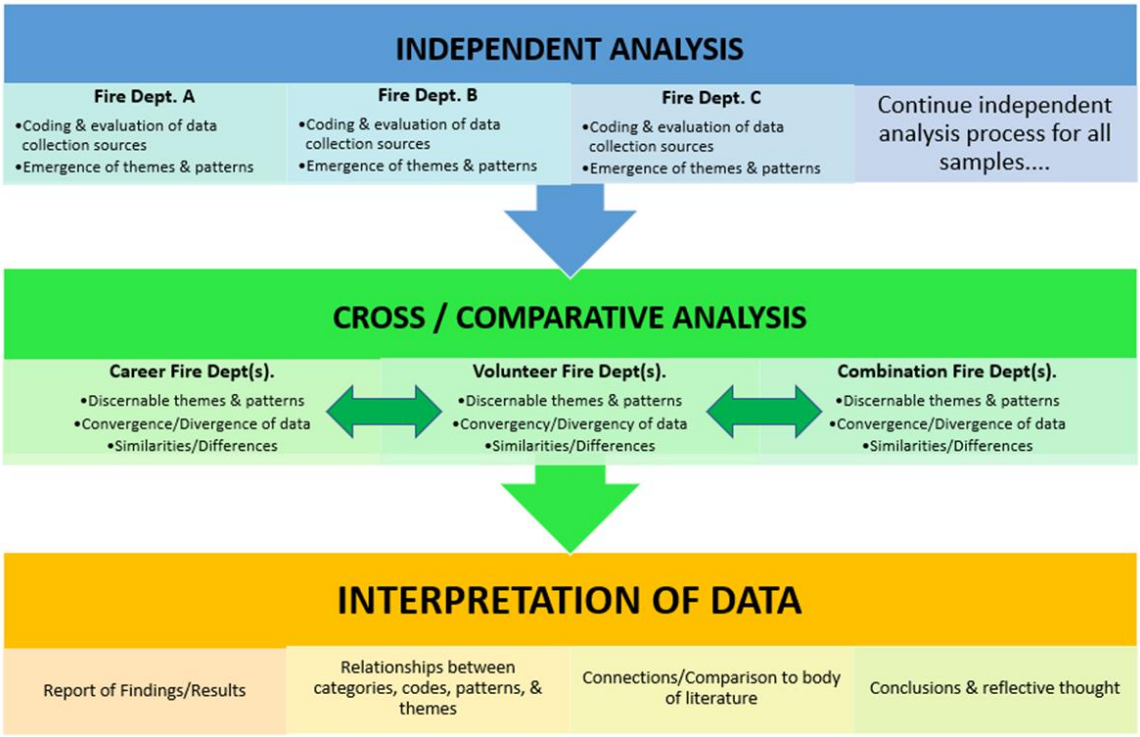
The semistructured interviews with the fire chiefs were conducted over the span of 6 weeks. Eight of the interviews were conducted by video conferencing and four were conducted by telephone. All interviews were digitally audio recorded. NVivo qualitative analysis software was used to transcribe the interview recordings. Member checking was used to verify information and ensure accuracy by sending the transcripts of the interviews to the respective fire chiefs via email. All fire chiefs verified their information provided in the interview and no adjustments were necessary.

Data Analysis

Data analysis in this study was conducted in phases and followed a systematic process once all data were organized. The first phase was an independent analysis to allow each fire department's circumstances surrounding implementation and compliance with NFPA 1582 to be analyzed individually. The second phase was a cross or comparative analysis among the three types of fire departments. In this phase, I analyzed the similarities and differences among the fire department types. The final phase was interpretation of the data from both independent and cross/comparative analyses. Figure 5 provides an overview of the items and activities relevant to each of these phases.

Figure 5

Overview of Data Analysis Phases



Throughout the data analysis process in this study, I followed the thematic analysis procedures suggested by Braun and Clark (2006). First, I familiarized myself with the data through the transcription of the interview, repeated review of the transcripts and interview notes, feedback provided during member checking, and information from secondary data sources. Next, I started generating initial codes using an inductive approach. This allowed the list of codes to be collated into a list of potential themes to be categorized. I then reviewed these potential themes to determine whether they could be combined or further refined. The next step was to provide a clear definition and name for each theme. The final step in thematic analysis was to produce the findings. Table 4 outlines the thematic analysis procedures in this study.

Table 4

Thematic Analysis Procedures

Thematic analysis step	Description	Process used in this study
Familiarizing yourself with your data	Transcription of the data and immersing yourself in the data to become familiar with it	Data were transcribed using NVivo
Generating initial codes	Production of initial codes for data, either manually or through software; data with same codes should be collated together	First, data were hand coded for each individual fire department. Data were then coded using NVivo software as a tool. Coding was then compared and refined.
Searching for themes	List of codes reviewed and sorted into potential themes	Refined codes were then sorted into potential themes
Reviewing themes	Deep review of identified themes to ensure they work in relation to coded extracts: (Level 1) potential themes are reviewed to ensure data forms a coherent pattern; (Level 2) ensure relationships between themes reflect the meaning of the data	Potential themes reviewed to ensure relationship with its associated codes and that it accurately reflects meaningful responses to address research questions
Defining and naming themes	Analyze each theme and its individual narrative to generate a name and clear definition	Potential themes are refined and finalized to give clear definition.
Producing the report	Final analysis	Report of the findings

Note. Adapted from Braun and Clark 2006.

Evidence of Trustworthiness

Trustworthiness in this research study was established by achieving credibility, transferability, dependability, and confirmability. The rigors of a methodological approach were consistently used throughout this study and substantive validation was

accomplished through triangulation, member checking, and peer-debriefing strategies to ensure trustworthiness.

Credibility

Credibility was assured by achieving substantive validation through several strategies. A panel of experts was used to validate the interview protocol to ensure alignment with the research questions and objectives. The interview protocol was followed carefully, and transcripts of the interviews were sent to the participants to validate for accuracy of information through member checking. Additionally, credibility was strengthened through triangulation by exploring the results of the analysis of the interview data to other available data sources. Peer debriefing was also conducted to provide an external review on the research process and results. This enhanced credibility by ensuring no bias or assumptions were made in the research and that no points were overemphasized or underemphasized that would steer any perspectives of the research process in any way.

Transferability

Transferability was established through the comprehensive description and details of the processes which were replicated in this qualitative study. Based on the vast amount of information provided, other researchers interested in similar fire service-related studies may be able to determine if these processes will be valuable to their study. Although the findings of this study may not be easily transferable to studies outside of the fire service industry, the concepts and framework of this study are transferable. The findings of this study may lead to other opportunities for research into other diseases or illnesses found

among firefighters in which the impact may be reduced by adherence to industry consensus standards.

Dependability

Dependability in this study was achieved through transparency, consistency, and continuous validation throughout the entire research process. A panel of experts were used in a pilot test to validate the interview tool. The process for data collection and data analysis were provided in significant detail, ensuring transparency, and allowing for replication as necessary. Dependability was enhanced by digital audio recordings, participant validated transcripts, and the use of NVivo qualitative data analysis software for coding.

Confirmability

Confirmability in this study was achieved through the peer debriefing strategy. Another researcher was selected to serve as a peer reviewer to confirm and validate the findings of the study. Since I am aware of my background and professional knowledge, this ensures that the study remained objective, and the interpretation of the findings was not influenced by any bias. An audit trail was also established to record descriptions of how the data in the study was analyzed and synthesized, including my thoughts, ideas, and reactions.

Results

This section presents the results of the study, which had the overall purpose to analyze the implementation and compliance of NFPA 1582 in fire department organizations that had a previous incidence of a heart attack related on-duty firefighter

fatality. The responses from the participants in the transcripts were coded, aggregated, and analyzed into themes using the QSR International's NVivo qualitative analysis software. The NVivo software was used as a tool to code and present the data more accurately and transparently, as well as audit the data analysis process. The following major themes emerged from the data analysis process and provided answers to the main research question and sub questions, as well as aligned with the theoretical framework of the study.

Most Fire Departments Are Not Fully Compliant With NFPA 1582

In this study, for a fire department to be fully compliant with NFPA 1582, initial medical evaluations for candidates being considered for training or participation in emergency response activities and periodic annual medical evaluations for current firefighters must be completed. Fire departments must also adhere to the heart and vascular medical diagnostic screening requirements of the standard since this study focused on heart attack related firefighter fatalities. All medical evaluations must meet the specific requirements in the NFPA 1582 standard, including any limitations based on medical conditions. In instances where fire departments were partially compliant with NFPA 1582 with candidate initial and member periodic annual medical evaluations, whether the fire department adhered to the heart and vascular component of NFPA 1582 was also identified.

