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I am submitting herewith a dissertation written by Christine Freaney entitled “Safety Culture and Safety Behaviors Among Firefighters.” I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy with a major in Health and Human Sciences.

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Safety Culture and Safety Behaviors Among Firefighters

A Dissertation

Presented for the Doctor of Philosophy

Degree

The University of Tennessee, Knoxville

Christine Freaney

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DEDICATION

This dissertation is dedicated to my parents, Petie and Susie Freaney.

Your sacrifices have led to my dreams becoming reality. No words are able to express the depth of my gratitude for your unconditional love and support.

ACKNOWLEDGEMENTS

To my siblings, thank you for setting the tone for achievement. To my brother, Patrick, thank you for challenging me. You continue to inspire and motivate me to be the best that I can be. It is a privilege to have you in my life and as a brother. To my sister, Kathy, your thoughtful cards with their words of encouragement and support throughout this process and my life mean more to me than you can imagine. I am fortunate to have you as a sister and as a friend.

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ABSTRACT

The purpose of this study was to investigate the safety culture and safety behaviors of metropolitan professional firefighters. A validated and reliable safety culture survey was used to assess the safety culture of a metropolitan fire department. A safety behavioral checklist was created and used to assess the safety behaviors of professional fire fighters. The sample for the study included 156 firefighters from a metropolitan fire department in North Carolina. A Pearson correlation was used to determine if there was a significant relationship between safety culture and safety behaviors. ANOVA and t-tests were used to determine if significant differences existed in safety culture and/or safety behavior on selected demographic factors.

Data analysis revealed a marginal correlation between safety culture and safety behavior. Results indicated the more positive safety culture is viewed, the more likely the firefighter is to practice safe behaviors. Findings also indicate that demographic factors such as education, marital status, work experience, and dependent status have no significance on how firefighters view safety culture and on the safety behaviors of firefighters. Data analysis did indicate a marginal significance in safety culture by participants who reported being moderately or severely injured 'on the job'.

Key Words: Firefighters, Safety Behavior, Safety Culture

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CHAPTER I

INTRODUCTION TO THE RESEARCH STUDY

Introduction

There are safety risks with every occupation; firefighting is considered one of the riskiest occupations (Moore-Merrell, Zhou, McDonald-Valentine, Goldstein, & Slocum, 2008). The main duties of a firefighter include:

...(1) respond to fire alarms, oil spillages, accidents (automobile, industrial, aviation and ship), building collapses and acts of nature (floods, mudslides and fires due to electric storms); (2) Rescue victims; (3) Control fire and extrication of casualties using various equipment and methods (axes, water, chemical extinguishers, ladders, vehicles, boats, etc.); (4) Use proper techniques for first aid; (5) Provide safety education to the public” (Albert, 2009, p.8).

While attempting to complete their firefighter duties, firefighters may be exposed to uncontrollable environmental exposures, heavy physical workloads, exposure to chemical and toxic agents, and high levels of stress (Szubert & Sobala, 2002). Research on the safety culture and safety behaviors of firefighters is imperative because similar to other occupations, injuries are costly. Researchers suggest that the fire service is one of the most hazardous industries based upon work-related injury rates (International Association of Firefighters, 1999; Karter and Badger, 2001; Walton, Conrad, Furner, & Samo, 2003). Walton et al. (2003) state, “the fire service remains one of the country’s most hazardous industries with work-related injury rates

exceeding those for most other industries” (p.454). According to the National Fire Protection Association, between 2003-2006, “...there was an estimated annual average of 40,270 firefighter fireground injuries in the U.S.” (Karter, 2009, p.1). When firefighters report to work, they are at an increased risk for musculoskeletal injuries, burns, fatigue, stress and even death (Reichard & Jackson, 2010). There is little research dedicated to the workers compensation costs associated with the injuries of firefighters. One study examined workers’ compensation records of firefighter injuries from 1992-1999 for 77 municipalities located in northeastern Illinois. This study collected the claim data of firefighters from a non-profit riskpooling firm that coded the data. Researchers of this study found, “the overall per-claim mean workers’ compensation cost of injury to firefighters was \$5,168...” (Walton et al., 2003, p.456). Overexertion is one of the most common injuries among firefighters (Karter, 2009; Walton et al., 2003). Walton et al. also found that overexertion tends to be the most costly injury and the mean for cost overexertion related injuries was \$9,715. According to Karter (2009), for the 2003-2006 time period, “...approximately 6,610 or 22% of reported injuries were the result of overexertion or strain” (p.8). The number of injuries increased from 2003 to 2006. In 2003, 38, 045 injuries were reported and in 2006 44, 210 injuries were reported (Karter). This increase in injuries means an increase in workers compensation costs. Safety culture and safety behaviors affect the bottom line. By studying the safety culture and safety behaviors of firefighters effective injury reduction programs can be formed and implemented.

Szubert and Sobala (2002) found “the nature and conditions of work performed by firefighters pose serious hazards to their health and life” (p. 49). There is an established risk with firefighting and though this occupation can never be without risk, it is imperative to make it as safe as possible (Windham, 2005). One way to reduce the risks of firefighting is to establish

standards to become a firefighter. Considering the working conditions firefighters are exposed to, it is necessary for firefighter candidates to possess, "...physical fitness...good sight, hearing, and color distinction. Any deficiency in this respect prevents a candidate from working as a firefighter" (Szubert & Sobala, p.49). Since the occupational risk of firefighting cannot be removed, the way to reduce risk is by adopting safe behaviors.

The term safety culture as used in this study was defined as:

The enduring value and priority placed on and public safety by everyone in every group at every level of an organization. It refers to the extent to which individuals and groups will commit to personal responsibility for safety, act to preserve, enhance and communicate safety concerns, strive to actively learn, adapt and modify (both individual and organizational) behavior based on lessons learned from mistakes, and be rewarded in a manner consistent with these values" (Weigmann, Zhang, von Thaden, Sharma, & Mitchell, 2002, p.8).

Safety behavior was defined by Hofmann and Moregson (1999) as, "adherence to established safety practices and procedures (e.g. the wearing of personal protection equipment, not taking unsafe shortcuts)" (p.288). Safety behavior can be affected and influenced by the safety culture in which an employee is immersed. "Definitions of culture commonly refer to values, attitudes, norms, beliefs, practices, policies, and behaviors of personnel", in essence culture is 'the way we do things around here'" (Pronovost & Sexton, 2005, p. 231).

Moore-Merrell et al. found that a detailed breakdown in line of duty injuries revealed, "one third of the firefighter LOD (Line of Duty), injuries were caused by a cluster of factors under the direct control of the individual firefighter and chief officers" (Moore-Merrell et al., 2008, p.3). The cluster identified, "lack of communication, standard operating

guideline/procedure breach, protocol breach, human error, and lack of situational awareness” as the controllable factors (Moore-Merrell et al., 2008). The information provided by Moore-Merrell et al., supports the finding that more than 30 percent of firefighter LOD injuries can be prevented by addressing safety behaviors. For the purpose of this study, the safety behaviors identified include a: seatbelt use, protective gear (bunker coats, face piece, gloves, and helmet), and apparatus procedures (using handle to get on and off apparatus and waiting to put apparatus in motion until all personnel is seated).

Statement of the Problem

The U. S. Fire Administration (2008) reported, “each year, tens of thousands of firefighters are injured while fighting fires, rescuing people, responding to emergency medical incidents, responding to hazardous materials incidents, or training for their job” (p.1). Injuries may range from minor to career ending. According to the National Fire Protection Agency as cited in Moore-Merrell et al. (2008), in 2005, “80,100 firefighters were injured; strain, sprain, and muscular pain were the leading types of injuries” (p.4). “The health impairments and disorders determined by the job characteristics include injuries, traumas, respiratory diseases, cardiovascular diseases, lung cancer, and cancers of other sites like intestine, bladder or kidney” (Szubert & Sobala, 2002, p.49). In 2004, “75,840 firefighters were injured while on duty” (U.S. Fire Administration, p.3). Nationally, in 2003, 850 firefighters were injured while 33 firefighters died in motor vehicle collisions that occurred while on the job. There were 15,900 collisions involving fire department emergency vehicles; the vehicles were either responding to or returning from incidents. (Karter & Molis, 2004, p. 2).

Research suggests that 30 percent of these injuries are related to a cluster of controllable factors (Moore-Merrell et al., 2008). The controllable factors that Moore-Merrell and associates focus on are behavioral related. These factors include decision making, lack of communication, standard operating guidelines/procedure breach, protocol breach, human error, and lack of situational awareness. This study investigated these safety behaviors and the safety culture of fire department personnel. The investigation of the safety behaviors can provide metropolitan fire departments with information that will assist in lowering injury rates. One way the study will do so is by identifying the firefighters commitment to personal responsibility for safety.

Significance of the Study

According to Moore-Merrell et al., (2008) firefighting is a profession that is prone to injuries and firefighters are not able to eliminate risk. However, through the practice of safe behaviors, firefighters can reduce the risk of serious injuries while preventing minor injuries. Minor injuries are defined as, "...first aid only and treated by a physician not a lost-time injury" (Karter, 2009, p.1). Serious injuries are separated include moderate and severe. Moderate and severe injuries are defined as, "...lost time injuries where there was little danger of death or permanent disability, and time lost injuries when there was a potentially life-threatening condition" (Karter, p.1).

A metropolitan city was selected for this study because the majority of professional firefighters work in metropolitan communities. According to Moore-Merrell et al., "...a large percentage of [career] firefighters are employed by fire departments in metropolitan areas" (p.4). This research will add to the current body of knowledge pertaining to firefighters, safety behaviors, and safety culture. Also, this research will provide information pertaining to injury

reduction among firefighters. Data collected will assist firefighters in comprehending safety behaviors and safety culture and therefore can be used to create initiatives to address the unsafe behaviors and safety culture issues identified.

This study will focus on a smaller metropolitan professional fire department in Wilmington, N.C. The Wilmington Fire Department is comprised of 180 firefighters and 11 operating firehouses. The Wilmington Fire Department protects the lives and property of 102,207 people (N.C. Office of State Budget, 2009). Wilmington is a coastal community and spans 41 square miles. The county of New Hanover, which Wilmington is a part of, spans 199 square miles (U.S. Census Bureau, 2000).

Wilmington Fire Department requires their firefighters have a High School Diploma or equivalent, be at least 19 years of age, and have a satisfactory driving record. In addition to those requirements, applicants must: (1) take an aptitude test, (2) have a background investigation, (3) pass a strength and agility test, (4) pass the oral interview, (5) pass the city's driving standard, (6) have a criminal/credit history check, (7) and other posted requirements (Fire Department of Wilmington, 2009). For equipment, Wilmington has 11 engines, 2 towers, 3 rescues, 2 fireboats and other miscellaneous apparatus such as the auxiliary mini pumper (City of Wilmington Fire Department, 2009). In 2008, the City of Wilmington hired a new Fire Department Chief, named Cecil "Buddy" Martinette Jr. Chief Martinette Jr. replaced Sam Hill who retired in March 2008 after 50 years with Wilmington Fire Department (Scott, 2008).

Since 2008 the City of Wilmington has been transitioning to a new administration. Chief Martinette Jr. has implemented new policies and procedures in the department and created the safety officer position. This type of administrative transition can have effects on the safety culture of the department. The results of this study should assist the Wilmington Fire Department

with establishing their current safety culture and provide them with baseline data of the firefighters safety behaviors.

Purpose of the Study

The purpose of this study was to investigate the safety culture and safety behaviors of professional firefighters in a metropolitan fire department.

Research Questions

1. Is there a significant relationship between safety culture as measured by the Anne Arundel Safety Culture Survey and safety behavior as measured by the Safety Behavioral Checklist?
2. Does safety culture as measured by the Anne Arundel Safety Culture Survey and/or safety behavior as measured by the Safety Behavioral Checklist, differ by one's level of education?
3. Does safety culture as measured by the Anne Arundel Safety Culture Survey and/or safety behavior as measured by the Safety Behavioral Checklist, differ by one's marital status?
4. Does safety culture as measured by the Anne Arundel Safety Culture Survey and/or safety behavior, as measured by the Safety Behavioral Checklist, differ by years of experience 'on the job'?
5. Does safety culture as measured by the Anne Arundel Safety Culture Survey and/or safety behavior as measured by the Safety Behavioral Checklist, differ by ones's measure of dependents?

6. Does safety culture as measured by the Anne Arundel Safety Culture Survey and/or safety behavior as measured by the Safety Behavioral Checklist, differ by one's previous injury status?

Assumptions

The basic assumptions for this study include:

1. Surveys were completed and returned by metropolitan professional firefighters.
2. Participant's self-reported responses reflected the perceptions and attitudes of metropolitan professional firefighters
3. The Anne Arundel Safety Culture instrument is both valid and reliable.

Delimitations of the Study

The study was delimited in the following ways:

1. The population in this study was delimited to professional firefighters in a metropolitan area of North Carolina.
2. Researcher delimited data collection to the month of July, 2010.

Limitations of the Study

Limitations of the study include:

1. Participants in this study had to be present at work in order to participate in the study.
2. Participants responded honestly.
3. This study was limited by the willingness of professional metropolitan firefighters to participate.

Definition of Terms

Active Duty/On the job/ On duty: For the purpose of this study active duty/on the job/ on duty will be defined as:

...refers to being at the scene of an alarm, whether a fire or non-fire incident; while responding to or returning from an alarm; while participating in other fire department duties such as training, maintenance, public education, inspection, investigation, court testimony, or fund raising; and being on call or stand-by for assignment at a location other than at the firefighter's home or place of business (Fahy, LeBlanc, & Molis, 2010, p.1).

Fireground: "Fireground operations include all tasks associated with fire suppression and incident mitigation including fire attack, water supply, command, salvage, and overhaul" (National Institute of Standards and Technology, 2004, p.9).

Injury: An injury can occur in workplace or at home. This study focuses on the occupational injuries endured by metropolitan professional firefighters. Occupational injuries are,

(1) all on-duty injuries, (2) specific to and caused by a job-related situation, regardless of what job the injured individual was performing at the time; (3) acute injuries, trauma, and illnesses, (4) transportation-related injuries (in fire vehicles) that occur during operations, injuries that occur in the station house" (National Institute of Standards and Technology, 2004, p.2).

