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A Look at the Deaths of Career and Volunteer Firefighters in America: Who has the Higher Rate of Death?

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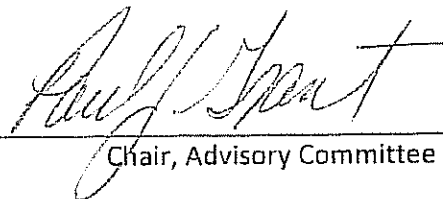
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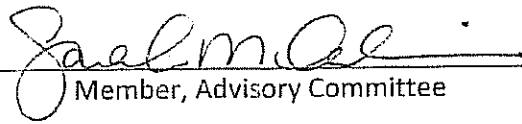
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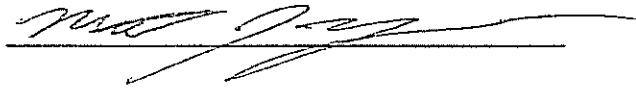


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A Look at the Deaths of Career and Volunteer Firefighters in America:

Who has the Higher Rate of Death?

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2010

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in partial fulfillment of the requirements

for the degree of

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DEDICATION

This thesis is dedicated to my mother who always pushed for me to succeed in school.

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I would like to thank my committee chair, Paul Grant, for his help throughout my college career. From my first semester until the submission of my thesis, he has been there to help me along the way. I would also like to thank the other committee members, Scotty Dunlap and Sarah Adkins, for their comments and assistance. I would like to express my thanks to my wife, Emily, for her understanding and patience for those times that school ruled my life. Also, thank you to all my fellow graduate students that made the experience so enjoyable.

Abstract

This study will look at whether career or volunteer firefighters are more likely to die while engaging in firefighting activities, including training. Also, it will look at the causes of death and determine the leading cause of death for both career and volunteer firefighters. This will be done through looking at the numbers of firefighter deaths reported and applying statistical analysis. Only municipal fire departments will be included in this study.

Table of Contents

Chapter	Page
1. Introduction.....	1
2. Literature Review.....	7
3. Methods.....	14
4. Results.....	16
5. Discussion and Conclusion.....	17
References.....	28
Appendix: Figures and Tables.....	33

List of Tables

Figure	Page
1. Firefighter Deaths: 1990 to 2007.....	34
2. Death Rates per 100,000: 1990 to 2007.....	35
3. Career Deaths: 1994 to 2004.....	37
4. Volunteer Deaths: 1994 to 2004.....	39

List of Figures

Figure	Page
1. Career Death Percentage – 1994 to 2004.....	36
2. Volunteer Death Percentage – 1994 to 2004.....	38
3. Firefighter Death Rates Per 100,000 Firefighters	40

Chapter 1

Introduction

Background

Firefighting is often viewed as one of the most dangerous professions in the United States. Each year, approximately 100 firefighters lose their lives while performing their firefighter duties. Nevertheless, the average citizen knows little about the causes of death among firefighters and how the causes of death differ between career firefighters (those whose paid occupation is firefighting) and volunteer (unpaid) firefighters. In this paper, I provide some data regarding these issues.

In 2006 there were 1,140,900 firefighters in the United States. Of these, there were approximately 823,950 volunteer firefighters and approximately 316,950 career firefighters. Roughly 95 percent of volunteers were in communities of less than 25,000 and of that 95 percent, about half were in communities of less than 2,500 people. Roughly 74 percent of career firefighters were in communities of over 25,000 people. In 2006, fire departments in the United States responded to a call approximately every 19 seconds (National Fire Protection Agency [NFPA]a, 2007). Over the past 18 years, 1,763 firefighters have died on duty (NFPAa, 2008). “On-duty fatalities include any injury sustained in the line of duty that proves fatal, any illness that was incurred as a result of actions while on duty that proves fatal, and fatal mishaps involving non-emergency occupational hazards that occur while on duty” (Fahy, LeBlanc, & Molis, 2007, p. 1). These incidents include sudden cardiac arrest, asphyxiation, motor vehicle accidents, burns, and drowning. “Career firefighters include full-time uniform firefighters regardless

of assignment (i.e. suppression, administrative, prevention/inspection, etc.)” (NFPAA, 2008. p. 2). Volunteer firefighters are anyone who participates in the fire department without being paid. There is consistently a large difference in the number of deaths between career and volunteer firefighters.