The results of this study revealed that most fire departments are not fully compliant with NFPA 1582. Generally, many fire departments only partially complied with the standard. The purposive sample of this study included four career fire

departments, four combination fire departments, and four volunteer fire departments. Only one career and one combination fire department were fully compliant with NFPA 1582. A mix of career, combination, and volunteer fire departments only partially complied with the standard, and two combination and two volunteer fire departments did not use the NFPA 1582 standard at all. Only some of the fire departments which partially complied with the NFPA 1582 standard, also complied with the heart and vascular component used to identify cardiovascular issues or medical limitations based on cardiac or vascular status found in medical evaluations. Table 5 provides a summary of the level of compliance by career, combination, and volunteer fire departments that participated in this study.

Table 5

Fire Department NFPA 1582 Level of Compliance

ID	Fire Department Type	NFPA 1582 Fully Compliant	Full NFPA 1582 Initial	Partial NFPA 1582 Initial	Non-NFPA 1582 Initial	Full NFPA 1582 Periodic	Partial NFPA 1582 Periodic	Non-NFPA 1582 Periodic	Periodic Evaluation Timeframe	Heart/ Vascular Req.
CAR01	Career	Yes	X			X			Annual	X
CAR02	Career	No	X				X		Voluntary	X
CAR03	Career	No	X				X		Promotion	X
CAR04	Career	No	X						None	X
COM01	Combination	Yes	X			X			Annual	X
COM02	Combination	No			X				None	
COM03	Combination	No			X				None	
COM04	Combination	No	X				X		2 Years	X
VOL01	Volunteer	No							None	
VOL02	Volunteer	No							None	
VOL03	Volunteer	No		X			X		Annual	
VOL04	Volunteer	No		X			X		Annual	

All career fire departments utilized the NFPA 1582 standard for initial candidate medical evaluations but varied considerably on the timeframe for periodic medical evaluations of their current firefighters. While the standard requires periodic evaluations

to be conducted annually, CAR02 allowed periodic medical evaluations only as voluntarily requested by the firefighter and CAR03 only required periodic evaluations when a firefighter is being promoted or transferred to a specialty assignment. However, all career fire departments did follow the heart and vascular component of NFPA 1582.

Half of the combination fire departments in this study did not use or follow NFPA 1582. Rather they required a medical clearance from a physician to participate in intense physical activity for initial candidate evaluations and did not require any periodic medical evaluations for their current firefighters. The other half of the combination fire departments either were fully or partially compliant with the NFPA 1582 standard. COM04 which was deemed partially compliant with NFPA 1582 required periodic medical evaluations every 2 years but adhered to the heart and vascular components of the standard.

In this study, volunteer fire departments either were partially compliant with NFPA 1582 or did not use the standard. The volunteer fire departments which did not use the standard did not require any initial or periodic medical evaluations at all. Conversely, the volunteer fire departments which used NFPA 1582 and was partially compliant did not adhere to the heart and vascular component of the standard or require an EKG stress test as one of the diagnostic procedures in their medical evaluations.

Fire Chiefs Are Motivated to Ensure Health, Safety, and Wellness

In all three types of fire departments, the fire chiefs were motivated to improve or enhance health, safety, and wellness among their firefighters. All fire chiefs responded that firefighter health, safety, and wellness was a high priority and indicated that initial

and periodic medical evaluations are important. Additionally, all fire chiefs also responded that their goals and objectives pertaining to the health, safety, and wellness were to ensure their firefighters remain healthy to be able to perform the job and remain safe to be able to return home to their families. Some fire chiefs further emphasized that it was their responsibility to keep their firefighters healthy and safe and to ensure that the resources are available to do so. The following excerpts are examples of their iterations:

> CAR03: As the Chief I am responsible for the lives of all firefighters. My goal is to try my best to make sure we have healthy firefighters on the job, that injuries are reduced, and the risk for death is minimized. There are a lot of factors beyond my control, but my goal is to do my best to make sure this happens.
>
> CAR04: I am responsible for the health, safety, and wellness of our firefighters on the job. My goal is to make sure we have programs in place that will contribute to the longevity of our firefighter's career and that they are able to perform at their best.
>
> COM03: It is important as fire chief that my firefighters continuously operate safely and that they stay healthy. My goal is to help them do that.
>
> VOL03: Safety, health, and wellness are all top priorities for me as fire chief. I am responsible for these firefighters. They volunteer to place their lives on the line to serve their community. And it is my responsibility to do all I can to ensure they are safe and have longevity in serving their community.

When asked about their opinions on heart attack related firefighter fatalities, all fire chiefs responded that these fatalities can either be minimized or avoided. Some fire

chiefs across all three types of fire departments added the dangerous and strenuous nature of the job and exerted that there are some factors beyond their control. They asserted to a personal responsibility and commitment on behalf of individual firefighters to maintain a good health status.

There were positive responses by all fire chiefs to the perceptions of the NFPA 1582 standard. The fire chiefs mostly acknowledged that the standard was in the best interest of firefighters to keep them healthy and safe, some emphasizing further on the importance of the consistent standard to determine fit for duty. Although all the responses were positive, some fire chiefs from combination and volunteer fire departments also elaborated on the difficulty of the standard due to resources. The following are a couple examples of their responses:

> COM03: NFPA 1582 is a very comprehensive standard with great objectives for ensuring healthy firefighters. It may not be fitting for every fire department as some small fire departments like ours may not be able to adhere to it fully.
>
> VOL02: The standard exists for a reason... a very good reason. But for many small volunteer fire departments, it is just not feasible to accomplish or comply with it.
>
> VOL04: NFPA 1582 is a superb standard. It is very comprehensive and serves to protect both firefighters and their fire departments. I know every fire department is different, with different capabilities or resources, but it is important that we make all efforts to include, as much as possible all the components of the standard.

Fire Chiefs Do Not Have Autonomy to Implement NFPA 1582 Policies

Although fire chiefs may implement operational policies within their fire departments, policies which align with the NFPA 1582 standard that may affect employment or membership need additional authorization or approval. The results of this study revealed that fire chiefs in two career and two combination fire departments required the review and approval of their jurisdiction's human resources agency. Two career and one combination fire department also needed approval by their jurisdiction's leadership, such as a city manager, town manager, or county executive. Additionally, in three career and one combination fire department which paid firefighters are a part of a labor union and collective bargaining is necessary, policies which adopt NFPA 1582 requirements, whether fully or partially, must be negotiated or approved. In one combination and three volunteer fire departments, an approval by the organization's board of directors or an executive committee is required. Therefore, the results of this study found that fire chiefs across all types of fire department organizations generally do not have the sole autonomy to implement policies which align with the NFPA 1582 standard.

Significant Events Had Little Influence on NFPA 1582 Compliance

All fire chiefs across all three types of fire departments identified their previous heart attack related line-of-duty fatality as an event which provided some focus or discussion on the need for medical evaluations consistent with NFPA 1582. Only one fire department in this study identified their fatality event as having an impact on compliance with the standard. This one combination fire department was already fully compliant with

NFPA 1582 per their policy requirements. However, they cited improved enforcement and changes in firefighter's behaviors towards medical evaluations as a positive influence on NFPA 1582 compliance. No career or volunteer fire departments indicated any impact of their firefighter fatality event on compliance with the standard. The following are some excerpts of the responses:

> CAR02: Our line of duty death in 2018 did make us revisit our standard operating procedures on medical evaluations. After that incident, we did try to make medical evaluations annually mandatory, but we failed to be able to do it in contract negotiations with the firefighter's union.
>
> COM01: Our department suffered a line of duty death of one of our volunteer officers in 2019. Since then, we have tightened up our requirement for periodic medical evaluations among all our firefighters.
>
> VOL04: In 2014, we had a volunteer firefighter die of a heart attack on the scene of a fire. We've had a couple situations where firefighters were restricted operationally due to serious issues discovered in their routine medical evaluations. Discussions to fully comply with the NFPA 1582 standard by incorporating all the components have been ongoing, but we have faced obstacles.

Fire departments that follow the NFPA 1582 standard fully have been able to use a firefighter fatality or other medical event to influence the enforcement of their current policies to be more compliant with the standard. Other fire departments which partially follow NFPA 1582 or do not use the standard may have initiated discussions or other

actions to implement or fully comply with NFPA 1582 but were unsuccessful in their endeavors for full compliance as they faced other challenges or barriers.