Metropolitan: "Metropolitan statistical areas are geographic entities defined by the U.S. Office of Management and Budget (OMB) for use by Federal statistical agencies in

collecting, tabulating, and publishing Federal statistics. A metro area contains a core urban area of 50,000 or more population” (U.S. Census Bureau, 2003).

Mild/Minor Injury: Minor injuries are categorized as, “...first aid only and treated by a physician not a lost-time injury” (Karter, 2009, p.1).

Moderate Injuries: Moderate and severe injuries are defined as, “...lost time injuries where there was little danger of death or permanent disability, and time lost injuries when there was a potentially life-threatening condition” (Karter, 2009, p.1).

Safety Behaviors: A safety behavior is the “adherence to established safety practices and procedures (e.g. the wearing of personal protection equipment, not taking unsafe shortcuts)” (Hofmann & Morgeson, 1999, p.288).

Safety Culture:

Safety culture is the enduring value and priority placed on and public safety by everyone in every group at every level of an organization. It refers to the extent to which individuals and groups will commit to personal responsibility for safety, act to preserve, enhance and communicate safety concerns, strive to actively learn, adapt and modify (both individual and organizational) behavior based on lessons learned from mistakes, and be rewarded in a manner consistent with these values (Weigmann et al., 2002, p.8).

Severe Injuries: Moderate and severe injuries are defined as, “...lost time injuries where there was little danger of death or permanent disability, and time lost injuries when there was a potentially life-threatening condition” (Karter, 2009, p.1).

Summary

This chapter provided: an introduction, statement of the problem, significance of the study, purpose of the study, research questions, assumptions, delimitations and limitations and definitions of the terms use. Chapter Two will discuss research pertaining to firefighter injuries, safety culture, and safety behaviors. Chapter Two will also discuss the social cognitive theory and how it was applied to this study.

CHAPTER II

REVIEW OF RELATED LITERATURE

The purpose of this study was to investigate the safety culture and safety behaviors of professional firefighters in a metropolitan city. The literature review will investigate prominent injuries firefighters sustain, safety culture, safety behavior, and social cognitive theory.

Background

Firefighters risk injury and death every shift they work. Firefighting is an occupation that is hazardous and the hazards cannot be removed; therefore it is imperative to make it as safe as possible (Windham, 2005). According to the National Fire Protection Association, as cited by Karter and Molis (2009), “79,700 firefighter injuries occurred in the line of duty in 2008” (p.3). Previous studies suggest that 30 percent of these injuries are related to a cluster of controllable factors (Moore-Merrell et al., 2008). The controllable factors that Moore-Merrell and associates focus on are behavioral related. Since the hazards of firefighting cannot be removed, investigating the safety culture and safety behaviors of firefighters may help in forming risk reduction plans, by addressing those controllable behavioral factors that compose 30 percent of injuries. This chapter will provide information on injuries, safety culture, safety behavior, and the social cognitive theory.

Social-Cognitive Theory

Theories assist with comprehending the causes of problems as well as assist with identifying mechanisms of change, help determine why programs succeed or fail, and assist in building better prevention programs (Gielen & Sleet, 2003). Theories can provide insight into how a program should be shaped in order to reach the affected population and affected organization (Trifiletti, Gielen, Sleet, & Hopkins, 2005). This study used the Social Cognitive Theory (SCT) as its foundation. The SCT was chosen because it creates a format for understanding, predicting, and changing human behavior. SCT focuses on the interaction of personal factors, behavior, and the environment (Rimer & Glanz, 2005). The surveys used in this study investigated the firefighters personal factors (demographic characteristics), their safety behaviors, and the safety culture of their working environment.

The Social-Cognitive Theory is a behavioral and social science theory. According to researchers, “behavioral and social sciences theories and models have the potential to enhance efforts to reduce unintentional injuries” (Trifiletti et al., 2005, p.26). Since this study researched safety culture and safety behaviors with a focus on injuries, the Social Cognitive Theory was able to assist with the comprehension of the causes of the injuries and helped identify mechanisms of behavioral change.

One construct of the Social Cognitive Theory is reciprocal determinism (Figure 2.2). Figure 2.2 demonstrates the interaction of environment, behavior, and person. The theory is based on the interaction of behavior, environment, and personal factors that form the dynamic of the organization (Wood & Bandura, 1989). According to Wood and Bandura, “because of the bidirectionality of influence, people are both products and producers of their environment” (p.362). This means that the environment has a direct influence on behavior of the individuals.

This study investigated reciprocal determinism by assessing the safety culture of the fire department, investigating the relationship between safety culture and safety behaviors of firefighters, demographic characteristics and safety culture and safety behaviors of firefighters.

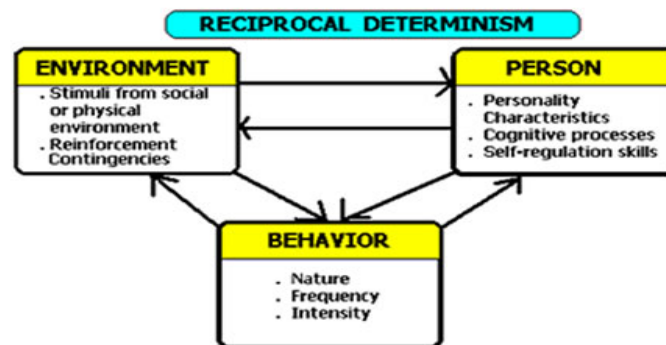


Figure 2.1: Reciprocal Determinism: Social Cognitive Theory

Source: Image from <http://www.usm.maine.edu/~psy/gayton/PF/psy102/Chapter12.htm>

Historically, firefighters attitudes and the environment that attitude created leads to injuries, it was described by Young (2001) as an “aggressive, uncontrolled, and individualistic approach” (p.1) Some fire departments recognizing the ‘old’ attitude have adjusted their ways. Young describes the UK approach as being more safety and team oriented. Another aspect of the social cognitive theory is, “the development of people’s cognitive, social and behavioral competencies through mastery modeling” (Wood & Bandura, 1989, p.362). The safety culture survey used in this study provides feedback on whether or not mastery modeling occurs within the fire department.

“Social cognitive theory provides a framework for understanding, predicting, and changing human behavior. The theory identifies human behavior as an interaction of personal factors, behavior, and the environment” (National Institute of Health Research, 2009, p.1).

According to Gielen and Sleet (2003), preventive intervention can positively affect those behaviors that contribute to injuries. “Behavioral science is an integral part of a comprehensive injury prevention strategy” (Gielen & Sleet, p.65). There will always be risks in firefighting; there are positive safety behaviors that firefighters can take to decrease the risk of injury.

The combination of the Anne Arundel Safety Culture Survey and the Behavioral Checklist address the constructs of the SCT. The Anne Arundel Safety Culture Survey consists of questions referring to personal factors and the environment of the fire department. Questions focused on interaction with peers and self regulation pertain to the personal factors of the SCT. Questions focused on the leadership, administration, and supervisors of the department focus on the environment of the fire department. The Behavioral Checklist focused solely on the behaviors of the firefighters and how often these behaviors occurred.

In the future fire departments need to move toward a more team-based, disciplined and managed approach that assesses risk and takes actions in the knowledge of the consequences.

“Historically, the fire service’s core mission, or reason to be, is to serve our customers and to provide that service no matter what the physical cost to our personnel” (Windham, 2005, p.11).

Injuries

“Firefighters experience inordinate numbers of line-of-duty injuries” (Moore-Merrell et al., 2008, p.3). The U. S. Fire Administration (2008) states, “each year, tens of thousands of firefighters are injured while fighting fires, rescuing people, responding to emergency medical incidents, responding to hazardous materials incidents, or training for their job” (p.1). Injuries may range from minor to career ending. In 2004, “75,840 firefighters were injured while on duty” (U.S. Fire Administration, p.3). Figure below illustrates the trend in firefighter injuries. It

would appear that firefighter injuries are decreasing; this is not attributed to any improvements in firefighting. Researchers at the NFPA have linked the decrease in firefighter injuries to a decrease in fire incidents. “The rate of injuries per 1,000 fires has not showed any consistent downward trend for the period. This is because the number of fire incidents also have decreased a considerable 49.8% for the 1981 to 2008 period” (Karter & Molis, 2009, p.7). This indicates that over 27 years the number of fire incidents have decreased and the number of injuries occurring to firefighters on the job have stayed the same.

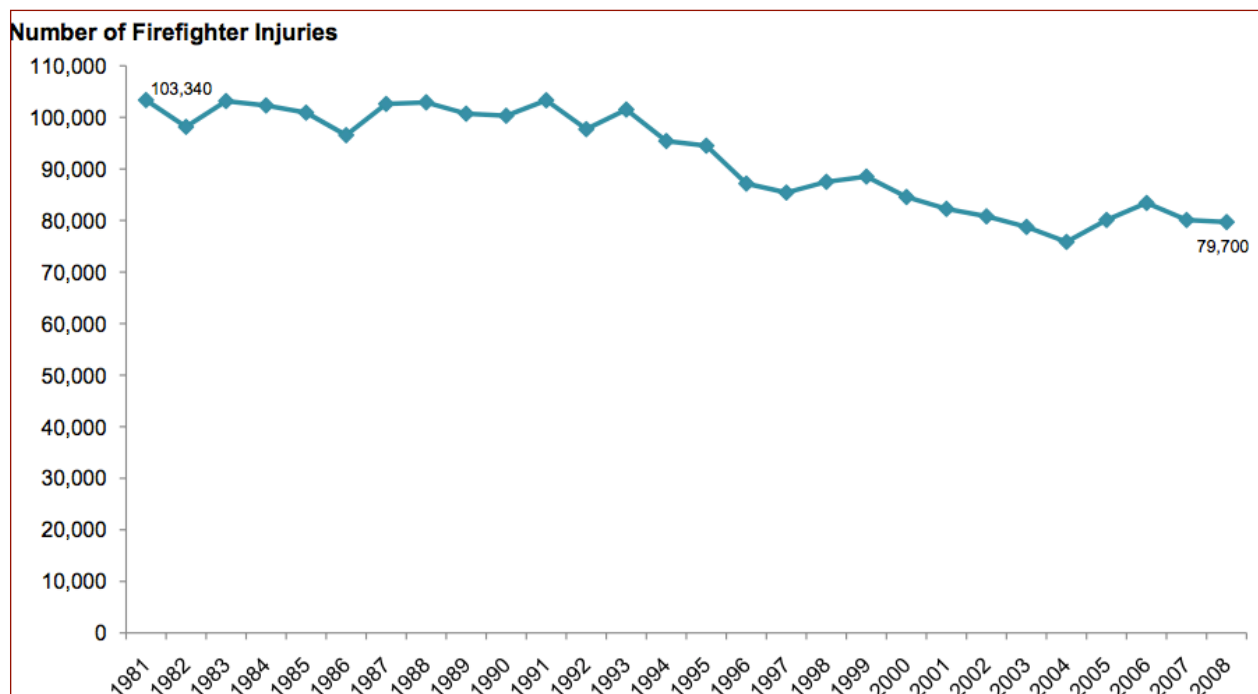


Figure 2.2 Firefighter Injuries 1981-2008

Source: NFPA Annual Survey of Fire Departments for U.S. Fire Experience

Firefighting is considered to be an occupation that is high-risk for injuries and traumas (Walton, Conrad, Furner, & Samo, 2003). Researchers, Szubert and Sobala (2002) attribute cardiovascular disease, respiratory diseases, and several cancers including lung cancer, and

cancers of other sites like large intestine, bladder, or kidney as health effects, related to firefighters' work. The National Fire Protection Association, as cited by researchers Karter and Molis, reported four major types of injuries that occurred during fireground operations. This list includes: strain, sprain (44.2 percent); wound, cut, bleeding, bruise (21.6 percent); burns (7.3 percent); smoke or gas inhalation (6.1 percent); thermal stress (5.6 percent). In 2008, the data collected showed similar statistics. In 2008, strain, sprain (48.8%); wound, cut, bleeding, bruise (15.6%); smoke or gas inhalation (6.2%); burns (6.2%); thermal stress (5.7%) (2009, p.7). Non-fireground injuries consisted of muscular strain, pain, and sprain (55.7 percent) and wound, cut, bleeding, bruise (20.3 percent) (2007,p.7).

Firefighters are also at risk for injury or death responding to the emergency and returning from the emergency. In 2003, 850 firefighters were injured while 33 firefighters died in motor vehicle collisions. The NFPA estimated in 2003, there were 15,900 collisions involving fire department emergency vehicles; the vehicles were either responding to or returning from incidents (Karter & Molis, 2004). The safety behaviors investigated in this study include fire truck safety behavior, such as firefighters wearing seatbelts. According to researchers from TriData Corporation, whom investigated the economic consequences of firefighter injuries and their prevention for the National Institute of Standards and Technology, over half of firefighter injuries occurred on the way to, at, and returning from the fireground (National Institute of Standards and Technology, 2004, p.2).

Based on available research, there is an average of 102 firefighter deaths in line of duty a year since 1995. Researchers propose that, "if significant changes are not made within the American Fire Service, more than 500 firefighters will be killed in the line of duty in the next five years" (Windham, 2005, p.6).

Safety Culture

The term safety culture is traced back to the nuclear explosion at Chernobyl in 1986 (Weigmann et al., 2002). At Chernobyl, two explosions led to the release of molten core fragments of the Chernobyl-4 nuclear reactor and fission products into the atmosphere. It is noted as one of the worst commercial nuclear power accidents in history. The International Atomic Energy Agency used the term “poor safety culture” to identify factors contributing and leading up to the Chernobyl accident (Weigmann et al). Though the term safety culture can be traced back to the 1986 event at Chernobyl, there are numerous definitions in use of the term safety culture. Mearns and Flin (1999) define safety culture as, “reflecting the fundamental values, norms, assumptions and expectations that exist in societal culture. Safety culture can be investigated by completing an analysis of how organizational members interact and form a shared view of safety” (p.5).

Other researchers, such as Sexton, Helmreich, Neilands, Rowan, Vella, Boyden, Roberts, and Thomas (2006), define safety culture as, “the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to, and the style of and proficiency of an, organization’s health and safety management” (p.2).

The definition of safety culture that is used for the purpose of this study was formed through reviewing the available literature and is to be used as a general definition.

Safety culture is the enduring value and priority placed on worker and public safety by everyone in every group at every level of an organization. It refers to the extent in which individuals and groups will commit to personal responsibility for safety, act to preserve, enhance and communicate safety concerns, strive to actively learn, adapt and modify (both individual and organizational) behavior based on lessons learned from

mistakes, and be rewarded in a manner consistent with these values (Weigmann et al., 2002, p.8).