Firefighter Deaths

Firefighters Deaths as a Whole

Firefighters die each year in many different ways. Some of these deaths are preventable, others are not. Sudden cardiac arrest is the leading cause of death among firefighters. In 2007, sudden cardiac arrest was the cause of death for 38 firefighters. That was nine more than the next closest cause of death. The total number of firefighters that died in 2007 is 102 (NFPAb, 2008). Out of the 38 firefighters that died of cardiac arrest there were 10 who had severe arteriosclerotic heart disease, five were hypertensive, the next four had prior heart conditions, and three of the firefighters were diabetic (Fahy et al, 2007). There are many locations where these incidents take place. (i.e. fire ground, responding/returning, on scene [non-fire], training, the fire house.) Since 1990 there have been 726 firefighters killed during fire ground operations, (not including the firefighters killed on September 11, 2001); 467 were killed either responding to or from the call, 139 killed on non-fire calls, 168 died during training, and 246 died in other areas (NFPAc, 2008). The average number of firefighters that die each year is approximately 100 (U.S. Fire Administration [USFA], 2001). “In 2007, 27 firefighters died in vehicle crashes.” (Fahy et al, 2007 p.8) Of the 27 firefighters who died, 11 of them were unrestrained.

Eight of the 11 were ejected from the vehicles and two were partially ejected (Fahy et al, 2007). Motor vehicle crashes are a leading cause of on duty death.

Volunteer Firefighters

Deaths of Volunteer Firefighters

Since 1990, there have been 1018 volunteer firefighters die on duty (NFPAa, 2008). In 2000, there were 102 firefighters killed and 63 percent of those killed were volunteers. Out of the 63 percent, 39 percent were rural volunteer firefighters. The remaining proportion consists of suburban/ urban volunteer departments (USFA 2001). Volunteer firefighters tend to operate in rural areas with large areas of farmland and farms tend to use chemicals that are dangerous when burning. Between 1993 and 1995 there were 76 deaths due to the release of these hazardous substances (Berkowitz, Horton, & Kaye, 2004). In 2007, 53 volunteer firefighters died on duty. Sudden cardiac arrest was once again the number one cause of death, twenty-one firefighters died of cardiac arrest. The next leading cause was internal trauma, resulting in the deaths of 19 volunteer firefighters. The number one type of duty involved with these causes of death was responding to or returning from a call. Seventeen volunteers died in vehicle crashes (Fahy et al, 2007).

Motor vehicle crashes are the second leading cause of death overall for volunteers. Between the years 1994 and 2004, 610 volunteers died. Twenty-six percent of those deaths were in motor vehicle crashes. One example: a volunteer firefighter was en route to an emergency traveling 80 mph on a 55 mph road. The volunteer firefighter lost control of the vehicle and went off the road, neither occupant was wearing a seat belt.

The driver of the vehicle was killed and the passenger was severely injured. Personally owned vehicles are most often involved in the fatal crashes, followed by water tankers (MMWR, 2005).

Career Firefighters

Deaths of Career Firefighters

The NFPA reported, between 1990 and 2007, 526 career firefighters died on duty (this does not include the 340 firefighters that died September 11, 2001) (NFPAa, 2008). “Sudden cardiac arrest is consistently the number one cause of on-duty firefighter fatalities in the U.S., and this was the case again in 2007.” (Fahy et al, 2007, p.4) The second leading cause of death among career firefighters was asphyxiation. There were 15 firefighters that died from sudden cardiac arrest and 13 from asphyxiation. Five firefighters were killed in motor vehicle accidents. In 2007, more firefighters died than in any year since the World Trade Center. Nine career firefighters died in Charleston, South Carolina, at a furniture store which had caught fire. There were six other cases of multiple losses of life; those involved two firefighters each. A water tanker crash, propane explosion, and four incidents of interior operation were the causes of the other multiple losses of life. Career firefighters had six personnel die from burns, then one die from drowning, crushing and electrocution each (Fahy et al, 2007). The largest number of career firefighters to die in one year since 1990 is 42 in 2007. The closest number to that was 37 in 1999 (NFPAa, 2008). This is not including the deaths at the World Trade Center.