Fiscal Resources Is a Common Challenge or Barrier to NFPA 1582

In this study, two career fire departments, four combination fire departments, and four volunteer fire departments identified fiscal resources, specifically a lack of money, funding, or budget as their main challenge or barrier to implementation or compliance with NFPA 1582. The following are some excerpts from the fire chief participants addressing challenges or barriers to NFPA 1582:

> CAR02: The only barrier we have encountered is the firefighter's union. Union collective bargaining is a huge issue for us. They just would not agree on making annual medical evaluations mandatory. We have been prepared to make it mandatory for years and have even allocated in our budget to ensure this happens. But we always fail in getting mutual agreement on this issue with the firefighter's union.
>
> CAR03: The primary challenge for us is money. It is a significant cost to the city and thus there is a fiscal barrier. The second challenge is acceptance from the firefighters that this is important for their wellbeing and safety. While some would advocate for it, many others oppose it.
>
> CAR04: Challenges I foresee to implementing routine medical screenings will be the cost of doing this for every firefighter annually and getting the labor groups to advocate for it without any resistance.

COM01: Our biggest challenge is fiscal resources. These medical evaluations are costly and seems to increase yearly. Trying to budget sufficiently to for all firefighters to have periodic evaluations is a challenge.

COM02: Funding and the availability of a medical facility to provide the medical evaluations per NFPA 1582 are our biggest challenges since we are in a rural area.

VOL01: We have a difficult time getting and keeping members in such a small community. Imposing the requirement would become a barrier, especially if our members would have to go very long distances to get their screening. We also do not have the money to impose such a requirement or even sustain it.

VOL02: The biggest barrier to this requirement for us would be funding and medical resources to implement it since we are in a rural town. But I also believe this would result in less operational members, especially in such a time when recruitment and retention is difficult. We would have less members to respond to emergencies.

VOL04: Current financial cutbacks in the city are a concern for us and can be a challenge. The city provides the medical evaluations for our members through their medical facility, including the funding for it. If there are cutbacks, we will not be able to do this on our own. It is expensive and just not sustainable for our volunteer department.

The results of this study identified additional challenges or barriers that may be unique to the fire department type or location. In this study, labor groups or unions were

identified as an additional challenge, specifically for two career fire departments. Three volunteer fire departments expressed significant concern with their membership and the ability to recruit or retain firefighters to respond to emergencies. Access to a medical facility to conduct medical evaluations to the NFPA 1582 standard was a challenge expressed by one combination and one volunteer fire department in this study that were in rural areas.

All fire chiefs asserted that resolutions to these barriers or challenges are complicated and that improvements to ensure healthy and safe firefighters with full compliance to NFPA 1582 are only possible if these barriers and challenges are resolved.

Summary

In this chapter, I presented the process in which the data were collected and analyzed, as well as the results of this study. Based on the data analysis, five major themes evolved that addressed the main research question and sub questions. Most fire departments are not fully compliant with the NFPA 1582 standard. Despite the fire chief's motivation to enhance or improve the health safety and wellness of their firefighters, they face challenges and barriers. Fiscal resources are the common challenge or barrier to compliance with NFPA 1582. Additionally, fire chiefs do not have autonomy to implement policies in line with NFPA 1582 but rather need additional approval from another agency, group, and/or higher authority. The previous incidence of a heart attack firefighter fatality or other significant medical related incidents had little influence on NFPA 1582 compliance within the fire departments.

In Chapter 5, I conclude the study and provide a general summary of the interpretation of the findings. I will also discuss the limitations of the study and recommendations to improve the compliance with the NFPA 1582 standard to enhance the health and safety of firefighters and minimize heart attack related on-duty firefighter fatalities.

Chapter 5: Discussions, Conclusions, and Recommendations

Introduction

Despite the existence of the industry standard NFPA 1582, *Standard on Comprehensive Occupational Medical Programs for Fire Departments,* heart attacks have consistently been the leading cause of on-duty firefighter fatalities for decades. NFPA 1582 addresses the medical screening requirements for firefighter candidates and current firefighters and provides a guideline for medical evaluation procedures to be conducted by a qualified physician. In this qualitative research study, I explored level of compliance with NFPA 1582 by career, combination, and volunteer fire departments and the challenges or barriers to implementation and compliance through the perspectives of fire chiefs. I focused on fire departments that had a previous incident of an on-duty heart attack-related firefighter fatality. Contextual interaction theory was used as the theoretical framework to guide this research study.

Analysis of the data collected in this study led to identification of five major themes: (a) most fire departments are not fully compliant with NFPA 1582; (b) fire chiefs are motivated to ensure health, safety, and wellness; (c) fire chiefs do not have autonomy to implement NFPA 1582 policies; (d) significant events have little influence on NFPA 1582 compliance; and (e) fiscal resources are a common challenge or barrier to NFPA 1582 compliance. The level of compliance with NFPA 1582 varied among different types of fire departments. Even though the fire chiefs are motivated to enhance or improve the health, safety, and wellness of firefighters, they face challenges and barriers to implementation and compliance with the standard. These challenges and barriers include

fiscal resources, access to medical resources, and disagreements among labor groups. Policies that align with NFPA 1582 requirements and impact employment or membership often require additional authorization or approval, resulting in the fire chief not having the sole autonomy to implement NFPA 1582 fully in their organizations. Although the fire departments in this study all experienced a heart attack-related firefighter fatality event, that event or any other medically related event had little influence on NFPA 1582 compliance.

In this chapter, I present interpretations of the findings and correlate the themes to the research question and subquestions. I connect the findings to the reviewed literature as well as the theoretical framework of the study. I also discuss the limitations of the study, recommendations for fire departments to improve compliance with NFPA 1582, and implications of the study.

Interpretations of the Findings

This study derived some findings that were compelling but not extremely surprising given the consistent trend of heart attack on-duty firefighter fatalities annually. The findings are supported by literature and other published reports.

NFPA 1582 Level of Compliance

The findings in this section answer to the main research question: What is the compliance with NFPA 1582 to prevent heart attack related firefighter fatalities among fire departments? These findings also answer the first part of SQ1: How is NFPA 1582 implemented in fire departments and what improvements can be made to ensure healthy and safe firefighters?

Most fire departments in this study were not fully compliant with NFPA 1582. I found that two of the fire departments were fully compliant, six were partially compliant, and four were completely noncompliant. Only four of the partially compliant fire departments adhered to the heart and vascular medical diagnostic screening requirements of the standard. The four completely noncompliant fire departments did not use the NFPA 1582 standard at all.

These findings were consistent with a published report that 71% of fire departments from firefighter fatality investigations conducted initial candidate medical evaluations and 31% conducted annual periodic member medical evaluations (NIOSH, 2007). In over a decade, there has been no significant change. Hard et al. (2019) indicated that initial candidate medical screenings and annual periodic medical screenings are the top recommendations made in firefighter fatality investigative reports by NIOSH. The findings on the level of compliance with NFPA 1582 by fire departments defines why this has been the top recommendation. In addition, Smith et al. (2019) found that 80% of duty-related cardiac fatalities among firefighters had evidence of heart disease that could have been detected through the components of an NFPA 1582 medical evaluation.

Of the two fire departments that were fully compliant with NFPA 1582 in this study, one was a career fire department and the other was a combination fire department. There were no volunteer fire departments that were fully compliant with NFPA 1582. I identified fiscal resources as the common challenge or barrier to NFPA 1582 by most career, combination, and volunteer fire departments. In addition, volunteer fire departments identified member recruitment and retention challenges resulting in fewer

firefighters to respond to emergencies as a challenge. From these findings, it appears that fire departments with paid firefighters are more likely to be fully compliant with NFPA 1582.

Several fire departments in this study were partially compliant with NFPA 1582. Variations existed among firefighter candidate initial medical evaluations and member annual periodic medical evaluations. In this study, all four career fire departments and two combination fire departments conducted full candidate initial medical evaluations but fell short with their member annual periodic medical evaluations. Many paid firefighters after being hired into a fire department may become part of an organized labor group. Some career and combination fire departments in this study identified agreement with labor unions as a challenge to NFPA 1582. From these findings, it appears that fire departments with paid firefighters are able to implement full NPFA 1582 requirements for screening candidates have difficulty imposing the NFPA 1582 requirements for annual periodic medical evaluations for already hired firefighters.

I found that one career, two combination, and two volunteer fire departments did not require periodic medical evaluations for firefighters. Among those that require periodic medical evaluations, only one career, one combination, and two volunteer fire departments met the NFPA 1582 timeframe requirement of conducting them annually. Others conduct them either voluntarily at the request of the firefighter, for promotion or specialty assignment, or every 2 years. There were no volunteer fire departments that conducted full initial candidate medical evaluations, but two of them conduct partial

initial candidate medical evaluations and partial annual periodic medical evaluations for current firefighters.