Welbourne and Booth-Butterfield (2005) have conducted studies on safety messages and firefighters. The purpose of their study was to evaluate the effectiveness of the health and safety alert message that is issued by National Institute for Occupational Safety and Health. This message is used to alert at-risk workers about specific occupation health or safety hazards risk and the recommendation to lower that risk. Welbourne and Booth-Butterfield, found, “attitudes, norms and perceived control were found to be significant predictors of safety intentions” (p.151). Researchers found a relationship between firefighter’s intentions to engage in safe behaviors to their own beliefs about the value of the behaviors, how others view the behaviors, and their perceptions of difficulty to complete these behaviors. Welbourne and Booth-Butterfield’s research focused on the health and safety alert message and whether it was effective or not. This study provided a foundation and a cause to further research in this area. A relationship was established between firefighters safety behaviors and their attitudes, norms, and perceptions towards safety however, the Welbourne and Booth-Butterfield’s research was limited to the health and safety alert message.

Windham (2005) conducted a research study on The Woodlands Fire Department (TWFD). The purpose of Windham’s study was to investigate the safety culture of TWFD. In addition to investigating the safety culture of TWFD, Windham also attempted to link culture behaviors. Participants were comprised of external fire service personnel, upper administration in the Houston area and The Woodlands Fire Department personnel. The safety culture of TWFD was assessed using a safety culture survey. Windham used behavioral observations that were made a year prior to distributing the survey. According to Windham, “observations were made

through video or photographs of emergency scenes or through reports from other individuals on the emergency scene”(p.15). The safety culture surveys were distributed during training sessions over a four week period. The researcher kept a list of attendees at each training session so that firefighters were not asked to participate in the study twice. The results of the survey were overall positive though the culture survey assisted with highlighting areas of concern. According to Windham, 74% of responses were positive and 9% were negative. Windham analyzed TWFD’s injury statistics and examined the safety behaviors of TWFD and suggested there was a discrepancy between the safety culture reported and the actual safety culture of the department. Windham (2005) noted that a cause for the safety culture survey responses to be more positive than the actual safety culture is due to

a possible reluctance of TWFD personnel to openly admit to a negative attitude towards safety, deficiencies in the survey used for this project resulting in an inability to discover actual safety culture weaknesses within the organization, low or poorly communicated organizational expectations with regards to safety and or an intentional or unintentional attempt by respondents to resist cultural changes by masking or hiding potential problem areas (p.27).

Allen S. Williams conducted a safety culture study in the Anne Arundel County Fire Department. A portion of the safety culture survey Williams used in the study on Anne Arundel County is the same safety culture survey used the researcher used in this study. Williams study included other surveys that were in reference to individual health/safety programs of Anne Arundel County. These surveys were not distributed in the proposed study. The forced choice questions Williams used in the study were comprised from previous studies conducted on naval

aviators and the health care industry. In addition, Williams included 17 other forced choice statements that came from, “either common themes identified after a detailed analysis of numerous other surveys including one by Windham” (Williams, 2007, p. 30). Anne Arundel County fire department is comprised of 1,425 career and volunteer personnel (Williams). The survey format required respondents to choose (a) strongly disagree; (b) disagree; (c) neutral; (d) agree; (e) strongly agree; (f) not applicable or don’t know (Williams, p.31). According to Williams, overall the responses were positive, 62.7% of responses were positive and 14.3% were negative. Williams’s study was able to identify certain safety issues that the Anne Arundel County personnel identified through their responses to the surveys. The areas that received negative responses include fear of being blamed for mistakes and communication (lack of communication/miscommunications) among the fire department (Williams). It is interesting to note that Williams experienced overall a higher percentage of positive responses from volunteer firefighters; only 8% of the volunteer force participated.

Safety Behavior

According to Williams (2007), “Behavior starts with an identification of inappropriate behavior and then designing and implementing programs designed to decrease the behavior causing the problem” (p. 21). Firefighters are issued personal protective equipment. This equipment includes breathing apparatuses, bunker gear, and work gloves and etc. There are two tools used to increase positive safety behavior of firefighters: (1) proper training, (2) the issue of quality personal protection equipment. All firefighters are issued the same basic personal protection equipment. Not all firefighters will use their personal protection equipment properly. Researchers from the TriData Corporation, found that all firefighters should have proper gear,

including self-contained breathing apparatuses (SCBA). Firefighters that do have all the proper personal protective equipment may not be in compliance with when to wear the protection. Researchers found that the firefighters did not wear their SCBA gear as long or as often as they should have and that overall, firefighters were sometimes careless and took risks (National Institute of Standards and Technology, 2004). Mark Jones, Deputy Chief Fire Officer and Deputy Chief Executive for Essex County (UK) Fire and Rescue Services compared the concepts, policies, and practices of firefighting in the UK to the United States. In Jones's investigation he found that smoke inhalation; burns, crushing injuries, and related trauma are the main causes of death in American firefighters. Smoke inhalation deaths could be prevented by wearing the issued breathing apparatuses. "In 24 years of service, I have never known a time when a self contained breathing apparatus (SCBA) was not available to me and my crews and it seems incredible that smoke inhalation remains as a significant figure in these statistics" (Jones, 2008, p.8).

In the United Kingdom, safety behavior of firefighters was addressed in order to reduce firefighter deaths and injuries. The UK Fire and Rescue authorities focused on "The Safe Person Concept". Firefighting is not comparable to a normal workplace. In occupational safety, the goal is to reduce injury by taking the necessary steps and initiatives to achieve a safe place environment (Melius, 2001). The UK Fire and Rescue authorities recognized this difficulty to make the workplace safe for firefighters and chose to approach workplace safety by focusing on making the person work safely (Jones, 2008). This approach of "taking safety to the incident" has two aspects: organizational responsibility and personal reasonability (Jones, p.5). The organization is responsible for training, instruction, supervision and protective equipment. The person is responsible for acting in a competent, disciplined, vigilant, and adaptable manner

(Jones). Jones (2008) states, “ the absence or ineffectiveness of any one of them can be a significant causation factor in systematic failures...” (p.5). According to the UK’s Health and Safety Executive, Jones (2008), “every serious injury is likely to be underpinned by several non serious injuries and that they in turn are probably associated with dozens of non injury events” (p.12). Non-serious injuries can be the root of serious injuries. Every time a firefighter takes a risk and does not get injured their risky behavior is likely to occur again and possibly escalate. According to a study cited by Windham, most firefighter fatalities can be attributed to some type of human error. “Human errors include such things as perceptions, decisions, and behaviors” (Windham, 2005, p.6). Examples of these human errors include, “lack of situational awareness, protocol breach, and lack of communication” (Moore-Merrell et al., 2008, p.17).

Summary

In summary, the literature review cited studies conducted concerning safety culture and the safety behaviors of firefighters. Studies have used different survey tools, and populations were comprised of various members of the fire service, including volunteer, professional, and upper administration.

The literature review revealed an inconsistent definition of the term safety culture. This study contributes to the previous body of knowledge because it uses a validated and reliable safety culture survey tool and analyzes the safety behaviors of career firefighters in a metropolitan area. Moore-Merrell et al. (2008) detailed study was able to provide insight into the causes of injuries and found that one third of injuries were caused by factors that could be controlled by firefighters and chief officers. Other studies have demonstrated that safety behavior can be affected and influenced by the safety culture an employee is immersed in. This

study was able to determine a correlation between safety culture and safety behavior. The controllable factors that cause injury may stem from the safety culture of fire departments.

There is limited available research cited, which suggests that more research is needed to be conducted in this area. Chapter Three will discuss the methodology of the study and the survey instruments.

CHAPTER III

METHODOLOGY

Introduction

The purpose of this study was to examine the safety culture and safety behavior of firefighters working in metropolitan city. This study investigated how safety culture influences firefighter attitudes, behaviors, and knowledge of safety. This study developed a profile of safety culture and safety behaviors practiced by professional firefighters. Firefighters completed surveys based on their perceptions of the safety climate and their safety behaviors.

Instrumentation

The Anne Arundel Safety Culture Survey was the primary instrument used in this study. In addition, respondents were asked to complete a safety behavioral checklist developed by the researcher. The safety culture survey was used to assess the perceptions, attitudes, and beliefs firefighters have pertaining to their safety and their fire department. The safety behavior checklist was used to assess the behaviors of the firefighters.

Anne Arundel Safety Culture Survey

The Anne Arundel Safety Culture Survey instrument used in this study was developed by Allen S. Williams and the Maryland Fire and Rescue Institute, College Park, Maryland. According to Williams the purpose of his survey is to provide administrators with insight to the safety culture of the organization and be able to identify areas the organization can improve on in order to reduce injury and death among firefighters (Williams, 2008). The survey was originally developed for use on the Anne Arundel County Fire Department. It is based upon a safety culture

survey developed by Ciavarelli and Crowson (Williams, 2008). The instrument is comprised of forty forced choice statements. These statements were used in previous safety culture surveys. The researcher was granted permission to use the questions. The responses used in the forty forced choice statements range from: (a) strongly disagree, (b) disagree, (c) neutral, (d) agree, (e) strongly agree, or (f) don't know (Williams, 2008, p. 5). The second section of the safety culture survey focused on firefighters perception of the effectiveness of Health/Safety Operational Procedures (Williams, 2008). Participants are able to rate their perception on a scale of one to five, one representing excellent and five representing poor (Williams, 2007). The final part of the survey was comprised of open-ended questions. Participants were asked to identify the most hazardous activity performed, ways the department could improve on the job safety, and the third open ended question asked firefighters how this survey could be improved.

Williams developed validity and reliability for the safety culture survey. William's reliability and validity process was comprised of numerous steps. Williams conducted a literature review, identified experts in the area of safety culture studies for purpose of interviewing, including contacting the National Fallen Firefighters Foundation.

Safety Behavior Checklist

In addition to the safety culture survey, firefighters were asked to complete a Safety Behavioral Checklist developed by the researcher. The behavioral checklist was designed to investigate the safety behaviors of professional firefighters. To develop the Safety Behavioral Checklist a literature review was conducted on the types of injuries that firefighters sustain and the behaviors that lead to the injuries. Additionally to the literature review, the behaviors that form the safety behavior survey were identified in consultation with the City of New York's

Department of Safety Chief, Stephen Raynis as common unsafe behaviors that cause unintentional injuries.

The City of New York's Fire Department was consulted because the F.D.N.Y. is one of the largest metropolitan fire departments in the northeast. It consists of 11,213 uniformed firefighters and has 221 firehouses (FDNY Vital Statistics, 2008). According to research, the northeast region of the United States reports a high amount of firefighter injuries (Karter & Molis, 2009). The Safety Behavioral Checklist developed for the purposes of this study, is not theory or conceptually based and therefore does not need to demonstrate validity or reliability.

Items on the behavior checklist include: (a) fastening the chin strap on the helmet, (b) bunker coats buttoned up all the way with collar up , (c) donning mask (putting on face piece) before entering contaminated area whether a smoke filled area suspected of some sort of contamination, (d) wearing gloves at all times when operating (e) using hand holds getting on and off apparatus, ensuring apparatus is fully stopped before getting on or off.

The Safety Behavioral Checklist does not need to be validated because it is a checklist, the questions are asking whether the firefighters do certain behaviors and not their opinions or attitudes. The Anne Arundel Safety Culture Survey achieved "face" when the survey instrument was reviewed by potential users (firefighters) and administrators. The Anne Arundel Safety Culture instrument and the Safety Behavior Checklist were reviewed by Assistant Chief Frank Blackley of Wilmington Fire Department, Chief Stephen Raynis of the FDNY, and firefighters from both Wilmington and the FDNY. According to Dr. Ciavarelli, as cited by Williams (2008), having potential users and administrators review the instrument helps establish "face" validity. In addition to "face" validity, content validity was also established by the individuals that reviewed the safety culture survey due to their extensive knowledge of the subject matter. According to

Williams, “research indicates that content validity could be established if the survey was then reviewed by individuals who have significant knowledge of the subject matter” (p.50).

Specific Procedures

Following approval for the research from the research’s doctoral committee, IRB Form A form was completed and submitted to the departmental IRB committee after receiving approval from the University of Tennessee to conduct the research study, the Fire Department of Wilmington, North Carolina was contacted. A request to conduct research was sent via postal mail, telephone, and email.

Wilmington Fire Department is comprised of 11 operating fire stations. As of July 2010, there were 180 active firefighters distributed throughout the 11 stations. Wilmington firefighters work 24 hour shifts. Wilmington Fire Department uses an alphabetical system to identify the three different shift schedules, A, B, or C. Firefighters are assigned to either A shift, B shift, or C shift

Subject Selection

For the purpose of this study, research participants included professional firefighters employed by Wilmington, a metropolitan city in North Carolina. The sample population included active duty captains, lieutenants, and firemen. The intended population selected for this study was a representative sample of metropolitan professional firefighters. Safety officer of Wilmington Fire Department was contacted via phone. Researcher was given access to all active firehouses and all active duty firefighters. An attempt to survey all active duty firefighters was made by the researcher.

Data Collection Methods

For the purpose of this study, the researcher went to centrally located firehouses in Wilmington, North Carolina. In Wilmington firefighters conduct meetings at a central location that was accessed by the researcher. The surveys were administered to the firefighters in a classroom setting. Out of 180 firefighters employed by Wilmington Fire Department 156 surveys were collected. All participants were surveyed in July 2010.

On the first day of data collection, the researcher went to each of the 11 firehouses. 58 surveys were collected. On the second and third day of data collection, the researcher went to 4 firehouses that were centrally located throughout the city. The firefighters from surrounding firehouses would meet at the centrally located firehouse. On day 2 and day 3 of data collection, the firefighters would report to the firehouse classroom. On day 2 of data collection, 54 surveys were complete and returned. On day 3 of data collection 44 surveys were collected and returned. The purpose of visiting the active firehouses for 3 days was to ensure access to all active duty firefighters. All three shifts, A, B, and C, were able to participate.

The instruments were administered and collected by the researcher. Before survey administration, the researcher explained the purpose of the research study and provided the participants with instructions for completing the survey.

Some firefighters were unable to participate because they were not on active duty, they were on vacation, or they were upper administration, such as Chief of Department.