There are a larger number of volunteer firefighters in America and the volunteers, on average, have a higher loss of life. In the eastern part of the United States, volunteers are still the most prevalent type of firefighter, except in large cities. Volunteer and career firefighters share the number one cause of firefighter fatalities, but after that they have different causes that are most often seen. “Other” category is the second leading cause of death for career firefighters and motor vehicle accidents are the second leading cause of death for volunteers. Each face their own dangers but, it is the firefighters’ health which gets them most often, not the fires. Both types of firefighters put themselves in danger, from responding to an emergency to training for the emergency call. Each has a significant loss of life.

Problem Statement

Firefighters are dying at an alarming rate each year. The number of firefighters dying each year tends to be approximately 100. According to the NFPA, 1,763 firefighters have died between 1990 and 2007. Those in the profession need to understand who is dying and how they are dying. The problem is with the advancements in technology and strategy, there are still approximately 100 firefighters dying each year during the years covered in this study. We need to know how firefighters are dying and which group, career or volunteer, have the higher risk of death.

Purpose of the Study

With an average of approximately 100 firefighters dying each year, there needs to be an understanding of whom (career or volunteer) is dying and what are the leading causes of these deaths. This study is intended to look at the rates at which career and

volunteer firefighters die and what the leading causes of death are. The main purpose of the study is intended to look at which, career or volunteer, have a higher risk of death.

Importance of the Study

Firefighters' lives are on the line. There needs to be an understanding of whom and how they are dying. The information in this study will give the people in the position to make change much important data. This will allow them to begin making the necessary steps to correct the deficiencies that have allowed approximately 100 firefighters to die each year. Without the proper knowledge, things are unable to change. Without change, firefighters will continue to die in the same ways and at the same rate.

Assumptions and Limitations

It will be assumed the data that is being used for the analysis is correct because it has been collected by the NFPA. The NFPA is a leader in the fire profession and is being relied upon for the data they have collected.

The limitations of the study will be in the fact that the numbers of calls that each category of firefighter has responded too has not been taken into consideration. Only the numbers of firefighters, number of deaths, and causes of death have been reviewed.

Chapter 2

Literature Review

According to an NFPA News article, motor vehicle accidents are a more likely cause of death among firefighters than any cause of death related to fighting fires (not including cardiac arrest). In the report it states that there were 37 firefighters killed while responding to or returning from an emergency scene. Out of those 37 deaths, 33 were involved in motor vehicle accidents. Those 33 deaths account for approximately 32 percent of the 105 line of duty deaths in 2003. The report lists hydroplaning, driving too fast and not wearing seatbelts as causes of accidents and deaths among the firefighters involved in these incidents. The report goes on to talk about the leading cause of death among firefighters as being stress and overexertion. Of the 105 line of duty deaths in 2003, 47 were from stress induced heart-attacks. The report states that heart attacks are the leading cause of death among firefighters on a consistent basis and many of those who die of heart attack have had previous heart problems. The report concludes that many firefighter deaths are preventable. (Vehicle crashes, 2004)

In the article, “Firefighter Fitness, Coronary Heart Disease, and Sudden Cardiac Death Risk”, the researchers looked at how the items in the title play into the culture of the fire service. The study took a special interest in the physical fitness of firefighters in regards to being a factor for coronary issues. The research team used questionnaires to determine what the culture among firefighters is in regards to physical fitness. The research shows that among firefighters, as long as they are able to perform their duties and are not holding the crew back, then they are in good physical condition. The culture

of the firefighter and fitness are tied closely to job performance. According to the study 45 percent of all firefighter deaths are due to cardiac heart disease and of that 45 percent a small portion is during fire suppression. The report concludes that the culture needs to be examined and addressed to assist in reducing the number of firefighter deaths due to cardiac heart disease. (Linnan et al, 2011)