Among the fire departments that conduct periodic medical evaluations for current firefighters, all career fire departments and some combination fire departments adhere to the heart and vascular medical diagnostic screening requirements of the standard. From these findings, it appears that fire departments with paid firefighters are more likely to adhere to the heart and vascular component of the standard. The volunteer fire departments that partially use NFPA 1582 for candidate initial medical evaluations and member periodic medical evaluations do not use the heart and vascular component of the standard. Although initial or periodic medical evaluations are conducted, any heart or vascular related medical issues may be missed. A custom report from the USFA database for a 5-year period from 2016 to 2020 revealed that 63.6% of heart attack-related on-duty firefighter fatalities were among volunteer firefighters and 36.4% among paid or career firefighters (USFA, 2022). These statistics align with my findings in this study.

Significant Incidents Had Little Influence on Compliance

This section provides the answer to SQ2: What actions or events have influenced the implementation or compliance of the NFPA 1582 standard? In this study, all fire chiefs of career, combination, and volunteer fire departments identified their organization's heart attack-related on-duty firefighter fatality as an event that encouraged discussion on NFPA 1582 medical evaluations. Some also mentioned significant medical incidents that resulted in a diagnosis of severe illness that required treatment. The findings reveal that fire departments already following the NFPA 1582 standard were

able to make some improvements based on enforcement of their current policies to ensure firefighters received timely NFPA 1582 medical evaluations. The event was able to spark discussion among fire departments who partially complied with NFPA 1582 or did not use the standard. However, these fire departments were unable to make any progress to implement or fully comply with NFPA 1582. Many participants cited challenges and barriers within their organization as the impediment to compliance.

The firefighter fatalities and significant medical incidents described by the fire chiefs can be considered focusing events. Kingdon (1984) defined a focusing event as an impactful event that affects a community, does harm, and has the potential for future harm. Kingdon explained it as a window of opportunity for policy change in which learning and improved understanding from a variety of policy actors can occur. The fire chiefs in this study expressed their involvement with trying to make changes to comply with NFPA 1582, but they were met with obstacles. Birkland (2009) identified that a potential pattern of the lessons learned process is the event will happen, it will be thoroughly investigated, but policy change will not occur due to cost, bureaucracy, opposition, or other usual reason for political or policy stasis. The experiences of the fire chiefs in this study accurately are reflected by assertions in the literature.

Challenges and Barriers to NFPA 1582

The findings in this section provides the answer to SQ3: What challenges exist to compliance with the NFPA 1582 standard and what can be done to address these challenges? It also provides the answer to the second part of SQ1: How is NFPA 1582

implemented in fire departments and what improvements can be made to ensure healthy and safe firefighters?

Fiscal resources were the common challenge or barrier to implementation and compliance with the NFPA 1582 identified by most fire chiefs of career, combination, and volunteer fire departments. Two career fire departments, all combination fire departments, all volunteer fire departments identified money, funding, or budget as their main challenge or barrier. Many of the fire chiefs indicated that the medical evaluations were costly and expressed concerns with sustainability if full compliance with the standard was achieved. The fiscal climate of their organization and/or their jurisdiction amid the pandemic was evident. Fire departments with paid firefighters, specifically career fire departments, expressed challenges with labor groups or unions. Volunteer fire departments expressed profound challenges with recruitment and retention of members and indicated that the NFPA 1582 requirements made it difficult to attract or retain firefighters to respond to emergencies in their communities. In addition, fire departments which were in rural areas expressed challenges with access to medical resources such as a qualified physician and facilities for diagnostic tests required for the NFPA 1582 medical evaluations.

Many of the fire chiefs across all three types of fire departments asserted that securing sustainable funding for NFPA 1582 medical evaluations would provide some relief with their challenges or barrier to full compliance with the standard. Fire chiefs from career fire departments also added that resolutions with their labor groups and an agreement to share in the responsibility to achieve full compliance with NFPA 1582

would be necessary. Some fire chiefs from volunteer fire departments mostly took the position that imposing full compliance with NFPA 1582 would not help their membership but rather make it more difficult to have enough operational members to serve as firefighters. There were 1 combination and 1 volunteer fire department in this study that were in rural areas. Both cited that resolving the access to medical resources would also help toward full compliance with NFPA 1582.

Many of the fire chiefs were persistent on their responses that resolving the challenges or barriers to achieve NFPA 1582 compliance would be improvements to ensure healthy and safe firefighters. However, some of the fire chiefs of volunteer fire departments perspectives and concerns were different with regards to having a sufficient pool of candidates or members that can successfully pass all the components of a NFPA 1582 medical evaluation.

Adequate resources play a critical part in the implementation and compliance of NFPA 1582. Availability of critical resources, such as human resources, financial resources, logistics, technology, and a conducive environment influences the capacity of a policy actor which can result in the success or failure of policy initiatives (Brynard, 2005). Bressers (2004) indicated that access to appropriate resources significantly impacts capacity and control and can hinder successful policy implementation or policy change if not sufficient. The findings as expressed by the fire chiefs on their challenges or barriers to NFPA 1582 depicts this hinderance.

Contextual Interaction Theory

The theoretical framework used for this study was the contextual interaction theory. It placed emphasis on the characteristics of the policy actors, focused on factors of their motivations, information, and power (Bressers, 2007). Motivation, information, and power are core factors which serve as the ultimate driving force of the policy implementation process (O'Toole, 2004). In fire department organizations, the fire chief is the authoritative figure and the primary policy actor responsible for implementation and compliance of policies and procedures. Thus, this study analyzed the motivations, information, and power of fire chiefs as the policy actor with regards to implementation and compliance with the NFPA 1582 standard.

All fire chiefs from career, combination, and volunteer fire departments responded positively expressing their motivation to improve or enhance the health, safety, and wellness among their firefighters. They all indicated that health, safety, and wellness was a high priority and emphasized the importance of initial and periodic medical evaluations to this. Additionally, the fire chiefs proclaimed the requirement to ensure their firefighter remain healthy and remain safe to return home to their families as their goal and responsibility. The fire chiefs had positive perceptions of the NFPA 1582 standard, and all believed that firefighter fatalities from heart attacks can be reduced or avoided. According to Bresser (2007), if a policy actor has no interest in advancing a policy, it is likely that implementation efforts will fail. Conversely, if a policy actor's goals, values, perceptions bear weight on his or her motivation, the likely implementation efforts will prevail. Brynard (2005) highlighted that commitment and willingness to

implement by those responsible for policy implementation are key factors for policy advancement.

Information is a key factor in the contextual interaction theory and refers to the knowledge held to be true and how a situation is interpreted. In this study, all fire chiefs exhibited the knowledge and understanding of the NFPA 1582 standard and their respective fire departments. This was evident through the adequate and comprehensive responses to the interview questions. The answers to the research question and sub questions were adequately derived from the interview responses of the fire chiefs. Budd et al. (2012) emphasized the important relationship and critical nature of adequate technical information and its understanding by policy actors to effective policy implementation.

Lastly, the factor of power encompasses capacity and control, including resources of the policy actors to provide the necessary action to achieve results. Control and resources are essential for policy action and determines the capacity of policy actors (de Boer & Bressers, 2011). The findings in this study revealed that fire chiefs do not have sole autonomy to implement policies which align with full compliance to the NFPA 1582 standard. Therefore, control is limited. Since such policies may affect employment or membership in the organization, additional authorization or approval is often required. Fire chiefs of career and combination fire departments identified review and approval from a human resources agency and oftentimes, approval from their jurisdiction's leadership. Fire department which has paid firefighters that are a part of a labor group or union where collective bargaining is necessary presented another challenge in which

policies which adopt provisions of the NFPA 1582 policy may have to be negotiated. Fire chiefs in most volunteer fire departments expressed that approval by the organization's board of directors or an executive committee is required. Consequently, resources are also an issue as expressed by the findings in this study. Many fire chiefs identified fiscal resources as the common challenges or barriers to full compliance with NFPA 1582 and in rural areas, medical resources were also identified. The lack of autonomy to implement NFPA 1582 policies and lack of resources diminishes the fire chief's capacity to be successful with policy changes.

According to Bresser (2007), the factors of a policy actor's motivation, information, and power are not independent on each other. There is a dynamic interaction among them in which changes to one, affects the other two. As evident in the findings of this study, fire chiefs were sufficient in their motivation and information, but deficient in their capacity and power to effect successful policy changes to become fully compliant with the NFPA 1582 standard.

Limitations of the Study

The following section discusses the limitation associated with this study. First, the small sample size was relatively small. Although different patterns were found among career, combination, and volunteer fire departments in this study, the results may not be generalized over the entire fire service industry. Future researchers may consider using a larger sample size.