Analysis of Data

Data were entered and analyzed by SPSS® Version 18. A Pearson correlation was used to investigate a possible significant relationship between safety culture and safety behavior. An

Analysis of Variance (ANOVA) was used to determine any significant differences between safety culture, education, and experience. An independent t-test was used to determine significant differences between safety culture and marital status, dependents, and injuries.

Summary

In summary, this chapter discussed the instruments used, the study population, data collection methods, and data analysis techniques. Chapter Four will discuss the analysis and interpretation of the data.

Chapter IV

ANALYSIS AND INTERPRETATION OF DATA

The purpose of this study was to examine the safety culture and safety behavior of firefighters working in a metropolitan city. This study investigated how safety culture influences firefighter attitudes, behaviors, and knowledge of safety. The objective of this study was to develop a profile of safety culture and safety behaviors practiced by professional firefighters. Firefighters completed surveys based on their perceptions of the safety climate and their safety behaviors.

Description of the Subjects

For the purposes of this study, the researcher went to centrally located firehouses in Wilmington, North Carolina. In Wilmington, firefighters conduct meetings at central location that was accessed by the researcher. Surveys were administered by the researcher in a classroom setting. Out of 180 firefighters employed by Wilmington Fire Department 156 surveys were collected for an 87% response rate. All participants were surveyed in July of 2010.

Data analysis revealed that the majority of the participants surveyed were the rank of firefighter. Although Wilmington Fire Department consists of various education levels, descriptive statistical analysis revealed the majority, 104 or 67 percent of participants reported achieving some college and a high school diploma. 113 or seventy-two percent of the respondents from the department were identified as being married. Analysis also revealed that the majority, 124 or eighty percent, of firefighters from the Wilmington Fire Department reported as having dependents. Wilmington Fire Department is largely comprised of experienced

firefighters. 54 or thirty five percent of Wilmington’s Fire Department had been in this profession for 11 years or more.

Rank

Participants were asked to mark their current rank within the fire department. According to self reported responses, this population consisted of 73 firefighters or 47% of the sample, 38 lieutenants/master firefighter, or 24% of the population, 41 captains or 26% of the sample, and 4 chiefs or 3% of the sample. Data pertaining to fire fighter rank is displayed in Figure 4.1.

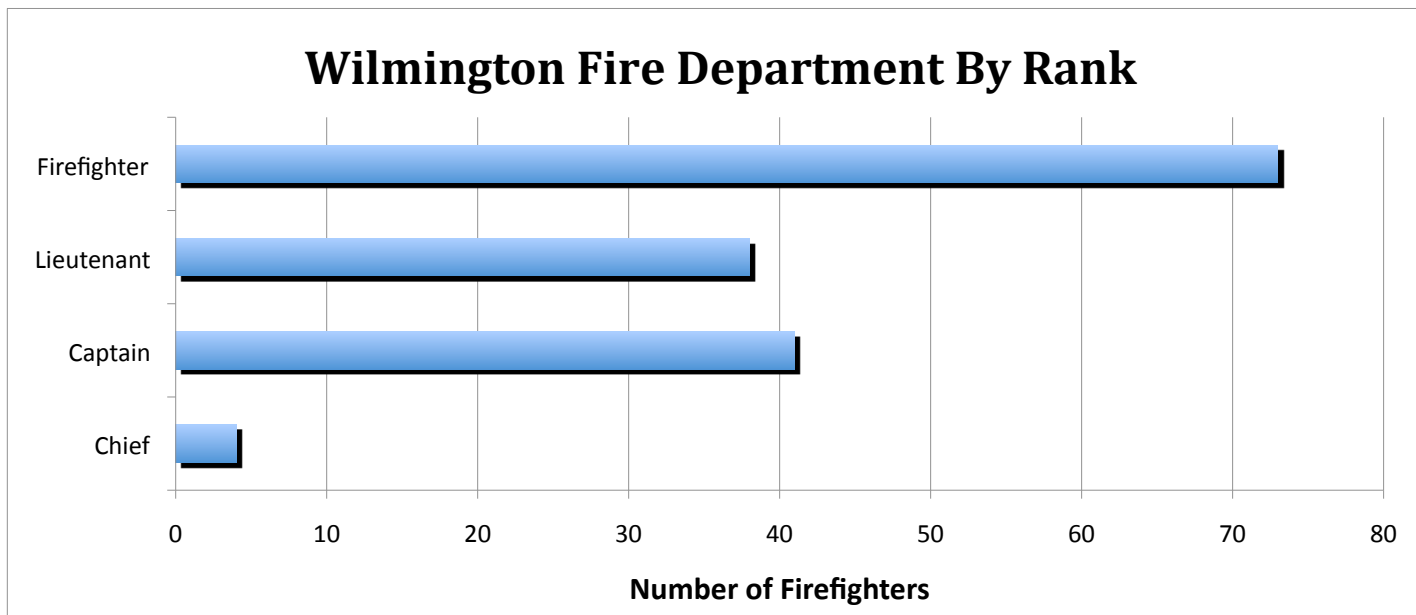


Figure 4.1 Wilmington Fire Dept by Rank

Education Level

Participants were asked to mark their highest level of education completed. According to participant’s self-reported responses, 42 employees or 27% of the study sample indicated having a high school diploma, 8 or 5% of the study sample indicated having a GED, 54 or 35% of the study sample reported having some college, 33 or 21% of the study sample reported having associates degree, and 19 or 12% of the study sample reported receiving a bachelors degree.

Since so few reported having a GED they were collapsed with high school graduates. For data analysis purposes, the GED and high school graduate categories were collapsed. Results are displayed in Figure 4.2.

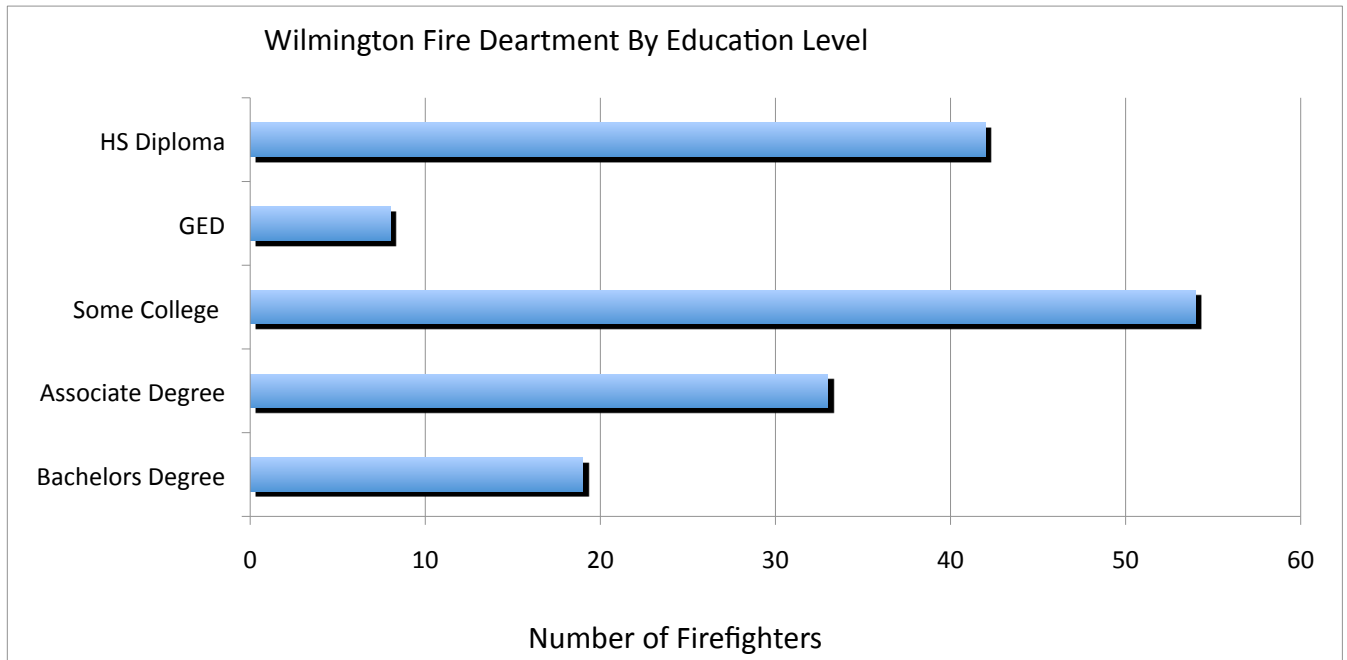


Figure 4.2 Wilmington Fire Dept by Education

Marital Status

Participants were asked to indicate their marital status. According to the participant's self-reported responses, 20 employees or 13% of the study population reported being single, 4 or 3% of the study sample, indicated that they were separated, 15 or 9% of study sample reported being divorced, 4 or 3% of study population, indicated that they had significant others, and 113 or 72% of study sample reported being married. For purposes of data analysis, marital status was collapsed into two groups, married and not married. The not married group is comprised of those individuals who identified as being single, separated, or divorced. Results for marital status are displayed in Figures 4.3 and 4.4.

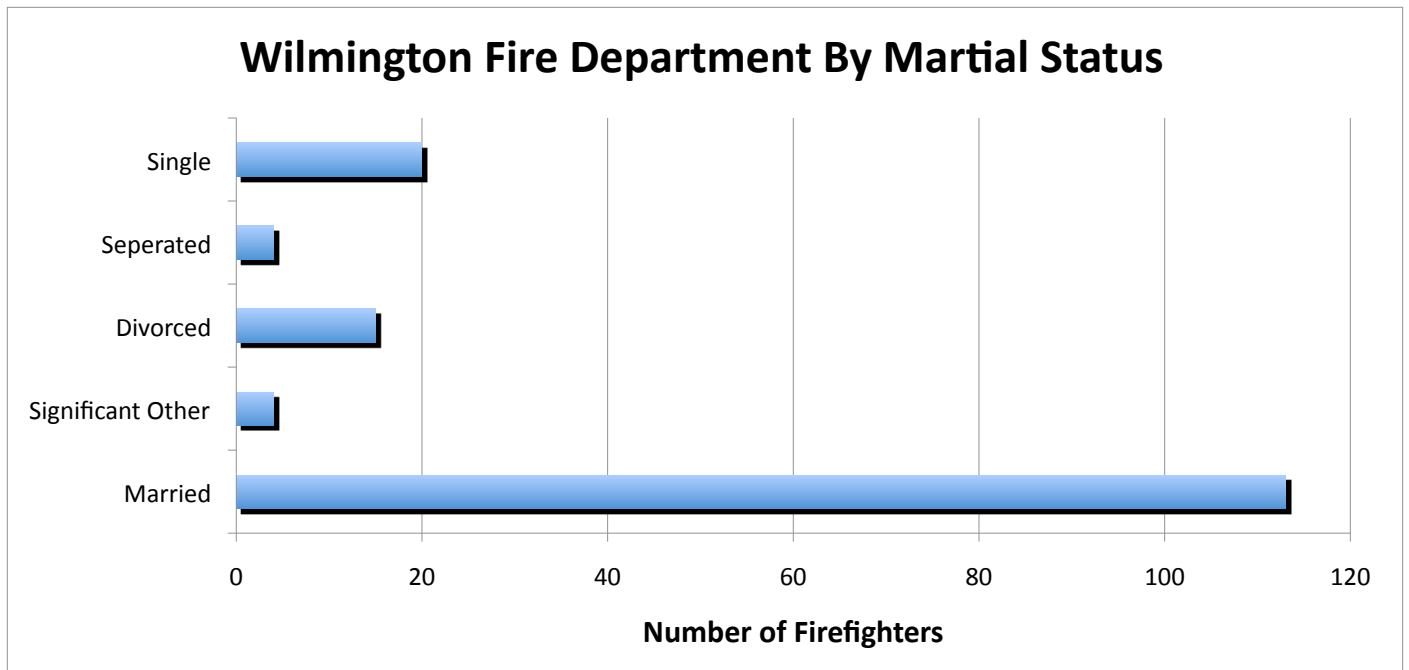


Figure 4.3 Wilmington Fire Department by Marital Status

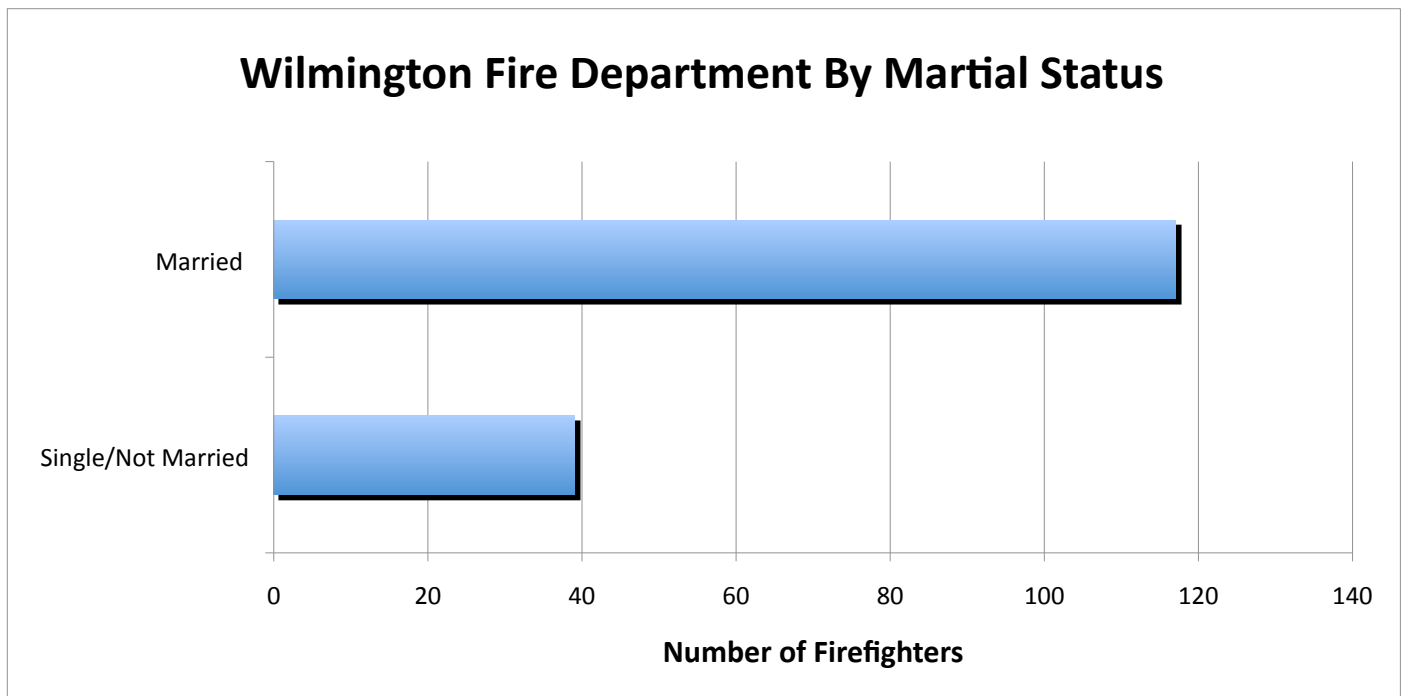


Figure 4.4 Wilmington Fire Department Two Marital Status Types

Dependents

For the purposes of this study, participants were asked to report if they had any dependents. According to the participants self reported responses, 124 or 80% of study sample participants reported having dependents, while 30 or 20% participants reported not having dependents. Data revealed that 94 or 60% of study sample reported having children aged 17 through 21. Approximately 31 or 20% of study sample reported their significant other as a dependent, while five firefighters claimed their parent as a dependent. The results are presented in the Figures 4.5 and 4.6.