The U.S. Fire Administration issued a report looking at the causes, firefighter classification, time, and locality of firefighter deaths. In the report heart attack is the leading cause with trauma following second. These two causes of death make-up approximately 75 percent of the causes among firefighters. Asphyxiation, other, and cerebrovascular accident finish out the causes of death. According to the report approximately 53 percent of the deaths were volunteers and approximately 38 percent were career. The states that have had the most firefighter deaths during the scope of the report are New York, California, Pennsylvania, North Carolina, and Ohio. The report concludes that heart attacks are the leading cause of firefighter deaths and that most firefighter deaths do not occur on the fire ground. (USFA, 2012)

In terms of firefighter line of duty death, cardiac events are shown to be the cause of between 40 and 50 percent of them according to the article titled “Acute effects of firefighting on arterial stiffness and blood flow”. The research conducted for this article focused on how firefighting activities affect vascular functions and if vitamin C would be able to reduce the impacts. The researchers put several firefighters through three hours of firefighting activities and performed several test to check their vascular functions. The tests showed “that 3 hours of firefighting activities acutely increased central artery stiffness and the augmentation index, while simultaneously increasing micro-vascular

function and producing carotid artery dilation.” (Agiovlasitis et al, 2011) According to the article this shows that three hours of firefighting activities are closely related to maximal aerobic exercise. It also showed that the vitamin C had no impact on the variables that were being observed during the study. (Agiovlasitis et al, 2011)

From 1998 to 2001 there were 191 medical, 75 motor vehicle and 144 non-motor vehicle trauma firefighter fatalities. In the article written by R. Braddee et al., it states that the number of firefighter killed in a structural firefighter had declined by 59 percent. Though with this decline the number of firefighter fatalities from traumatic injuries during structural fires has increased. The article looks at the three categories above and breaks them down further. Approximately 90 percent of the medical fatalities came from myocardial infarctions. In regards to the motor vehicle accidents, 37 percent were single vehicle accidents. The motor vehicle accidents account for the second largest cause of death. Asphyxiation and burns account for 48 percent of the non-motor vehicle trauma fatalities. Within the non-motor vehicle trauma fatalities 68 percent were related to structural fires. The article states that there needs to be more training in regards to assessing the likelihood of a collapse during a structure fire. (Braddee et al, 2004)

Firefighters are exposed to several things that are known or suspected to cause cancer. The study conducted by Dr. Kang et al, looks at what types of cancers that firefighter are at an elevated risk of developing due to exposures on the job. The focus was on white firefighters in the state of Massachusetts, this is due to the low number of minority and women firefighters during the period of the study. The cancers that the researchers found to have the most elevated probability were colon and brain cancer. There was also an elevated risk of bladder cancer. The comparisons were made between

all white males that met the study requirements in the state of Massachusetts and a separate sub-group of police officers. There was an elevated risk of melanoma for firefighters when compared to the general population but when compared to the police officer sub-group the risk decreased. Police have a higher risk of melanoma. The researchers believe the elevated risks in the certain cancers are related to certain substances that firefighters are likely to come into contact with while performing their duties. (Davis et al, 2008)

In the research article titled “Cancer Risk Among Firefighters: A Review and Meta-analysis of 32 Studies” the researchers are trying to determine the probability of cancer in firefighters. The researchers set out a set of criteria for the research and 32 cases were discovered, upon further review the number was taken down to 26 cases. When the researchers were looking at those 26 cases they discovered that certain cancers were a higher probability for firefighters. Three cancers were listed as probable for firefighters and they were identified as multiple myeloma, non-Hodgkin’s lymphoma, and prostate cancer. The researchers also looked at and proposed upgrading testicular cancer to the level of probable. The researchers believe that there is a likely connection between these cancer and compounds that firefighters are exposed to on the job. (Barriera-Viruet et al, 2006)