A second limitation to this study was that the semistructured interviews with the fire chiefs were conducted via video conferencing platform or telephone. Although

feasible, this limited any control over the setting or environment which the interview was conducted. In the interviews conducted by video conferencing and telephone, full body language could not be observed. Facial expressions could not be observed in the interviews conducted by telephone. Background noises or distractions could not be avoided. The fire departments in this study were from various locations across the United States. Travel to different areas across the country to conduct face-to-face interviews would have taken several months and would have been fiscally challenging. Additionally, due to the global coronavirus pandemic, face-to-face interviews were considered unsafe due to high risk for exposure.

Another limitation to this study was the time constraints of busy fire chiefs to participate in this study. This may have limited further in-depth or accurate responses to the interview questions. Also, some of the participants in this study were not fire chiefs at the time of the firefighter fatality incident within their organizations. They may not have been privy to some of the information because they were not in a leadership position. Although the fire chiefs provided their best responses for their fire departments, this may have presented a likelihood of some incomplete information being provided that can influence the data.

Recommendations

The findings in this study identified several challenges or barriers to compliance with the NFPA 1582 standard by career, combination, and volunteer fire departments. Fiscal resources, medical resources, autonomy to implement policy, and labor relations were among these challenges and barriers. The following recommendations seek to

minimize these challenges or remove barriers that impedes a fire chief's ability to implement and comply with the standard in their fire departments.

In this study, 10 of the 12 fire departments identified fiscal resources as their main challenge or barrier to compliance with NFPA 1582. Based on this finding, fire chiefs should seek opportunities to obtain grant funding from federal, state, or local governments. Fire chiefs should take advantage of two federally available grants from the Federal Emergency Management Agency (FEMA) that may assist with funding for NFPA 1582 medical evaluations for candidates or current firefighters. The Assistance to Firefighters Grant (AFG) aims to provide firefighters with needed equipment, gear, vehicles, training, or other resources necessary for protecting the public from fires and other related hazards (Federal Emergency Management Agency [FEMA], 2022a). The Staffing for Adequate Fire and Emergency Response (SAFER) grant provides funding to fire departments to help increase or maintain trained firefighters in their communities (FEMA, 2022b). Millions of dollars in grant funding are awarded from these two grants to thousands of fire departments annually. State governments may provide grant funding opportunities for fire departments as well. Fire chiefs should contact their state emergency management agency to determine if such funding opportunities exist.

All career and some combination fire departments in this study were part of a local government or municipality that provided the funding for NFPA 1582 medical evaluations. Conversely, some combination and all volunteer fire departments were independent organizations that had limited access to funding. However, it was found that one volunteer fire department's candidate initial and member annual periodic medical

evaluations were provided and funded by their municipal government in an agreement for providing emergency service coverage to their community. Based on this finding, fire chiefs should seek to determine if medical evaluation services and the funding to provide it is available from the local government or municipality in the community being served. Fire chiefs should contact the leadership of their local government or municipality to determine if this type of fiscal or medical resources support is available and seek collaborative partnerships to ensure the health, safety, and wellness of firefighters.

The fire chiefs in this study indicated they did not have the autonomy to implement policies consistent with compliance to the NFPA 1582 standard. Approvals would be needed from a jurisdiction's leadership, an external human resources agency, and in some cases, a labor group or firefighter's union. Based on this finding, fire chiefs should ensure communication and understanding of the benefits to compliance with the standard among all parties or agencies which have a shared responsibility in health, safety, and wellness policy initiatives. This includes establishing collaborative relationships with labor groups, unions, human resources agencies, governmental leadership, and other executive boards or committees to agree on policies in the best interest of firefighters and their longevity in the fire service. Fire chiefs should emphasize to these groups that compliance with the NFPA 1582 standard ensures the health, safety, and wellness of firefighters by: reducing liability; establishing fitness for duty; identifying health risks early to gain treatment; and reducing morbidity and mortality.

In many cases, fire departments may not be able to provide medical evaluations that align with the NFPA 1582 standard. This study found that 2 combination fire

departments that did not use the standard required applicants for membership as firefighters to obtain medical clearances from their private physician. In addition, 2 volunteer fire departments required no medical screening at all. Based on this finding, fire chiefs should strongly encourage candidates for membership/employment as firefighters or current firefighters to obtain initial and annual periodic medical evaluations from a qualified physician and provide them with guidance on the required NFPA 1582 components. Fire chiefs should do this by providing their members and their physicians with two guides published by the International Association of Fire Chiefs (IAFC) to communicate the NFPA 1582 requirements. The *Healthcare Providers Guide to Firefighter Physicals* assists primary care providers with the evaluation, treatment, and surveillance of the health and wellness needs of firefighters (International Association of Fire Chiefs [IAFC], 2022a). *First, Save You: Your Guide to the NFPA 1582 Annual Physical* is a publication designed to inform firefighters of the medical screening requirements of an NFPA 1582 evaluation (IAFC, 2022b). Both guides are available electronically through the IAFC website.

There are many opportunities for future research on implementation and compliance with the NFPA 1582 standard. One of the limitations in this study was the relatively small sample size. It was sufficient to gain an in-depth understanding of the problem but not sufficient to form a generalization over the entire fire service industry. The sample size in this study provided a tremendous amount of information and achieved data saturation but it significantly underrepresented the total number of fire departments in the United States. A recommendation for future research is a quantitative study among

the three types of fire departments to analyze additional data on compliance with NFPA 1582 using a larger sample size. The scope of this study should also be expanded to include fire departments that did not experience a heart attack related on-duty firefighter fatality.

One of the findings in this study was that labor groups and unions were specifically identified by two career fire departments as challenges or barriers to implementation or compliance with NFPA 1582. One additional career fire department and one combination fire department asserted resistance to an NFPA 1582 policy. This finding was surprising as many labor groups and unions often advocate in the best interest of firefighters and their working conditions. Another recommendation for future research is a qualitative study to achieve an understanding of the nature of the resistance to enhancing firefighter health, safety, and wellness through an NFPA 1582 policy by firefighter labor groups or unions.

Implications

The findings of this study may have future implications. It identified the level of compliance with NFPA 1582 among different types of fire departments and the barriers or challenges to implementation. These findings may inform ways by which fire departments can enhance the health, safety, and wellness of firefighters and become more compliant with the NFPA 1582 standard. Challenges or barriers, as well as policy implementation and compliance issues may be addressed using these findings. The result will be the overall reduction in annual firefighter fatalities and the break in the continued trend of heart attacks being the leading cause of firefighter deaths. Improving or

enhancing the health, safety, and wellbeing of firefighters will help protect the lives of these first responders who risk their lives to protect ours.

Conclusion

Heart attacks continue to be the consistent leading cause of on-duty firefighter fatalities despite the national consensus standard, NFPA 1582, *Standard on Comprehensive Occupational Medical Programs for Fire Departments*. This qualitative research study explored the level of compliance with NFPA 1582 by career, combination, and volunteer fire departments and the challenges or barriers to implementation and compliance with the standard. It also determined the challenges or barriers which exist to policy implementation or compliance with the standard. Through the perspectives of fire chiefs, an understanding was achieved by the exploration of the level of compliance to NFPA 1582 and the challenges or barriers to compliance which contributed to this ongoing problem. This chapter presented the interpretations of the findings and provided connections of the major themes to the research question and sub questions. It also provided connections of the findings to associated reviewed literature. Connections of the findings to the theoretical framework of the study, contextual interaction theory, was also explained. This chapter also discussed the limitations of the study, recommendations for fire departments to improve compliance with NFPA 1582, as well as future implications of the study.

The results of this study found that most fire departments were not fully compliant with the NFPA 1582 standard. Despite fire chief's motivation and technical knowledge to enhance or improve the health, safety, and wellness of firefighters and

willingness to comply fully with NFPA 1582 in their fire departments, they face considerable challenges and barriers with resources and autonomy to effect policy change. Fiscal resources, medical resources, and labor relations were among the challenges and barriers identified by fire chiefs. Additionally, policies which adopted provisions of the NFPA 1582 standard that may affect employment or membership needed additional approval from the jurisdiction's leadership, external human resources agency, board of directors, executive committee, and in some cases, negotiated with labor groups or unions.

This study brings into perspective the reasons why heart attacks have continued its trend as the leading cause of on-duty firefighter fatalities in the United States for decades. Compliance with NFPA 1582 is lacking, but not because of an unwillingness by fire service leaders. Rather, it is an inability to overcome the challenges or barriers to implementation or compliance with the standard. Previous research indicated that candidate and annual periodic medical screenings for firefighters consistent with NFPA 1582 were the top recommendations in NIOSH firefighter fatality investigative reports (Hard et al.,2019). However, no previous research could be found on the challenges or barriers to NFPA 1582.