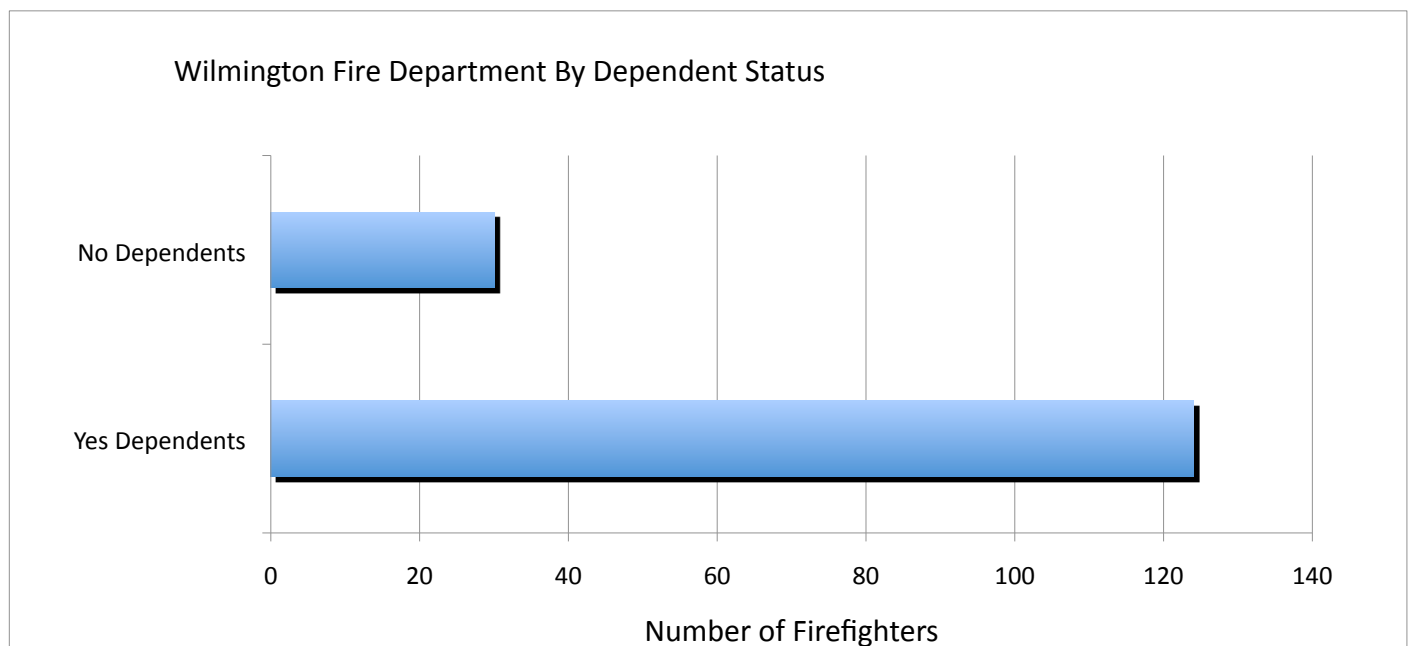


Figure 4.5 Wilmington Fire Department by Dependent Status

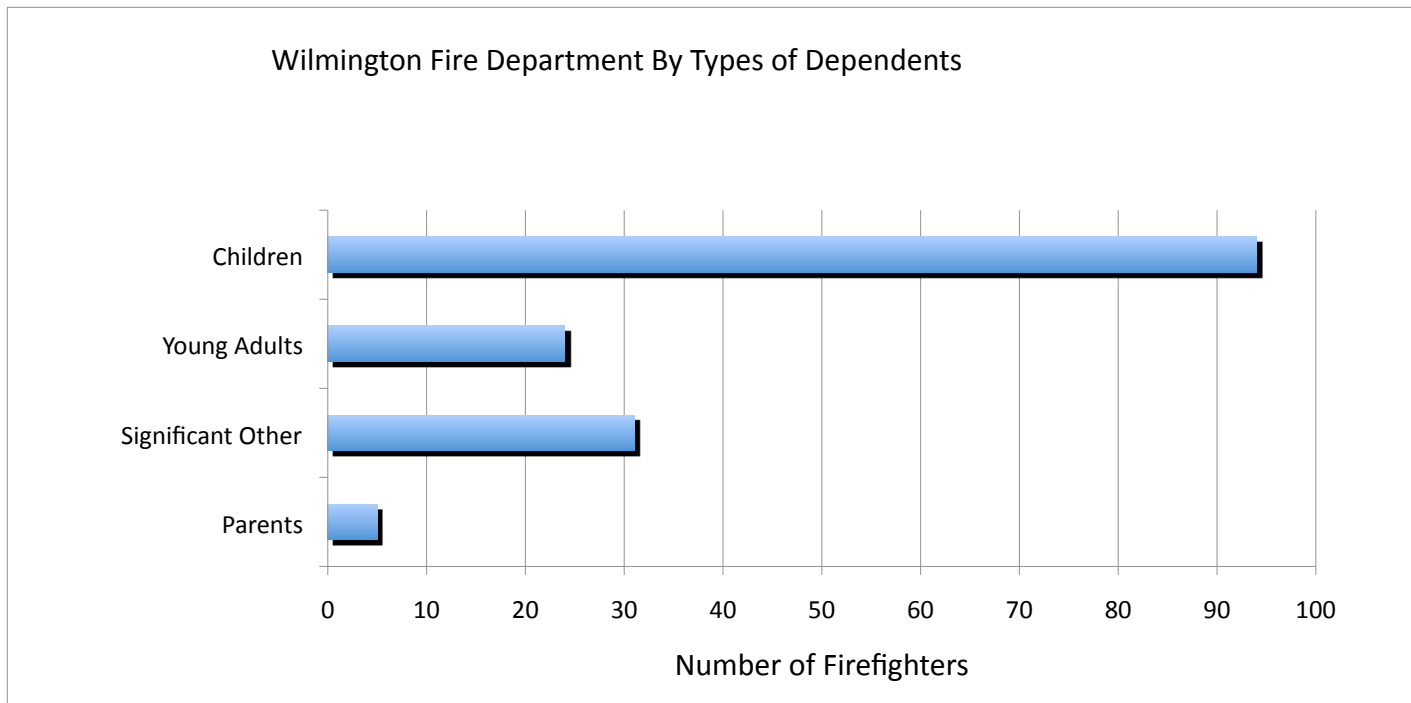


Figure 4.6 Wilmington Fire Department by Types of Dependents

Experience

Participants were asked to identify how many years they have been an “on the job” firefighter for Wilmington Fire Department. According to their self reported responses, 19 or 12% reported having 0-3 years of experience, 14 or 9% reported having less than 6 years of experience, 40 or 26% reported having between 6 and 10 years of experience, 54 or 35% reported having between 11 and 20 years of experience, and 28 or 18% reported having more than 20 years of experience. The majority of the department has worked with Wilmington’s Fire Department for more than 6 years. Results of firefighter experience are displayed in Figure 4.7.

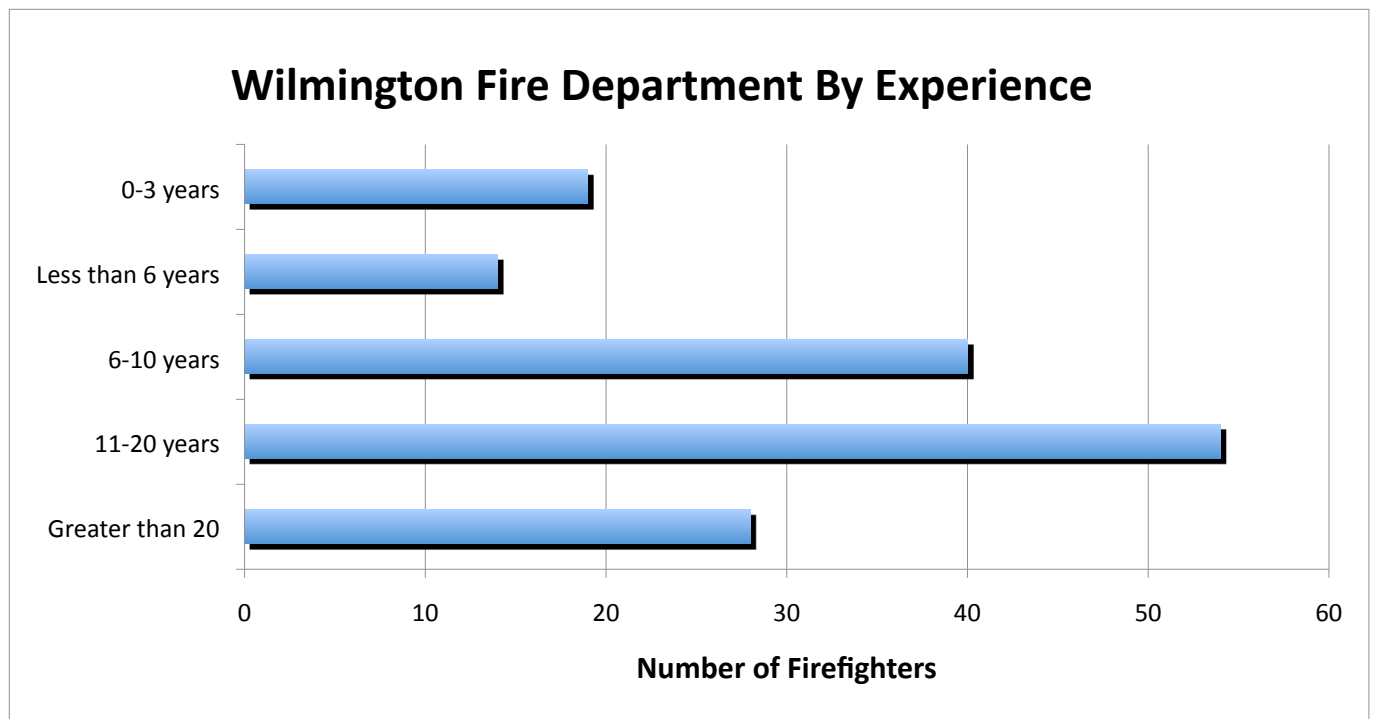


Figure 4.7 Wilmington Fire Department by Experience

Injuries

Participants were asked to indicate if they were previously injured on the job. According to the self-reported responses, 64 or 41% reported being previously injured on the job and 91 or 59% reported that they have not been injured on the job. Of the 64 participants that reported being previously injured on the job, 37 or 57% reported mild injuries, 22 or 34% reported moderate injuries, and 6 or 9% reported having severe injuries. Participants were asked to indicate the worst injury they had received while on the job ranging from mild, moderate, and severe. For statistical analysis, the data were collapsed into two groups. Results are displayed in Figure 4.8.

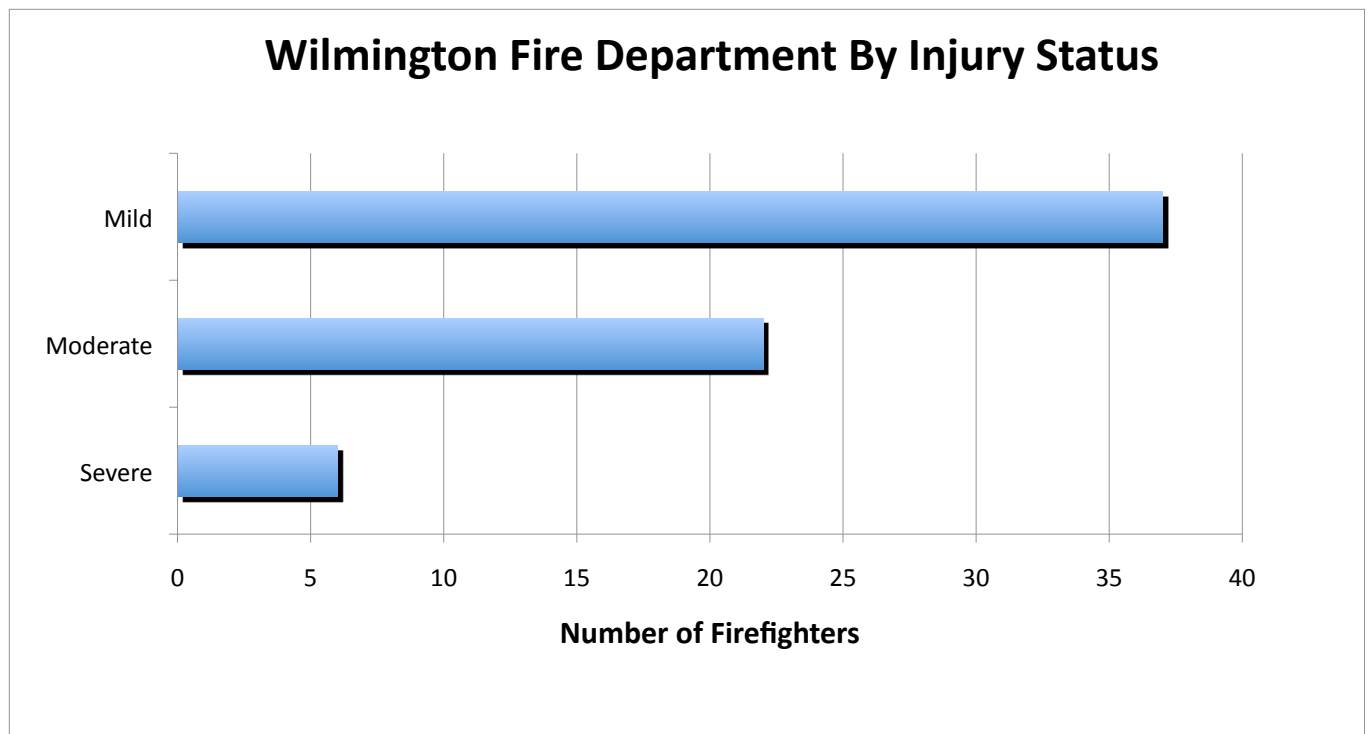


Figure 4.8 Wilmington Fire Department Previously Injured

Research Question 1

Is there a significant relationship between safety culture as measured by the Anne Arundel Safety Culture Survey and safety behavior as measured by the Safety Behavioral Checklist?