From 1995 to 2004 there were 440 career firefighter fatalities due to sudden cardiac death. That number accounts for 44 percent of the fatalities during that time period. The research conducted by Donovan et al, shows that this number is twice that of police officers. The article states that the reason for such high numbers is still unknown but other research has pointed to individual risk factors. This article focuses on metabolic

syndrome or multiple cardiovascular disease risk factors. The research showed that 15 percent of the test subjects met the criteria for metabolic syndrome. There were also 25 percent to be found to have a cardiovascular level lower than would be deemed safe to perform the job of a firefighter. The study also showed that firefighters are less likely to have metabolic syndrome than the general public. Within the study there were multiple test groups broken down by age group. The research showed that the test group ages 20-29 that fourteen percent of them met the criteria for metabolic syndrome which is double that of the general population. The researchers state that this is something that needs to be watched and also that it may be an anomaly due to the small nature of the study.

(Donovan et al, 2009)

Motor vehicle crashes are listed as the second leading cause of death for firefighters according to the article “Analysis of Firetruck Crashes and Associated Firefighter Injuries in the United States.” The article states that motor vehicle crashes account for between 20 and 25 percent of all firefighter fatalities, second only to stress and over exertion. In the 10 year span of 2000 to 2009 there were 49 fire vehicle related crashes that led to a firefighter fatality. According to the research rollover crashes are the type of crashes that are most likely to lead to a firefighter fatality. Firefighter ejection is also a leading cause of fatalities during crashes. The researchers found that 42 percent of the firefighters surveyed believed that due to the trucks size and weight there was no need to wear a seatbelt. Most though stated that they did not wear a seatbelt because they had trouble with them while wearing their fire gear. The rate of firefighter fatalities due to motor vehicle crashes has remained fairly constant even though many departments

require that personnel wear their seatbelt at all times according to the report. (Donouge et al, 2012)

“Within the United States, there are an estimated 1.1 million firefighters involved in the response to fire and associated emergencies.” (Burton, 2007) He also states that there are approximately 100 firefighters killed each year and the leading cause is heart attack. It is shown that heart attacks make-up approximately 44 percent of the firefighter fatalities, followed by trauma at 27 percent. Career firefighters were shown to be 33 percent of the fatalities and volunteers 57 percent. The article states that the career firefighters’ rate is abnormally high due to the fact they account for approximately 28 percent of the fire service. Over twenty percent of firefighter fatalities have been linked to motor vehicle crashes since the mid 1980’s. Out of that percentage, one quarter has been shown to be volunteers in their personally owned vehicles. The article points out that even though technology has advanced, approximately the same numbers of firefighters are dying. It also states the root causes to be health and motor vehicle operations. (Burton, 2007)

Throughout the literature review a common theme is that heart attacks or heart related issues are the leading cause of death among firefighters. Also, a common theme is that motor vehicle crashes are the second leading cause. Some of the literature points to common causes of the heart related issues but others point to other ideas. There is no set consensus on the reason behind heart related issues being the leading cause of death among firefighters. Most agree though that firefighter fitness does have some type of impact. Cancer is normally listed in the other categories in the literature but there were two articles that brought it to the forefront. These articles however do not agree upon

what cancers are mostly associated with firefighters. This is an area that has not received much attention at the time these articles were written. A couple articles pointed out that poor handling of the emergency vehicles and not wearing seatbelts are leading causes of crashes and causes of firefighter fatalities. There was one article that pointed to career firefighters having a higher likelihood of death on the job. It showed that career firefighters make-up 28 percent of the service but account for 33 percent of the deaths. Besides the repetitive issue of heart related deaths, another issue that is brought up frequently throughout the literature is that many of these fatalities are preventable.

Chapter 3

Methods

Design and Sample

This observational study was performed by analyzing data collected from the National Fire Protection Administration for 1990 to 2007. Each year the NFPA compiles data on the number of firefighters and number of deaths of firefighters in the United States. The NFPA break it down into three categories: career, volunteer, and non-municipal. The information used in this paper is from the NFPA report “Firefighter Fatalities in the United States”.