One of the implications of this study is that policy implementation and compliance issues may be addressed using these findings and fire service leaders can focus on solutions to addressing the challenges and barriers to NFPA 1582 identified in this study. Some recommendations provided were to seek federal, state, or local grant funding opportunities, explore partnership agreements for needed medical resources, and

establish collaborative relationships with parties having shared responsibility for firefighter health and wellness. The overall result will be an improvement in the health, safety, and wellness of firefighters, and eventually a reduction in heart attack related on-duty firefighter fatalities.

References

Albert, C. M., Mittleman, M. A., Chae, C. U., Lee, I. M., Hennekens, C. H., & Manson, J. E. (2000). Triggering of sudden death from cardiac causes by vigorous exertion. *The New England Journal of Medicine. 343*(19), 1355–1361. https://doi.org/10.1056/nejm200103153441114

Ali, D. (2020). Firefighter line-of-duty deaths: Wellness counts! *Fire Engineering, 173*(3), 63-71. https://www.fireengineering.com/health-safety/firefighter-line-of-duty-deaths-wellness-counts/#gref

American Heart Association. (2021a). *Heart and stroke encyclopedia*. http://www.heart.org/HEARTORG/Conditions/New-Heart-and-Stroke-Encyclopedia_UCM_445688_SubHomePage.jsp

American Heart Association. (2021b). *Stress and heart health*. https://www.heart.org/en/healthy-living/healthy-lifestyle/stress-management/stress-and-heart-health

American Heart Association. (2021c). *Understand your risks to prevent heart attack.* https://www.heart.org/en/health-topics/heart-attack/understand-your-risks-to-prevent-a-heart-attack

Anderson, R. B. (2014). Belief bias in the perception of sample size adequacy. *Thinking & Reasoning, 20*(3), 297-314. https://doi.org/10.1080/13546783.2013.787121

Anney, V. (2014). Ensuring the quality of the findings of qualitative research: Looking at trustworthiness criteria. *Journal of Emerging Trends in Educational Research and Policy Studies, 5*, 272–281.

Arrebola-Moreno, M., Petrova, D., María-José Sánchez, Rivera-López, R., & Ramírez-Hernández, J. A. (2020). Who does what the cardiologist recommends? Psychosocial markers of unhealthy behavior in coronary disease patients. *PLOS One, 15*(1), 1–15. https://doi.org/10.1371/journal.pone.0228262

Ayres, L., Kavanaugh, K., & Knafl, K. A. (2003). Within-case and across case approaches to qualitative data analysis. *Qualitative Health Research, 13*(6), 871–833. https://doi.org/10.1177/1049732303013006008

Bacon, S. L. (2019). Stress, psychiatric disorders, and cardiovascular disease. *British Medical Journal, 365,* 1–2. https://doi.org/10.1136/bmj.l1577

Bakari, E., & Frumence, G. (2013). Challenges to the implementation of international health regulations (2005) on preventing infectious diseases: Experience from Julius Nyerere International Airport, Tanzania. *Global Health Action, 6*(1), 20942. https://doi.org/10.3402/gha.v6i0.20942

Birkland, T. A. (2009). Disasters, lessons learned, and fantasy documents. *Journal of Contingencies and Crisis Management*, *17*(3), 146–156. https://doi.org/10.1111/j.1468-5973.2009.00575.x

Birt, L., Scott, S., Cavers, D., Campbell, C., & Walter, F. (2016). Member checking: A tool to enhance trustworthiness or merely a nod to validation? *Qualitative Health Research*, *26*(13), 1802–1811. https://doi.org/10.1177/1049732316654870

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Bressers, H. (2004). Implementing sustainable development: How to know what works, where, when and how. In William M. Lafferty (Eds.), *Governance for sustainable development: The challenge of adapting form to function* (pp. 284–318). Edward Elgar Publishing.

Bressers, J. T. A. (2007). *Contextual interaction theory and the issue of boundary definition: Governance, and the motivation, cognitions, and resources of actors* [report]. Center for Clean Technology and Environmental Policy, University of Twente.

Brook, R. D., Franklin, B., Cascio, W., Hong, Y., Howard, G., Lipsett, M., Luepker, R., Mittleman, M., Samet, J., Smith Jr., S. C., & Tager, I. (2004). Air pollution and cardiovascular disease: A statement for healthcare professionals from the expert panel on population and prevention science of the American Heart Association. *Circulation*, *109*(21), 2655–2671. https://doi.org/10.1161/01.cir.0000128587.30041.c8

Brynard, P. A. (2005). Policy implementation: lessons for service delivery. *Journal of Public Administration. 40*(4), 649–664. https://repository.up.ac.za/handle/2263/3909

Budd, E. L., Schwartz, C., Yount, B., & Haire-Joshu, D. (2012). Factors influencing implementation of school wellness policies in the United States, 2009. *Preventing Chronic Disease*, *9*, 110296. https://doi.org/10.5888/pcd9.110296

Byczek, L., Walton, S., Conrad, K., Reichelt, P., & Samo, D. (2004). Cardiovascular risks in firefighters: Implications for occupational health nurse practice. *AAOHN*

Journal, *52*(2), 66-76. https://doi.org/10.1177/216507990405200205

Carey, M. G., Al-Zaiti, S. S., Dean, G. E., Sessanna, L., & Finnell, D. S. (2011). Sleep problems, depression, substance use, social bonding, and quality of life in professional firefighters. *Journal of Occupational and Environmental Medicine*, *53*(8), 928–933. https://doi.org/10.1097/jom.0b013e318225898f

Centers for Disease Control and Prevention. (2006). Fatalities among volunteer and career firefighters in the United States, 1994-2004. *Morbidity and Mortality Weekly Report*. *55*(16), 453-455.

Centers for Disease Control and Prevention. (2019). *National Firefighter Registry*. https://www.cdc.gov/niosh/firefighters/registry.html

Centers for Disease Control and Prevention. (2020). *Heart disease facts*. http://www.cdc.gov/HeartDisease/facts.htm

Cleary, M., Horsfall, J., & Hayter, M. (2014). Data collection and sampling in qualitative research: Does size matter? *Journal of Advanced Nursing*, *70*(3), 473-475. https://doi.org/10.1111/jan.12163

Daniels, R. D., Kubale, T. L., Yiin, J. H., Dahm, M. M., Hales, T. R., Dalsu, B., Zahm, S. H., Beaumont, J. J., Waters, K. M., & Pinkerton, L. E. (2014). Mortality and cancer incidence in a pooled cohort of US firefighters from San Francisco, Chicago, and Philadelphia (1950-2009). *Occupational & Environmental Medicine*, *71*(6), 388-397. https://doi.org/10.1136/oemed-2013-101662

de Boer, C. & Bressers, H. (2011, June 23-25). *Contextual interaction theory as a conceptual lens on complex and dynamic implementation processes* [Paper

presentation]. Research Conference COMPACT Work: Challenges of Making Public Administration and Complexity Theory Work, Rotterdam, The Netherlands.

DeJoy, D. M., Kunadharaju, K., & Smith, T. D. (2010). Line of duty death among U.S. firefighters: An analysis of fatality investigations. *Injury Prevention, 16,* A95-A96. https://doi.org/10.1136/ip.2010.029215.345

Fahy, R. F., & Molis, J. L. (2019). *Firefighter fatalities in the US – 2018.* https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/Emergency-responders/osFFF.pdf

Farioli, A., Yang, J., Teehan, D., Baur, D. m., Smith, D. L., & Kales, S. N. (2014). Duty-related risk of sudden cardiac death among young US firefighters. *Occupational Medicine*. *64*(6), 428-435. https://doi.org/10.1093/occmed/kqu102

Federal Emergency Management Agency. (2022a). *Assistance to firefighters grants*. https://www.fema.gov/grants/preparedness/firefighters/assistance-grants.