To examine if there is a significant relationship between safety culture and safety behavior a Pearson correlation was used. Data analysis revealed a significant correlation between safety culture and safety behavior. The results of the correlation were $r = 0.277$, $p < 0.001$. Results indicated that the more positive the safety culture is viewed, the more likely the firefighter is to practice safe behaviors. Data analysis also revealed a mean of 3.59 for safety culture and a mean of 4.10 out of 5.00, for safety behavior. Results are displayed in Table 4.1.

Table 4.1: Means Safety Culture and Safety Behavior

	N	Minimum	Maximum	Mean	Std. Deviation
SC Mean	156	3.59	4.60	3.59	0.413
SB Mean	156	3.60	5.00	4.10	0.569

Research Question 2

Does safety culture as measured by the Anne Arundel Safety Culture Survey and/or safety behavior as measured by the Safety Behavioral Checklist, differ by education?

An ANOVA was used to determine if significant differences existed between safety culture and education, as measured by the Williams Anne Arundel Safety Culture Survey. Table 4.2 displays the means for safety culture by education. The results from the ANOVA indicated there was no significance between how City of Wilmington firefighters view safety culture and their level of education, $F(3,152)=1.042$, $p=0.376$.

For data analysis purposes, an ANOVA was used to determine significance between the safety behavior of Wilmington's firefighters and their education levels as measured by the Safety Behavior Checklist. Table 4.3 displays the means for safety behavior by education. The results of the ANOVA indicated no significance difference between Wilmington's firefighters safety behavior and their education levels, $F(3, 152)= 1.329$, $p=0.267$.

Table 4.2: Mean Safety Culture by Education

Education Level Completed	Number of Responses	Mean	Std. Deviation
HS Diploma	50	3.59	0.419
Some College	54	3.60	0.366
Associate Degree	33	3.50	0.431
Bachelor Degree	19	3.71	0.489
Total	156	3.59	0.413

Table 4.3: Mean Safety Behavior by Education

Education Level Completed	Number of Responses	Mean	Std. Deviation
HS Diploma	50	4.14	0.482
Some College	54	4.06	0.621
Associate Degree	33	4.22	0.610
Bachelor Degree	19	3.92	0.538
Total	156	34.10	0.569

Research Question 3

Does safety culture as measured by the Anne Arundel Safety Culture Survey and/or safety behavior as measured by the Safety Behavioral Checklist differ by marital status?

An independent samples t-test was used to determine if there was significance between safety culture and marital status as measured by William's Anne Arundel Safety Culture Survey. Figure 4.4 displays the means for safety culture by marital status. The results from the t-test indicated there was no significance between how City of Wilmington firefighters view safety culture and their marital status $t(154) = -0.486, p=0.628$. The total number of responses was 156 but they are not reported with the t-test procedure.

An independent sample t-test was used to determine significance between firefighter reported safety behavior and their marital status. Figure 4.5 displays the means for safety behavior by marital status as measured by the Safety Behavior Checklist. The results from the t-test indicated no significance difference between safety behavior and marital status, $t(154) = -0.901, p=0.369$.

Table 4.4: Mean Safety Culture by Marital Status

Marital Status	Number of Responses	Mean	Std. Deviation
Single, Separated, or Divorced	39	3.56	0.378
Married or Significant Other	117	3.60	0.425

Table 4.5: Safety Behavior by Marital Status

Marital Status	Number of Responses	Mean	Std. Deviation
Single, Separated, or Divorced	39	4.03	0.570
Married or Significant Other	117	4.13	0.569

Research Question 4

Does safety culture as measured by the Anne Arundel Safety Culture Survey and/or safety behavior as measured by the Safety Behavioral Checklist, differ by years of experience ‘on the job’?

An ANOVA analysis was used to determine significance between experience and safety culture as measured by Williams Anne Arundel Safety Culture Survey. Table 4.6 displays the means for safety culture by experience. The results from the ANOVA indicated no significance between how the City of Wilmington firefighters view safety culture and years as a firefighter in Wilmington, $F(3, 151) = 0.177, p = 0.912$.

An ANOVA analysis was also used to determine significance between firefighter safety behavior and their experience (time on the job) as measured by the Safety Behavior Checklist. Table 4.7 displays the means for safety behavior by experience. The results from the ANOVA

indicated no significance difference between safety behavior and experience, $F(3, 151) = 0.740$, $p = 0.530$.

Table 4.6: Mean Safety Culture by Experience

Experience	Number of Responses	Mean	Std. Deviation
Less than 6 years of experience	33	3.60	0.391
6 to 10 years of experience	40	3.61	0.422
11 to 20 years of experience	54	3.60	0.393
More than 20 years of experience	28	3.54	0.480
Total	155	3.59	0.413

Table 4.7: Mean Safety Behavior by Experience

Experience	Number of Responses	Mean	Std. Deviation
Less than 6 years of experience	33	4.01	0.666
6 to 10 years of experience	40	4.20	0.424
11 to 20 years of experience	54	4.10	0.567
More than 20 years of experience	28	4.11	0.617
Total	155	4.11	0.565

Research Question 5

Does safety culture as measured by the Anne Arundel Safety Culture Survey and/or safety behavior as measured by the Safety Behavioral Checklist differ by dependents?

An independent samples t-test was used to determine if a significant difference exists between how the City of Wilmington's firefighters view safety culture and whether or not the firefighter has a dependent as measured by William's Anne Arundel Safety Culture Survey. Table 4.8 displays the mean for safety culture by dependents. The results from the t-test indicated no significance difference between firefighters view on safety culture and whether the firefighter has a dependent, $t(152) = 0.493$, $p = 0.623$. The total number of responses was 156 but they are not reported with the t-test procedure.

An independent samples t-test was also used to determine the significance of safety behaviors and having a dependent as measured by the Safety Behavior Checklist. Table 4.9 displays the means for safety behavior by dependents. The results from the t-test indicated no significance difference between firefighter safety behavior and having a dependent, $t(152) = 1.580$ and $p = 0.116$.

Table 4.8: Mean Safety Culture by Dependents

Status of Dependent	Number of Responses	Mean	Std. Deviation
Has a dependent	124	3.60	0.423
Does not have a dependent	30	3.55	0.388

Table 4.9: Means Safety Behavior by Dependents

Dependent Status	Number of Responses	Mean	Std. Deviation
Has a dependent	124	4.15	0.567
Does not have a dependent	30	3.98	0.430

Research Question 6

Does safety culture as measured by the Anne Arundel Safety Culture Survey and/or safety behavior as measured by the Safety Behavioral Checklist differ by injury status (previous injury and severity)?

An independent samples t-test was used to determine significance between safety culture and injuries as measured by William's Anne Arundel Safety Culture Survey. Table 4.10 displays the means for safety culture by firefighters that have not been previously injured and firefighters that have been previously injured. The results from the t-test indicated there is no significance difference of safety culture by injuries, $t(153) = -1.085$, $p = 0.280$. In addition, severity was analyzed of those reported injuries from mild to severe. Table 4.11 displays the means for safety culture by firefighter severity of injury. A marginal significance was found, $t(62) = 1.985$, $p = 0.052$. Data indicated that the more severe the injury the more negatively safety culture is viewed. The total number of responses was 156 but they are not reported with the t-test procedure.

An independent samples t-test was used to determine the significance between safety behaviors and being previously injured on the job as measured by the Safety Behavioral

Checklist. Table 4.12 displays the means for safety behavior by injury. The results from the t-test indicated no significance difference between the firefighter's safety behaviors and being previously injured, $t(153) = .108, p=0.914$. For data analysis purposes, the researcher collapsed the injuries, grouping moderate and severe injuries into the same category. Results indicated, $t(62) = .836, p=0.406$, the means are displayed in table 4.13.

Table 4.10: Means Safety Culture by Previously Injured

Injured	Number of Responses	Mean	Std. Deviation
Yes	64	3.55	0.431
No	91	3.62	0.400

Table 4.11: Means Safety Culture by Severity of Injury

Injury Comparison	Number of Responses	Mean	Std. Deviation
Mild	37	3.64	0.362
Moderate or Severe	27	3.43	0.483

Table 4.12: Safety Behavior by Injury

Injured	Number of Responses	Mean	Std. Deviation
Yes	64	4.11	0.556
No	91	4.10	0.575

Table 4.13: Means Safety Behaviors by Severity

Injury Comparison	Number of Responses	Mean	Std. Deviation
Mild	37	4.16	0.519
Moderate or Severe	27	4.05	0.605

Summary

Chapter Four presented the analysis and interpretation of data collected from surveys investigating the relationships between safety culture as measured by William's Anne Arundel Safety Culture Survey and safety behaviors as measured by the Safety Behavior Checklist of firefighters working in Wilmington, North Carolina. Data were collected from 156 participants or 87% of the Wilmington Fire Department. A Pearson correlation indicated a significant relationship exists between safety culture and safety behavior. Results also indicated that demographic characteristics cannot be used to predict safety culture and safety behavior or fire fighters. Data analysis did indicate a marginal significance in safety culture by participants who were previously injured on the job. Chapter 5 will present the findings, conclusions and recommendations.

CHAPTER V

RESULTS

Introduction

The purpose of this study was to investigate the safety culture and safety behavior of professional firefighters in a metropolitan fire department. The Wilmington Fire Department was selected to serve as the population for the study. A behavioral safety checklist and a valid and reliable instrument focusing on firefighters' safety attitudes, beliefs, and demographic information were distributed in July 2010.

Based on the research question, the self reported responses were analyzed using ANOVAs, T-tests, and a Pearson correlation. Comparisons were also made on select demographic factors, safety culture and safety behaviors of professional firefighters. This chapter will summarize the findings, provide conclusions, and make recommendations. Out of 180 firefighters employed by Wilmington Fire Department during July 2010, a total of 156 surveys were collected and analyzed.

Findings

Demographic Factors

1. There were 180 firefighters employed by Wilmington Fire Department in July 2010. Twenty-four were on vacation during the month data was collected. However, 156 instruments or 87% were completed and collected for analysis.

2. The participants were asked to mark their current rank on the survey. The survey listed (1) probational fire fighter, (2) firefighter, (3) lieutenant/master firefighter, (4) captain, and (5) chief. There were 73 firefighters, 38 lieutenants/master firefighters, 41 captains, and 4 chiefs.
3. The participants were asked to mark their highest level of education completed, the choices consisted of: (1) High school Diploma, (2) GED, (3) Some college, (4) Associate Degree, (5) Bachelors Degree, (6) Graduate Degree. According to self-reported responses, 42 participants had a high school diploma, 8 had a GED, 54 had some college credits, 33 had an associate's degree, and 19 had a Bachelor degree.
4. The participants were asked to indicate their martial status. According to the participant's self-reported responses, 20 employees reported being single, 4 indicated they were separated, 15 reported being divorced, 4 indicated that they are with significant others, and 113 reported being married.
5. The participants were asked to report if they had any dependents. According to the participants, 124 reported having dependents, 30 participants reported not having dependents.
6. Participants were asked to report their years of work experience, 19 reported being on the job for 0-3 years, 14 reported having less than 6 years of experience, 40 reported having between 6 and 10 years, 54 reported having between 11 and 20 years of experience, and 28 reported having more than 20 years of experience. The majority of the firefighters have worked with Wilmington's Fire Department for more than 6 years.
7. Participants were asked to indicate if they were previously injured on the job. Sixty-four participants reported being previously injured on the job and 91 reported that they have not been injured on the job. Of the 64 that reported being previously injured, 37 reported mild injuries, 22 reported moderate injuries, and 6 reported severe injuries.

8. A Cronbach's Alpha was found on the data obtained from this study. The Cronbach's Alpha for this study was found to be .916.

Research Question 1

Is there a significant relationship between safety culture as measured by the Anne Arundel Safety Culture Survey and safety behavior as measured by the Safety Behavioral Checklist?

8. According to the analyzed data, a correlation was found between safety culture and safety behavior. The results of the correlation were $r=.277$, $p> 0.01$. Results indicate that the more positively a Wilmington firefighter views safety culture the more likely the firefighter is to practice safe behaviors.

9. The overall mean for safety culture was found to be 3.59 out of 5.00, based on the Likert scale; thus firefighters view the safety culture neutrally. The overall minimum of safety culture mean was 3.59; the overall maximum was 4.60. The overall safety behavior mean was 4.10. Firefighters reported practicing safety behaviors on a regular basis. The overall minimum of safety behavior reported was 3.60; the overall maximum mean was 5.00.

Research Question 2

Does safety culture as measured by the Anne Arundel Safety Culture Survey and/or safety behavior as measured by the Safety Behavioral Checklist differ by one's level of education?

10. The results from the ANOVA indicated there was no significant difference with how Wilmington Firefighters viewed safety culture by their level of education. The mean for those

participants with a bachelors degree was 3.71, while the mean for those with an associate degree was 3.50. Those participants that have earned some college credits but not a degree reported a mean of 3.60. Participants with a high school diploma or GED reported a mean 3.59. All the groups recorded means for safety culture by education in the neutral range; the range was 3.50-3.71

11. The results from the ANOVA indicated no significant difference for safety behaviors by education. Firefighters with a bachelors degree reported a mean of 3.92. Firefighters who have an associate's degree reported a mean of 4.22. Firefighters with some college reported a safety behavior mean of 4.06, and those participants with a high school diploma or equivalent reported a safety behavior mean of 4.14. The range of safety behaviors by education was 3.92-4.14.

Research Question 3

Does safety culture as measured by the Anne Arundel Safety Culture Survey and/or safety behavior as measured by the Safety Behavioral Checklist differ by one's marital status?