Procedure

The total number of firefighter deaths was divided by the total number of firefighters to calculate the firefighter death rate for career and volunteer firefighters for each year. In addition to the death rates among the firefighters, the leading causes of death among firefighters were reviewed. An independent sample t-test was used to determine if there was a difference between death rates of career and volunteer firefighters. A significance level of $\alpha=.05$ was used for this analysis. Microsoft Excel 2007 was used for all statistical analysis.

Limitations and Bias

This study only covers the number of firefighters and the number of deaths. The number of calls responded to, type of calls, and severity were not factored into the analysis. This limits the study into only looking at a portion of the data that could go into looking at firefighter death rates. Also, career firefighter deaths can be over reported. A career department may report a firefighter who is at work and dies of a heart attack that is not job related.

Chapter 4

Results

There is a significant difference between the death rates of career and volunteer firefighters ($t= 5.99$, $df= 34$, $p< .001$). The mean death rate for career firefighters was 10.36 ($SD=1.93$) and 7.06 ($SD=1.19$) for volunteers, indicating career firefighters have a higher death rate than volunteers.

Chapter 5

Discussion and Conclusion

The NFPA was used throughout this paper to examine the death rates of career firefighters versus volunteer firefighters. The paper shows that there are an alarming number of deaths among firefighters and that there are steps that need to be taken to lessen the loss of life.

When examining only the frequency of deaths per year, it appears that more volunteers are dying while on duty. At no time in the years covered have more career firefighters been killed than volunteer firefighters (excluding the deaths on September 11, 2001). However, when the death rate based on the number of firefighters each year is taken into consideration, it changes the results. Each year there are approximately two to three times as many volunteer firefighters as career firefighters on active service. With so many volunteer firefighters, the death rates are lowered below that of the career firefighters. The total number of career firefighter was 5,081,850 and total number of volunteer firefighters was 14,446,700 for the 18 year period covered.

There is a factor that was not controlled in this paper and that was the number of calls responded too. This information could change the results of the test. However, the fire service can still use this information to look at what needs to be done to lower the death rates among firefighters. There was a common trend among the deaths of the firefighters; that trend was sudden cardiac arrest being the leading cause of death. The

second leading cause of death among career firefighters is “other” and volunteer firefighters it is motor vehicle accidents.

There is a significant relationship between the deaths of career and volunteer firefighters. They share the common leading cause but have two very different secondary causes. This paper shows how many firefighters have died over an 18 year period; it should show the country that there needs to be strict guidelines in the training of career and volunteer firefighters, to include physical fitness training. Universal training for both career and volunteer firefighters could drastically reduce the death rates.

Approximately 100 firefighters die each year during firefighting activities. During the years covered in the research, 526 career firefighters died while 1,018 volunteer firefighters died for a total of 1,544 firefighters as shown in Table 1.¹ The top cause of death for both career and volunteer is heart attack. According to the study, 142 career firefighters died of heart attack for 39% and 306 volunteer firefighters died of heart attack for 50%, shown in Table 3 and Figure 1. When the total number of firefighters is taken into consideration without the number of calls run, the research shows that a career firefighter is more likely to die than a volunteer. Table 2, shows a list of the death rates for the 18 year period. The death rate for career firefighters is 10.36 per 100,000 firefighters and the death rate for volunteer firefighters is 7.06 per 100,000 firefighters. During the 18 year period that is covered by the research, there are two years that stand out above the rest in regards to the comparison of the two groups. Those years are 1994 and 2007. In 1994, the death rate for career firefighters was 12.8 per 100,000 and 4.7 per 100,000 for volunteer firefighters. In that year the death rate for career firefighters was

¹ All tables and figures are located in the appendix.

nearly three times greater than that of volunteer firefighters. Then in 2007, the death rate for career firefighters was 12.99 per 100,000 and 6.42 per 100,000 for volunteer firefighters. That year the death rate was almost double that of the rate for volunteer firefighters. In both of those years there were more volunteer firefighters that died. In 1994, 34 career firefighters died and 38 volunteer firefighters died. In the year 2007, 42 career firefighters died and 53 volunteer firefighters died, shown in Table 1. The lowest death rate for career firefighters was 7.26 in 2006 and the highest death rate was 13.75 in 1991. For volunteer firefighters, the lowest death rate was 4.7 in 1994 and the highest death rate was 9.04 in 1999. This shows that just looking at the number of deaths per group will not show who is at a greater risk. Figure 3, shows the trend for the death rates of both career and volunteer firefighters. This trend shows that death rates among career firefighters are consistently higher. In 2001, the rates are almost the same but the career firefighter death rate is one tenth higher.