Federal Emergency Management Agency. (2022b). *Staffing for adequate fire and emergency response (SAFER).* https://www.fema.gov/grants/preparedness/firefighters/safer

Fraess-Phillips, A., Wagner, S., & Harris, R. L. (2017). Firefighters and traumatic stress: A review. *International Journal of Emergency Services, 6*(1), 67-80. https://doi.org/10.1108/ijes-10-2016-0020

Fusch, P. I., & Ness, L. R. (2015). Are we there yet? Data saturation in qualitative research. *The Qualitative Report, 20,* 1408-1416. https://doi.org/10.46743/2160-

3715/2015.2281

Geibe, J. R., Holder, J., Peeples, L., Kinney, A. M., Burress, J. W., & Kales, S. N. (2008). Predictors of on-duty coronary events in male firefighters in the United States. *The American Journal of Cardiology*, *101*(5), 585-589. https://doi.org/10.1016/j.amjcard.2007.10.017

Gentles, S. J., Charles, C., Nicholas, D. B., Ploeg, J., & McKibbon, K. A. (2016). Reviewing the research methods literature: principles and strategies illustrated by a systematic overview of sampling in qualitative research. *Systematic Reviews*, *5*(1), 1-11. https://doi.org/10.1186/s13643-016-0343-0

Govtrack.us. (2019). *H.R. 1499 (111th): Firefighter Fatality Reduction Act of 2009.* https://www.govtrack.us/congress/bills/111/hr1499

Gunawan, H., Bressers, H., Mohlakoana, N., & Hoppe, T. (2017). Incorporating air quality improvement at a local level into climate policy in the transport sector: A case study in Bandung City, Indonesia. *Environments, 4*(3), 1-17. https://doi.org/10.3390/environments4030045

Hard, D. L., Marsh, S. M., Merinar, T. R., Bowyer, M. E., Miles, S. T., Loflin, M. E., & Moore, P. H. (2019). Summary of recommendations from the National Institute for Occupational Safety and Health Fire Fighter Fatality Investigation and Prevention Program, 2006–2014. *Journal of Safety Research*, *68*(1), 21–25. https://doi.org/10.1016/j.jsr.2018.10.013

Harvey, L. (2014). Beyond member checking: A dialogic approach to the research interview. *International Journal of Research & Method in Education*, *38*(1), 23-

38. https://doi.org/10.1080/1743727x.2014.914487

Hophmayer-Tokich, S. (2013). Water pollution control legislation in Israel: Understanding implementation processes from an actor-centered approach. *Water, 5*(3), 1393-1418. https://doi.org/10.3390/w5031393

International Association of Fire Chiefs. (2022a). A healthcare providers guide to firefighter physicals. https://www.fstaresearch.org/resource/?FstarId=11591

International Association of Fire Chiefs. (2022b). *Guide to NFPA 1582 annual physical.* https://www.iafc.org/topics-and-tools/resources/resource/guide-to-the-nfpa-1582-annual-physical

International Association of Fire Fighters. (2000). *2000 Death and Injury Survey*. http://www.iaff.org/hs/PDF/2000%20D&I.pdf

International Fire Service Training Association. (2019). Chief officer. (4th ed.). Fire Protection Publications.

Javakhishvili, N., & Jibladze, G. (2018). Analysis of anti-domestic violence policy implementation in Georgia using contextual interaction theory (CIT). *Journal of Social Policy, 47*(2), 317-334. https://doi.org/10.1017/s0047279417000551

Kales, S. N., Soteriades, E. S., Christoudias, S. G., & Christiani, D. C. (2003). Firefighters and on-duty deaths from coronary heart disease: A case control study. *Environmental Health: A Global Access Science Source, 2*(1), 14. https://doi.org/10.1186/1476-069x-2-14

Kales, S. N., Soteriades, E. S., Christophi, C. A., & Christiani, D. C. (2007). Emergency duties and deaths from heart disease among firefighters in the United States. *The*

New England Journal of Medicine, *356*(12), 1207-1215. https://doi.org/10.1056/nejmoa060357

Kingdon, J. W. (1984). *Agendas, alternatives, and public policies*. Little, Brown & Company.

Li, C., Ford, E. S., Mokdad, A. H., Balluz, L. S., Brown, D. W., & Giles, W. H. (2008). Clustering of cardiovascular disease risk factors and health-related quality of life among US adults. *Value in Health*, *11*(4), 689-699. https://doi.org/10.1111/j.1524-4733.2007.00307.x

Malik, R., Begum, S., & Afridi, M. N. (2016). Acute myocardial infarction: Frequency of modifiable risk factors. *Professional Medical Journal*, *23*(3), 293-297. https://doi.org/10.29309/tpmj/2016.23.03.1476

Malterud, K., Siersma, V. D., & Guassora, A. D. (2016). Sample size in qualitative interview studies: Guided by information power. *Qualitative Health Research*, *26*(13), 1753–1760. https://doi.org/10.1177/1049732315617444

Mi-Ji, K., Jeong, Y., Choi, Y., Ae-Rim Seo, Ha, Y., Seo, M., & Ki-Soo Park. (2019). The association of the exposure to work-related traumatic events and work limitations among firefighters: A cross-sectional study. *International Journal of Environmental Research and Public Health, 16*(5), 756. https://doi.org/10.3390/ijerph16050756

Mozaffarian, D., Benjamin, E. J., Go, A. S., Arnett, D. K., Blaha, M. J., Cushman, M., et al. (2015). Heart disease and stroke statistics—2015 update: A report from the American Heart Association. Circulation, *131*(4), e29–322.

Murphy, J. K. (2008). Firefighter fitness and medical evaluations: A difficult journey. *Fire Engineering*, *161*(12), 67-68.

National Fire Protection Association. (2017). *NFPA 1582: Standard on comprehensive occupational medical programs for fire departments.*

National Fire Protection Association & International Association of Fire Chiefs. (2014). *Fundamentals of fire fighter skills*. Jones & Bartlett Learning.

National Institute for Occupational Safety and Health. (2007). *NIOSH Alert: Preventing fire fighter fatalities due to heart attacks and other sudden cardiovascular events.* http://www.cdc.gov/niosh/docs/2007-133/pdfs/2007-133.pdf

National Institute for Occupational Safety and Health. (2008). *NIOSH fire fighter fatality investigation and prevention program: leading recommendations for preventing fire fighter fatalities, 1998-2005*. http://www.cdc.gov/niosh/docs/2009-100/pdfs/2009-100.pdf

Owens, K. A. & Bressers, H. (2013). A comparative analysis of how actors implement: testing the contextual interaction theory in 48 cases of wetland restoration. *Journal of Comparative Policy Analysis: Research and Practice*, *15*(3), 203-219. https://doi.org/10.1080/13876988.2013.785668

O'Toole, Jr., L. J. (2004). The theory – practice issue in policy implementation research. *Public Administration, 82*(2), 309-329. https://doi.org/10.1111/j.0033-3298.2004.00396.x

Page, II, R.L., Ghushchyan, V., & Nair, K. (2011). A call to action: Responding to the future forecasting of cardiovascular disease in America. *American Health & Drug*

Benefits, *4*(5), 280-287.

Paton, N. (2017). Firefighters exposed to extreme heat at risk for heart attack. *Occupational Health & Wellbeing*. *69*(6), 4.

Patton, M. Q. (2015). *Qualitative research & evaluation methods*. (4th ed.). Sage Publications.

Pinkerton, L., Bertke, S. j., Yiin, j., Dahm, M. Kubale, T., Hales, T., Purdue, M., Beaumont, J. J., & Daniels, R. (2020). Mortality in a cohort of US firefighters from San Francisco, Chicago, and Philadelphia: an update. *Occupational & Environmental Medicine*. *77*(2), 84-93. https://doi.org/10.1136/oemed-2019-105962

Risavi, B. L. & Staszko, J. (2015). Prevalence of risk factors for coronary artery disease in Pennsylvania firefighters. *Prehospital and Disaster Medicine*. *31*(1), 102-107. https://doi.org/10.1017/s1049023x15005415

Rosenstock, Linda, M.D., M.P.H., & Olsen, Jorn, M.D., PhD. (2007). Firefighting and death from cardiovascular causes. *The New England Journal of Medicine, 356*(12), 1261-1263. https://doi.org/10.1056/nejme078008

Rubin, H. J. & Rubin, I. S. (2012). *Qualitative interviewing: The art of hearing data*. (3rd ed.). Sage Publications.

Rudestam, J. E. & Newton, R. R. (2015). Surviving your dissertation: A comprehensive guide to content and process. (4th ed.). Sage Publications.