12. The results from the t-test indicated there was no significant difference of safety culture by marital status. The mean for both groups, single and married, was reported in the neutral range. Those that were married reported a safety culture mean of 3.60 while participants that identify as single, separated, or divorced reported a mean of 3.56.

13. The results from the t-test indicated no significant difference for safety behaviors by marital status. Participants that identify as married reported a safety behavior mean of 4.13. Single, separated, or divorced participants reported a mean of 4.03. The means from both groups, single and married, indicated that both married and single firefighters regularly practice safe behaviors.

Research Question 4

Does safety culture as measured by the Anne Arundel Safety Culture Survey and/or safety behavior as measured by the Safety Behavioral Checklist differ by years of experience 'on the job'?

14. The results from the ANOVA indicated there was no significant difference with how Wilmington Firefighters view safety culture by their years of experience as a firefighter. The range for safety culture by years of experience as a firefighter was 3.54-3.61. All the groups recorded means for safety culture by experience in neutral range.

15. The results from the ANOVA indicated no significant difference for safety behaviors by years of experience. The overall mean was 4.11. All groups were very close to the overall mean, indicating that years on the job bear no significance when practicing safe behaviors.

Research Question 5

Does safety culture as measured by the Anne Arundel Safety Culture Survey and/or safety behavior as measured by the Safety Behavioral Checklist differ by one's measure of dependents?

16. The results from the t-test indicated no significant difference in safety culture by the firefighter's dependent status, $t(152) = .493$, $p = .623$. Participants with a dependent reported a mean 3.60 for safety culture. Participants without a dependent reported a mean of 3.55 for safety culture. Both groups, those with a dependent and those without, recorded means for safety culture by experience in the neutral range.

17. The results from the t-test indicate no significant difference for safety behaviors by dependent status, $t(152) = 1.580$ and $p = 0.116$. Those participants that indicated having a

dependent reported a mean of 4.15, which indicated they are regularly participating in safe behaviors. Those without a dependent reported a mean of 3.98, which implies they are regularly practicing safe behaviors.

Research Question 6

Does safety culture as measured by the Anne Arundel Safety Culture Survey and/or safety behavior as measured by the Safety Behavioral Checklist differ by previous injury status?

18. The results from t-test indicated no significance in safety culture by those participants that were previously injured on the job. Data were then collapsed to analyze safety culture by severity of injury. A slight significance was found, $t(63)= 1.999$, $p=0.052$. This finding indicated the more severe the injury the more negatively safety culture was viewed.

19. The results from the t-test indicated no significant difference for safety behaviors by those that were previously injured on the job. Participants that reported being previously injured on the job indicated a mean of 4.11. Those participants that reported never being injured on the job indicated a mean of 4.10. The means from both groups indicated that a previous injury does not bear any significance on firefighters practicing safe behaviors.

20. Participants that reported being injured were separated into two groups, mild and moderate/severe. The mildly injured group reported a mean of 4.16 and participants that have been moderately/severely injured on the job reported a mean of 4.05.

Conclusions

Based on the findings of this study, the following conclusions were drawn:

1. There is a correlation between safety culture and safety behavior. The literature does support the study's conclusion that safety culture does affect safety behaviors (Williams, 2007; Windham, 2005). In Windham's research on The Woodlands Fire Department, Windham (2005) states, "If TWFD is to improve its overall safety performance and reduce exposure of personnel to unnecessary risk, we must change the current safety culture of this department" (p.9).
2. This study is based in the Social Cognitive Theory, the use of this theory is supported by renowned safety behavior researcher, Scott Geller. "Geller distinguishes three, 'dynamic and interactive factors': person, behavior, and environment... basically, Geller applies principles of behaviorism and social learning theory to the field of safety... "(Guldenmun, 2000, p.242).
3. The correlation between safety culture and safety behavior demonstrates reciprocal determinism, one of the constructs of the Social Cognitive Theory.
4. The more positively a firefighter views the safety culture of the department the more likely the firefighter is to partake in safe behaviors. The literature does support the study's conclusion (Windham, 2005). According to Windham, "culture not only influences our behaviors, but it actually determines how we behave" (p.12).
3. Results from this study indicated that these demographic characteristics were not factors in firefighter's views on safety culture or their safety behaviors. The demographics investigated in this study include: (1) education, (2) marital status, (3) years of experience, and (4) dependent status.
4. Results indicated that 73 of 156 participants or 47 percent of participants in this study are of firefighter rank. Research has shown that more injuries tend to occur in the firefighter rank than

any other (Moore-Merrell et al., 2008). Data demonstrated no significant difference of how safety culture is viewed by rank. Also, data demonstrated no significant difference on safety behaviors by rank.

5. Data from this study indicated no significance difference on how Wilmington firefighters view safety culture and their level of education. This study also indicated no significant difference between Wilmington's firefighters safety behaviors by their education levels. A review of available literature was conducted related to studies on education levels and the safety culture and safety behaviors of firefighters. No research studies appeared during this literature review. Though primary research was no existence on the comparison of education levels and safety of firefighters.

6. There was no significant difference of safety culture by marital status. There was no significant difference of safety behaviors by marital status. There is no research available on the effects of marital status and the safety culture and safety behaviors of firefighters.

7. This study found that there was no significant difference for years of experience by safety culture. This study also found that there is no significant difference for safety behavior by experience. These results differ from some of the current research. "More firefighter LOD injuries occur in firefighters with less than 6 years of service and in those with between 11-20 years of service" (Moore-Merrell et al., 2008, p.9). Moore-Merrell et al. (2008) also examined the contributing factors to reported injuries. In the employment bracket of less than 6 years 35% of injuries were attributed to decision making, communication, procedure breach, protocol breach, human error, and situational awareness. These can also be termed as safety behaviors.

8. This study found that there was no significant difference for dependent status by safety behavior. The researcher was unable to locate any available research to compare results.

9. The results from this study indicated no significance difference for safety culture by injuries.
10. Data indicated that the more severe the injury the more negatively safety culture is viewed. Results indicated no significance difference in the safety behaviors of firefighters that reported being previously moderately/severely injured.
11. Participants that identified as not being previously injured on the job reported similar means for safety behaviors as those participants that identified as being previously injured on the job.
12. These findings suggest that Wilmington firefighters are regularly practicing safe behaviors regardless of their injury history.

Recommendations

Based on experiences and findings gained from this study, the following recommendations are offered.

1. Future research needs to be conducted on a larger population, particularly a population that experiences higher injury rates than Wilmington Fire Department.
2. Future research needs to be done on this correlation in order to expand on the relationship between safety culture and safety behavior. Injury reduction plans are more complex than previously thought. Injury interventions were previously comprised of engineering, education, and enforcement (Gielen & Sleet, 2003). Injuries and the behaviors that lead towards injuries are more complex. It was commonly thought that by changing an individual's awareness about the injury would change their behavior but this is not commonly thought now. "Many authors have noted that need to improve behavioral interventions by using better empirical data about

determinants of behavior as well as theories and frameworks pertaining to change in health behavior” (Gielen & Sleet, p.65)

3. Research is needed in investigating demographic characteristics and safety culture and safety behaviors in a larger population. Based upon the demographic information collected from Wilmington firefighter study participants, Wilmington Fire Department is not a diverse population; a larger and more diverse population might establish a significant difference between demographic characteristics and safety culture and safety behaviors.

4. It is recommended the fire service devise a strategic plan that fire department administrators can implement in their departments in order to create a positive safety culture. Until such a plan is devised, it is the responsibility of the administration of each fire department to establish what their current safety culture status is, what areas need improvement, and how best to improve on them.

5. Conducting research on safety culture and departments that have an established positive safety culture would be beneficial; researchers could use findings to establish the basis of the characteristics of a positive safety culture in a fire department.

Summary

This chapter summarized the findings, provided conclusions, and made recommendations for future research. Additional research focusing on the safety culture and safety behaviors of firefighters will assist fire departments by highlighting the areas of safety culture that need to be addressed. Addressing the safety culture within fire departments can assist in creating a positive safety culture thus positively affecting the safety behaviors of firefighters. Chapter Six will

focus on the importance of the study, observations about the study, implications for administration of fire departments, implications for firefighters, and a discussion section.

Chapter VI

THE STUDY IN RETROSPECT

Purpose

The purpose of this study was to investigate the safety culture and safety behaviors of professional firefighters in a metropolitan fire department. By surveying the firefighters, information collected can assist with comprehending their safety behaviors and their safety culture. Therefore fire departments can use to create initiatives that address the identified unsafe behaviors and the safety culture.

Observations about the Study

When working in the line of duty firefighters are always at risk for injury. It is important to address controllable risks such as safety behaviors and wearing department issued personal protection equipment properly. As demonstrated by this study and previous studies, how safety culture is viewed is one of the factors that determine whether a firefighter will properly wear his/her personal protection equipment. “It’s the cultural climate that shapes the attitudes and guides the behavior” (Richardson, 2008, p.17). Its important to address firefighter safety because metropolitan professional firefighters are city employees. Taxpayers fund their injuries and healthcare costs. Also, firefighters are public health workers; their job is to protect the public and property. If firefighters are fatally injured or severely injured than the public is vulnerable for injury or death due to fire and other hazards firefighters protect against. Addressing and improving the safety culture within the fire department has been recognized as a focus area for the fire service. The 2004 Firefighter Life Safety Summit served to establish 16 initiatives, “the

first initiative related to improving the culture within the fire service. In fact, this seemed to be the most fundamental issue among all participants” (Williams, 2007, p.9). Also, according to Williams (2007), the Firefighter Life Safety Summit intends to “reduce the number of firefighter deaths by establishing a mechanism to measure and act upon fire department culture” (p.9). Placing ‘improving safety culture’ as a top initiative and planning to establish a way to measure and improve safety culture in fire departments is a step to reducing injuries and deaths among firefighters (Williams, 2007). While research has been conducted on the safety culture of fire departments little research has been conducted on how to create and implement a plan that would positively affect the safety culture of fire departments. Further research needs to be conducted and various fire departments that report positive safety cultures should be studied in order to establish a validated plan that other fire departments can implement. The results obtained from this study can be used by the City of Wilmington to form and implement a plan to address the safety culture of the department and the safety behaviors of the firefighters. The data demonstrates the strength the weaknesses of the department. The study highlights the areas that would benefit Wilmington to address and areas that Wilmington succeeds in.

The researcher’s communication and experiences with various fire departments and through conducting the literature review for this study, leads to the belief that fire departments recognize the importance of addressing the safety culture issues, but there is no established plan nor is there follow-up on actions.

Implications for Administration of Fire Departments

This study provides data indicating there is a correlation between the safety culture of a fire department and the safety behaviors of its firefighters. The Firefighter Life Safety Summit

officially recognized the importance of addressing the safety culture of fire departments and set safety culture as a top initiative. By addressing the safety culture of a department, the administration is also addressing firefighters injuries and death rates. For these reasons it is important that the administration of fire departments address the safety culture concerns of the department. According to Maxwell (as cited in Richardson, 2008) “although resources such as apparatus, tools, equipment, and facilities, are essential towards meeting goals and objectives, the primary success factor is the development of people and the organization’s culture ”(p.4). One researcher suggested that if culture is to change there are certain elements that must be present. According to Williams (2007), the elements that must be present include, “ (a) an urgent need to change and it must be communicated; (b) resources and capabilities to change must exist; and (c) an action plan to guide the transition from old to new must be developed” (p. 21).

Implications for Firefighters

In most work places, when work hazards are identified, the hazard is typically addressed and removed, thus work can occur in a safe manner and in a safe environment. In firefighting, there is no method to remove all the hazards (Young, 2001). “As the hazard cannot be removed it is necessary for the safety of the firefighter to be through some other means. In other words the firefighter needs to become a safe person” (Young, 2001, p. 4). Creating a positive safety culture environment is one method to develop safe firefighters. An implication of fire departments focusing on safety culture and positive safety behaviors has been the improvement of fire equipment with safety as a focus. An example of this is available on newer fire trucks and engines. Similar to seat belt devices in cars, if a seat belt is not buckled in the fire truck or engine, the drive/chauffer will be notified via a beeping noise. In some additions of this model,

the driver can also be informed of which seat does not have the seat belt buckled. This technology can be helpful; however, firefighters have found a way to make the technology ineffective. A firefighter can buckle the seatbelt, then sit; the alert system will show that the seatbelt is fastened though the firefighter is not buckled in safely. Technology can be helpful but if there is not a positive safety culture present then technology can be ineffective. If a positive safety culture was established in this hypothetical situation, then possibly the firefighter would use the seat belt as instructed or another firefighter would step in and request the firefighter use the seat belt as intended.

Implications for Administration/Organization

It is important to recognize that firefighting is inherently a risky occupation, but there are areas where risks can be reduced. A positive safety culture in a fire department can positively affect safety behaviors. Data collected and analyzed from the Wilmington Fire Department reported an overall means for safety culture as neutral based on the Likert Scale, the firefighters neither agree with it nor disagree. This neutral attitude should not be viewed as a positive attitude towards safety. Wilmington Fire Department has experienced some recent changes, including a change in Chief of Department. With the change of Chief of the Department, came a change in how the upper administration of the department viewed safety. Wilmington is currently working on improving their safety culture. The WFD has designated a safety officer and implemented other safety initiatives. The administration of Wilmington Fire Department did conduct their own study prior to implementing some of these changes. The implications of their changes have yet to be seen since the instituted changes are relatively recent. Hopefully, more research will be

conducted on Wilmington Fire Department as the effects of these changes progress. It is the belief and hope of this researcher that more research is conducted on safety cultures of fire departments and safety behaviors of firefighters. This is an area that can reduce risks and assist fire department with lowering the number of injuries and deaths that occur beyond the Wilmington Fire Department.

Summary

This chapter provided the importance of the study, observations about the study, implications for firefighters, and implications for administration of fire departments.