There are many potential reasons for the disparity in the death rates. The numbers of fires, the type and severity that each group of firefighters responded too are all potential reason for the disparity. This paper does not look at the numbers, types or severity of the calls. This information could show that there is a correlation to the number or types of calls. Others reasons can be the cultures of the two different groups or even the training. There are many aspects that would go into determining the reason for the disparity. Whatever the reason there is a large disparity between the death rates of career firefighters and volunteer firefighters. The reason for it could be how each group handles the potential reasons for firefighter deaths below.

The culture, lack of/failure of training, and policies and procedures are all potential reasons for the numbers of deaths among career and volunteer firefighters. Each fire department has its own culture and there are many things that go into developing that culture. One of the main components of the development of a culture within a fire department is tradition. Fire departments hold onto tradition and those traditions become the culture of the fire department. A likely phrase to hear around a fire house is, “this is the way we have always done it”. An example of this is a fire department that goes into every structure fire. There was a time when that was done by many departments, but what is the reason for going into an abandoned building that is scheduled to be demolished. The culture of that department is what sent those firefighters into that building. It is in scenarios like this that firefighters are needlessly killed. There is also the culture of physical fitness. Many firefighters see physical fitness only as being able to perform the job. The firefighters look and say as long as I can do my job then I am physically fit enough. The culture of a fire department is a very hard thing to change, even though the culture could be the reason for some of the deaths that occur. There is quote about the fire service that demonstrates this very well, “150 years of tradition unimpeded by progress”.

The lack of/failure of training is another of the potential reasons leading to the deaths of firefighters. This is not just training the performance of the job but also physical fitness training. Many fire departments devote a lot of time and energy to training but not all training is effective. Fire departments need to ensure that all of the essential training is being conducted and that the training is done in a manner that everyone on the department can understand. In regards to sudden cardiac arrest, the lack of physical fitness training could be a key reason for the high number of deaths. There are those

firefighters out there that will not do any physical fitness training unless it is done by the department. For career firefighters, the lack of/failure of training in things such as construction, fall protection and ways to free themselves when caught under something may be a reason for the second leading cause of career firefighters. These three issues are part of the “other” category which is the second leading cause of death among career firefighters. As for volunteers, the lack of/failure of training in regards to motor vehicle operations could be the reason for the high number of deaths associated with motor vehicle accidents. Many volunteers respond to calls in their personal vehicles. Many of the volunteers have their vehicles equipped with emergency lights and sirens, which helps with their safety. The firefighters need to be trained how to operate their personal vehicles while operating the lights and sirens. If there is a lack of/failure of training in this area then, this could be a cause for the numbers of deaths seen by this cause of death. Training is a key element in all aspects of firefighting.

A third potential reason for the number of deaths among firefighters is policies and procedures. A lack of a policy or procedures can lead to placing or allowing firefighters to be in unnecessary danger. Without the proper or effective policies and procedures firefighters are able or expected to do things that would not be allowed if the proper policies and procedures were in place. Policies and procedures are meant to give guidance in how to get the job done the quickest and safest way possible. Without a physical fitness policy, firefighters are allowed to be in any physical condition. This in return can lead to a larger number of deaths from sudden cardiac arrest. This also goes for a policy regarding making entry into structures that are known to be vacant or responding to a call in personal vehicles. There may be policies and procedure in place that address

these areas but they may be ineffective. Within the policies and procedures there are no consequences for violating them, this makes them ineffective. The lack of or ineffective policies and procedures can lead to firefighter deaths.