Sanchez, V., Hale, R., Andrews, M., Cruz, Y., Bettencourt, V., Wexler, P., & Halasan, C. (2014). School wellness policy implementation: Insights and recommendations

from two rural school districts. *Health Promotion Practice, 15*(3), 340-348. https://doi.org/10.1177/1524839912450878

Smith, D. L., Barr, D.A, & Kales, S. N., (2013). Extreme sacrifice: sudden cardiac death in the US Fire Service. *Extreme Physiology & Medicine, 2*(6), 1-9. https://doi.org/10.1186/2046-7648-2-6

Smith, D. L., Haller, J. M., Korre, M., Sampani, K., Porto, L. G. G., Fehling, P. C., Christophi, C. A., & Kales, S. N. (2019). The relation of emergency duties to cardiac death among US firefighters. *The American Journal of Cardiology*, *123*(5), 736–741. https://doi.org/10.1016/j.amjcard.2018.11.049

Soteriades, E. S., Kim, J., Christophi, C. A., Kales, S. N. (2019). Cancer incidence and mortality in firefighters: A state-of-the-art review and meta-analysis. The Asian Pacific Journal of Cancer Prevention, *20*(11), 3221-3231. https://doi.org/10.31557/apjcp.2019.20.11.3221

Spratt, K. (2009). Policy implementation barriers analysis: Conceptual framework and pilot test in three countries. Washington DC: Futures Group, Health Policy Initiative, Task Order I.

Stefani, T. (2017). Time for a cultural change: Accepting the magnitude of chemical exposure risks. *Firehouse*, A-8-A11.

Subramanian, N., & Abdulrahman, M. (2017). An examination of drivers and barriers to reducing carbon emissions in China's manufacturing sector. *International Journal of Logistics Management, 28*(4), 1168-1195. https://doi.org/10.1108/ijlm-07-2016-0171

U.S. Fire Administration. (1993). *Analysis report on fire fighter fatalities in 1992.* http://www.usfa.fema.gov/downloads/pdf/publications/ff_fat92.pdf

U.S. Fire Administration. (2011). *Firefighter fatalities in the United States in 2010.* https://www.usfa.fema.gov/downloads/pdf/publications/ff_fat10.pdf

U.S. Fire Administration (2020). *Firefighter fatalities in the United States in 2019.* https://www.usfa.fema.gov/downloads/pdf/publications/firefighter-fatalities-2019.pdf

U.S. Fire Administration (2021). *Firefighter fatalities in the United States.* [custom reports]. https://apps.usfa.fema.gov/firefighter-fatalities/fatalityData/reportBuilder

U.S. Fire Administration (2022). *Firefighter fatalities in the United States.* [custom reports]. https://apps.usfa.fema.gov/firefighter-fatalities/fatalityData/reportBuilder

Waters, M. (2014). Reducing firefighter injuries and LODDs. *Fire Engineering*, *167*(12), 83-89.

World Health Organization (2021). Cardiovascular diseases (CVSs). https://www.who.int/en/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds).

Yin, R. (2016). *Qualitative research from start to finish.* New York: The Guilford Press.

Zhang, L., Bao, Y., Wang, X., Zhou, Y., Tao, S., Xu, W., & Liu, M. (2020). A meta-analysis on the prevalence, associated factors and diagnostic methods of mental stress induced myocardial ischemia. *Journal of Translational Medicine*, *18*(1), 1-21. https://doi.org/10.1186/s12967-020-02383-z

Appendix A: Invitation to Participate in Research Study

Dear Prospective Fire Chief Participant,

My name is Ernest Lindqvist. I am a doctoral student in Walden University's Public Policy and Administration Program. I am kindly requesting your participation in a research study for my dissertation entitled: Heart Attack Related Firefighter Fatalities and Compliance with NFPA 1582. The purpose of this research study is to explore how fire departments implement and comply with *NFPA 1582, Standard on Comprehensive Occupational Medical Programs for Fire Departments* and determine the challenges or barriers that exist to implementation and compliance with the standard.

This study will potentially benefit the fire service industry by enhancing the safety, health, and wellbeing of firefighters. By assessing the level of compliance with NFPA 1582 and identifying the challenges and barriers to implementation and continued compliance, policy implementation issues can be addressed. This information can be used to advocate for support for routine medical screenings for firefighters in an effort to reduce the number of annual firefighter fatalities and the break in the continued trend of heart attacks being the leading cause of firefighter deaths.

This research study involves a semistructured interview with the prospective fire chief participant. The interview will take approximately 1 hour. You may also be asked to provide copies of any relevant policy/procedure documents to support the data in this study, if available.

Participation in this research study is completely voluntary and you are in no way obligated to respond to this invitation. If you decide to participate, you may choose to withdraw from the study at any time. This study is completely anonymous. Your name and the fire department's name will not be disclosed in the research study.

This research study is being conducted in partial fulfillment of my PhD program at Walden University. Your participation in this research study will be greatly appreciated. If you would like to participate in this research study, please contact me. I will provide you with a consent form.

Respectfully,

Ernest S. Lindqvist

Appendix B: Semistructured Interview Guide

Hello, thank you for agreeing to participate in this study on heart attack related firefighter fatalities and the compliance of fire departments with the NFPA 1582 standard. I am very interested in learning about your fire department's efforts and challenges to comply with requirements for medical screenings of firefighters.

I would like to remind you that participation in this study is completely voluntary. During the interview, if there are any questions you prefer not to answer, we can skip it and proceed.
Also, you may withdraw from the study at any point. This interview will take approximately 1 hour. This interview will be recorded to ensure accuracy of the data collected. You may request for me to stop the recording at any time.

Before we begin, do you have any questions for me about the research study in general?
[Respond to questions]

(Main Questions & Probing Questions)

Background

1. Briefly, please tell me about your fire department.
    a. Does your department have paid firefighter, volunteer firefighters, or a combination of both?
    b. How many members/firefighters are in your fire department?
2. Briefly, please tell me about yourself and your role as fire chief.
    a. How long have you been fire chief of this fire department?
    b. How many years of fire service experience do you have?
3. Describe your fire department's requirement or policy for initial and routine medical screenings for candidates and firefighters consistent with NFPA 1582?
    a. How long have this been a requirement or how long have this policy been in place?

Motivations

4. What are your personal values regarding health, safety, and wellness?
5. As the fire chief, describe your goals and objectives as it pertains to the health, safety, and wellness of firefighters?
6. What is your opinion on heart-attack related on-duty firefighter fatalities?
7. What is your perception on the *NFPA 1582, Standard on Comprehensive Occupational Medical Programs for Fire Departments?*
8. How does initial and routine medical screenings for firefighters consistent with NFPA 1582 impact your fire department?
9. Describe the level of priority you would give to initial and routine medical screenings for firefighters.

10. Describe any pressure or influence from individuals, groups, or organizations that advocate for or against medical screenings for firefighters?
    a. How does this impact your fire department?

Power

11. What key people are involved with the implementation and/or compliance with a requirement or policy for medical screenings for firefighters?
    a. Are these people internal or external to the fire department?
    b. Explain their level of involvement?
12. Describe the resources necessary for your fire department to implement and/or comply with initial and routine medical screenings for firefighters consistent with NFPA 1582.

Information

13. Describe the overall health and wellness status of the firefighters in your fire department.
14. Since NFPA 1582 is a voluntary consensus standard, please explain how the requirement for firefighter medical screenings are implemented in your fire department.
    a. Are all the requirements in NFPA 1582 fully adopted or partially with just some requirements?
    b. (If partially) Can you elaborate on which NFPA 1582 requirements are not adopted and why?
15. Are medical evaluations consistent with NFPA 1582 required for candidate firefighters prior to hire in your fire department?
16. How often are medical evaluations consistent with NFPA 1582 required for current member firefighters of your fire department?
17. Does your fire department adhere to the heart and vascular medical screening components of NFPA 1582 specific to identifying heart conditions and reducing the risk for heart attacks and how do these impact your fire department?
18. Does your fire department adhere to the heart and vascular system requirements and medical conditions limitations outlined in NFPA 1582 and how do these impact your fire department?
19. Describe any past actions or events that may have led your fire department to focus on the requirements for medical screenings for firefighters.
20. What do you see as challenges or barriers to implementation and/or compliance with requirements for firefighter medical screenings consistent with NFPA 1582 to prevent heart attacks?
21. Describe any resource support your fire department receives that facilitate the implementation and/or requirement for routine firefighter medical screenings.

Interactions

22. How is the requirement for medical screenings communicated to ensure compliance in your fire department?

23. How do your firefighters perceive the requirement for medical screenings?
    a. Describe the level of acceptance or resistance to the medical screening requirements.
        i. (If resistance) Why do you think there is resistance?
        ii. (If resistance) How do you overcome this resistance?

Conclusion

24. Is there anything that you would like to add about what we have discussed in this interview?
25. Do you have any additional questions for me regarding this research study?

If there are any documents that you would like to share with me regarding your fire department's requirements for initial and routine medical screenings for firefighters such as policies, procedures, or memorandums, please let me know what the most convenient way for me is to obtain these from you.

I appreciate your time today for this interview. If you think of any questions at any time, please do not hesitate to contact me. Once the interview is transcribed, you will be provided with a copy of the transcript to review. You will also have an opportunity to review the research study findings once they are available.