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APPENDICES

APPENDIX A

Safety Culture Survey

In this section, you will be presented with a series of statements concerning health and safety in your department. Please mark the response that best represents your feelings about the statement.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A Don't Know
1. The department is genuinely concerned about safety.	☐	☐	☐	☐	☐	☐
2. Leadership provides a positive climate that promotes reasonably safe Fire/EMS operations.	☐	☐	☐	☐	☐	☐
3. The number of local and national firefighter deaths and injuries is unacceptable.	☐	☐	☐	☐	☐	☐
4. Firefighting has been made about as safe as it can be.	☐	☐	☐	☐	☐	☐
5. The department is doing more now to promote safety than in the past.	☐	☐	☐	☐	☐	☐

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A Don't Know
6. Leadership conducts adequate reviews and updates of safety standards and operating procedures.	☐	☐	☐	☐	☐	☐
7. The department has a defined process to set training goals and to review performance.	☐	☐	☐	☐	☐	☐
8. Leadership closely monitors proficiency and currency standards to ensure firefighters are qualified to function.	☐	☐	☐	☐	☐	☐
9. Leadership is actively involved in the safety program and management of safety matters.	☐	☐	☐	☐	☐	☐
10. Our Health/Safety Policies and Procedures are adequate in communicating standards needed for conducting safe operations.	☐	☐	☐	☐	☐	☐

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A Don't Know
11. Supervisors encourage reporting safety discrepancies without the fear of negative repercussions.	☐	☐	☐	☐	☐	☐
12. Co-Workers are willing to report safety violations, unsafe behaviors or hazardous conditions	☐	☐	☐	☐	☐	☐
13. Peer influence is effective at discouraging violations of standard operating procedures, or safety rules.	☐	☐	☐	☐	☐	☐
14. Violations of safety operating procedures are rare.	☐	☐	☐	☐	☐	☐
15. My department has a reputation for high-quality performance.	☐	☐	☐	☐	☐	☐
16. My supervisors closely monitor quality and correct any	☐	☐	☐	☐	☐	☐

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A Don't Know
deviations from established quality standards.						
17. Supervisors permit cutting corners to get a job done.	☐	☐	☐	☐	☐	☐
18. I have sometimes felt too fatigued to do my job safely.	☐	☐	☐	☐	☐	☐
19. Lack of experienced personnel has adversely affected my station/assignment's ability to operate safely.	☐	☐	☐	☐	☐	☐
20. Safety decisions are made at the proper levels, by the most qualified people in my command.	☐	☐	☐	☐	☐	☐
21. Leadership takes the time to identify and assess risks associated with its Fire/EMS operations.	☐	☐	☐	☐	☐	☐
22. Supervisors do a good job managing risks associated with its operations.	☐	☐	☐	☐	☐	☐

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A Don't Know
23. I am provided adequate resources to accomplish my job.	☐	☐	☐	☐	☐	☐
24. Equipment and facilities are designed with safety in mind.	☐	☐	☐	☐	☐	☐
25. Operational Risk Management processes are incorporated into decision-making at all levels.	☐	☐	☐	☐	☐	☐
26. My department would rather lose a building than unnecessarily risk my personal safety.	☐	☐	☐	☐	☐	☐
27. My supervisor can be relied on to keep his/her word.	☐	☐	☐	☐	☐	☐
28. Leadership is successful in communicating its safety goals to unit personnel.	☐	☐	☐	☐	☐	☐
29. Leadership communicates the lessons learned from collision/injury investigations.	☐	☐	☐	☐	☐	☐

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A Don't Know
30. Mistakes have actually led to positive changes.	☐	☐	☐	☐	☐	☐
31. Leadership sets the example for compliance with standards.	☐	☐	☐	☐	☐	☐
32. Leadership reacts well to unexpected changes to its plans.	☐	☐	☐	☐	☐	☐
33. My supervisor does not hesitate to temporarily restrict individuals from functioning who are under high personal stress.	☐	☐	☐	☐	☐	☐
34. I am adequately trained to safely conduct all of my duties.	☐	☐	☐	☐	☐	☐
35. Morale and motivation at my station/assignment is high.	☐	☐	☐	☐	☐	☐
36. Leadership provides adequate safety backups to catch possible human errors during high-risk operations.	☐	☐	☐	☐	☐	☐

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A Don't Know
37. Good communications flow exists up and down the chain of command.	☐	☐	☐	☐	☐	☐
38. Safety education and training are adequate in my command.	☐	☐	☐	☐	☐	☐
39. The Health/Safety Division is well-respected.	☐	☐	☐	☐	☐	☐
40. I am kept informed of important safety information.	☐	☐	☐	☐	☐	☐

Safety Behavior Survey

In this section, you will be presented with a series of statements concerning health and safety behavior in your department. Please mark the response that best represents your feelings

	Never	Occasionally	Frequently	Regularly	Always	N/A Don't Know
1. All the firefighters are seated with their seatbelts on before the apparatus responds to the call	☐	☐	☐	☐	☐	☐
2. When preparing to respond to an emergency my bunker coat is buttoned fully with collar up	☐	☐	☐	☐	☐	☐
3. When entering an emergency situation the chin strap on my helmet is fastened	☐	☐	☐	☐	☐	☐
4. I wear my face piece before entering a smoke filled area.	☐	☐	☐	☐	☐	☐
5. I wear my face piece during overhauling	☐	☐	☐	☐	☐	☐
6. When on the scene of an emergency and when operating I wear gloves	☐	☐	☐	☐	☐	☐
7. I use the hand holds when getting on and off apparatus	☐	☐	☐	☐	☐	☐

about the statement.

8. I ensure apparatus is fully stopped before getting on or off apparatus	☐	☐	☐	☐	☐	☐
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APPENDIX B

Approval from Wilmington Fire Department

-----Original Message-----

From: Frank.Blackley@wilmingtonnc.gov [<mailto:Frank.Blackley@wilmingtonnc.gov>]

Sent: Wed 6/9/2010 12:22 PM

To: Freaney, Christine Marie

Cc: jason.jordan@wilmingtonnc.gov; jon.mason@wilmingtonnc.gov

Subject: RE: Research

Christine,

We are good to go to help with your surveys. If you would contact our department's safety officer (Capt. Jason Jordan) to coordinate that would be great. His office number is 910-772-4124.

Asst. Chief Frank Blackley

Operations Division

Wilmington Fire Dept.

801 Market St.

Wilmington, NC 28401

910-343-3939

910-343-4772 (fax)

www.wilmingtonnc.gov/fire

APPENDIX C

Survey Instrument Approval: Anthony Ciavarelli

Dear Ms. Freaney:

Yes -- I strongly encourage you to pursue your doctorate in the area of Safety Climate and Culture assessment. You have my permission to use the survey adapted by Allen S. William. He did a fine study in his community and I am sure that you and your own participants will benefit as well from this line of research.

The survey is copyrighted -- but that is to protect commercial application -- and not academic and scientific research. I do expect, however, to be on distribution for your dissertation research and publications. And you must ensure me that there will be no commercial interest involved.

In support of your dissertation -- you may want to discuss changes made to the survey over the past few years to improve the instrument -- as we have applied it in Aerospace, and used revised survey items for Aviation and Health Care.

Give me a call if you want to discuss your research and would like further background on our own applications.

Anthony Ciavarelli, Ed.D. President, Chief Scientist *HUMAN FACTORS ASSOCIATES,*

INC <http://www.hfa-oses.com>

18367 Corral Del Cielo

Salinas, CA 93908-9115

Phone voice: 831.484.8033

Cell: 831.594.0856

Fax 831.484.0224

APPENDIX D

Survey Instrument Approval: Allen S. Williams

Christine,

Thanks for the interest in the Safety Culture Study completed with the Anne Arundel County Fire Department. A number of the questions that I used in the Anne Arundel Survey belong to Dr. Ciavarelli from the Post Naval Graduate School in California. Those specific questions are listed in Appendix D on page 64 of my research paper. You are welcome to use any of my questions, but only he could authorize the use of his questions. I've included my contact information for him below. Depending on the scale that you intend to use them, I imagine he would allow you to use them.

Another suggestion might be to use the survey in the latest study I did in Safety Culture. It assessed the safety culture within the State of Maryland, not just one county within the state. Honestly, this survey is probably more valid than the one used in the Anne Arundel Survey as I worked closely with a Doctorial Candidate who had done similar work in Canada. All of the questions in this survey belong to Bill Pessemier. He completed the survey as part of the "Everyone Goes Home Initiative." Here's a link to that web site.

<http://www.everyonegoeshome.com/>

Here's the link on that website to the report referencing Bill Pessemier's work:

<http://www.everyonegoeshome.com/resources/osu/OSU->

[FPP_LODDReportPhaseII.pdf](#)

Contact information for Bill is also listed below. He was very willing to allow me to use the survey and edit it in any fashion I wanted. I imagine he would offer the same to you.

Good luck. If I can help further, let me know.

...Allen

APPENIX E

IRB Form

FORM A

Certification for Exemption from IRB Review for Research Involving Human Subjects

A. PRINCIPAL INVESTIGATOR(s) and/or CO-PI(s) (For student projects, list both the student and the advisor.):

Christine Freaney, MHA Gregory Petty, Ph.D.
Principal Investigator Professor and Faculty Advisor

B. DEPARTMENT: Department of Nutrition

C. COMPLETE MAILING ADDRESS AND PHONE NUMBER OF PI(s) and CO-PI(s):

Christine Freaney, MHA	Gregory Petty, Ph.D.
8313 Landmark Dr.	1914 Andy Holt Ave
Knoxville, TN 37923	HPER 390
	Knoxville, TN 37996

D. TITLE OF PROJECT: Safety Behaviors and Safety Culture Among Firefighters

E. EXTERNAL FUNDING AGENCY AND ID NUMBER (if applicable): N/A

F. GRANT SUBMISSION DEADLINE (if applicable): N/A

G. STARTING DATE (NO RESEARCH MAY BE INITIATED UNTIL CERTIFICATION IS GRANTED.): Upon IRB approval

H. ESTIMATED COMPLETION DATE (Include all aspects of research and final write-up.): April 2011

I. RESEARCH PROJECT

1. Objective(s) of Project (Use additional page, if needed.):

Objectives for this project include:

- 1) Add to the current body of knowledge pertaining to safety culture and safety behavior among professional firefighters
- 2) Collect and analyze self-reported responses from active duty firefighters of a metropolitan city
- 3) To create a profile of safety behavior and safety culture

2. Subjects (Use additional page, if needed.):

Subjects who will be requested to participate in the survey will be active firefighters. The firefighters names will not be collected and the firefighters themselves will remain anonymous. Individuals participating in the study will be over the age of twenty-one years ~~of age~~ and the request to participate will occur in person. Responses to the surveys will be kept in a secure location.

3. Methods or Procedures (Use additional page, if needed.):

The following methods will be used to collect survey information:

- 1) The researcher will obtain information regarding firehouses activity levels from the fire departments recorded emergency responses. Three firehouses from each of the five boroughs will be chosen based on their activity levels. A different firehouse will be chosen to represent low, moderate, and high levels of activity.
- 2) The Captains of the participating firehouses will be notified of the study by the Chief of Safety, of the department. Captains of the firehouses will also be contacted by researcher five days prior to researcher being on site.

- 3) Researcher will collect data on site. Data will be collected before and after the two scheduled shift changes, 9 am and 6 pm. Research will be collected at each site for three days.
- 4) Each willing participant will be handed an informed consent form, instructions for the survey, and the survey itself. Once participant has completed survey, the participant will be instructed to place survey face down in a manila envelope. The envelopes with complete surveys will be secured in a locked cabinet at researchers residence (39 Vinton st, Long Beach, N.Y. 11561). Survey responses will be ~~confidential and~~ anonymous. All identifier information will be removed.
- 5) Participants will be able to contact the researcher with any questions or concerns about the research project or survey. Contact numbers will be provided with the survey instructions and informed consent form.

Participant completion of this survey will be voluntary and responses will remain anonymous and ~~confidential~~. Final survey results will be kept in a locked cabinet in the researchers residence (39 Vinton st., Long Beach, NY 11561). Completed surveys will not have an individual identification locator number or name. Completed data will be entered directly into the Statistical Program for Social Sciences (SPSS). Data will be analyzed using SPSS. The data obtained from the survey will be used for competing a dissertation and for developing manuscripts for possible publication.

4. CATEGORY(s) FOR EXEMPT RESEARCH PER 45 CFR 46 (See instructions for categories.):

This project should receive category two exemption status because the research uses a self-reported survey with a design that ensures confidentiality and requires no names, social security numbers, or other forms of identification. The data that is gathered will be recorded in a manner that no participant will be identified and only aggregate data will be reported.

J. CERTIFICATION: The research described herein is in compliance with 45 CFR 46.101(b) and presents subjects with no more than minimal risk as defined by applicable regulations.

Principal Investigator:	_____	_____	_____
	Name	Signature	Date
Student Advisor:	GREGORY PETTY		4/29/2010
	Name	Signature	Date
Department Review Committee Chair:	Michael Zemel		4/30/10
	Name	Signature	Date
APPROVED:			
Department Head:	Jay Whelan		4/30/10
	Name	Signature	Date

COPY OF THIS COMPLETED FORM MUST BE SENT TO COMPLIANCE OFFICE IMMEDIATELY UPON COMPLETION.

VITA

Christine Freaney was born and raised in Long Island, N.Y. Christine earned her Bachelor's of Arts degree from the University of North Carolina at Wilmington in 2003. She then attended Hofstra University and graduated with a Master of Health Administration degree in 2006.

After commencement, Christine was hired by New Hanover County Health Department as a health educator and Coordinator of Project ASSIST (Project American Stop Smoking Intervention Study) for New Hanover, Pender, and Brunswick Counties. As coordinator for Project ASSIST, Christine was responsible for organizing and implementing tobacco education related events for populations ranging from children to adults.. She worked with local politicians and local government branches to institute stricter health policies regarding tobacco use in public areas. Also, she was responsible for administering, organizing, and conducting a tri-county tobacco coalition. In addition to coordinating Project ASSIST, Christine created and implemented an asthma awareness program for New Hanover County.

Christine resigned from her position as Coordinator of Project ASSIST to pursue her doctorate at the University of Tennessee, Knoxville. While enrolled in the doctoral program Christine was a Graduate Teaching Associate (GTA). As a GTA, she was responsible for teaching Health 110-Personal Health and Wellness, Health 300-Health Education, Promotion, and Behavior, and Public Health 311-Advanced First Aid and Emergency Care. During her tenure at Tennessee, Christine created and conducted dietary education sessions for people with HIV/AIDS. In 2010, Christine became a nationally Certified Health Education Specialist (CHES). Also, in 2010, she was selected as a safety student ambassador for the National Safety Council.

Christine's doctoral research topic was inspired by her father, Peter Freaney. Peter Freaney is a retired Captain of the FDNY where he worked for 33 years.