There are steps that can be taken to potentially lower the number of deaths among firefighters. First there has to be a change in the culture of the fire departments, as long as the quote “150 years of tradition unimpeded by progress” rings true, firefighters will continue to die in the same ways. Each fire department has to look at its personnel and figure out what is the best way to begin to change the culture. Fire departments should look at making small changes at first and implement them slowly. Many people do not like change and will fight it if it is thrust upon them. By making small changes that will affect the culture slowly, they will have a better chance of being accepted. For fire departments that have academies, start in the academies with the recruits. This way the culture can start changing with them. There is a potential that the department veterans will fight the changes but instilling them in the recruits in the beginning will offer a better shot at the culture changing over time. For departments that do not have academies, ensure that the changes that need to be made are taught to the new firefighters during training. Select personnel that have embraced the new culture or that are trying to adapt to the new culture, to train the new firefighters. Fire departments can also assign those personnel as mentors to the new firefighters. Culture does not change overnight and any fire department that is trying to make cultural changes has to remember that or it will be an uphill battle to make the changes.

Training can be a key to lowering firefighter deaths. Physical fitness training is one aspect that should be put at the top of the list. Sudden cardiac arrest is the leading

cause of death among both career and volunteer firefighters. There are different aspects to physical fitness training. It is not just having the firefighters run around the station each shift but also educating them on how to safely train and eat properly. There needs to be a proper blend of having the firefighters actually go out and do fitness training along with classroom training. Physical fitness training will improve their fitness while the classroom portion will educate them how too. Just telling a firefighter to go run around the station is not going to properly improve their fitness. Without being taught the proper and safe way of doing it, they may injure themselves. It is easier for career departments to do this than volunteer departments. Volunteers have other jobs, they cannot commit as much time as a career firefighter. Volunteer departments can setup extra training sessions and also incorporate physical fitness training into their weekly training day. Each department has to find the way that works best for them for implementing physical fitness training.

Volunteer fire departments should look at the way their firefighters are being trained in how to operate motor vehicles when in route to a call. Each firefighter should receive initial and refresher training in how to properly operate a vehicle when in route to a call. There should be a classroom portion and a road test. These should be completed before a firefighter is ever allowed to respond to a call using lights and sirens or driving above the posted speed limit. This training should be detailed and as thorough as possible. Too many volunteers are dying in this manner. There is an emergency vehicle operators course which should be taught, but there should be additional training. Many volunteer department use the emergency vehicles operators course but with the number of deaths from accidents, there should be additional training conducted when possible. It is

more difficult for volunteer departments to perform training but it needs to be done to protect the firefighters. The volunteer departments can coordinate with another local agency, state troopers or local police, to assist in the training of the personnel. Training is one way that can potentially reduce the number of fatalities.

Career fire departments need to ensure that the training they are providing their personnel is effective. The second leading cause of death for career firefighters is “other”. This includes collapse, caught under, and falls. The career departments should look at their training and ensure that these subjects are being covered and that the firefighters understand the training. The training cannot just be classroom training, there needs to be a hands-on portion for each of these trainings. For the portion covering collapse, bring in a structural engineer and show different types of collapses. When it comes too caught under, put the firefighter in their gear and put them in a situation where they are caught under something, then instruct them how to free themselves or let other firefighters know where they are. The third portion of this section is falls. Use the classroom to teach the firefighters about potential areas that have the risk of exposing them to falls, then take them out and show them how to recognize the areas, avoid when possible and how to use fall protection. The department needs to discover what the best way to train their personnel is and use it.

Policies and procedures are the aspects that go with both of the previous recommendations on how to lower the death rates among both groups of firefighters. Each department can put into place policies and procedures that govern training and that will affect the culture of the fire department. To begin each fire department should look at what cultural changes need to be made, and then establish the policies and procedures to

begin making those changes to the culture. Fire departments need to consider these changes and the impact they will have on the firefighters before implementing them.

A policy can be put into place that requires each firefighter to pass a physical and physical fitness test to be an active firefighter. There are different types of test that can be established, depending on the department and their resources. Columbus Fire Department uses the Bruce Treadmill Test Protocol. This is used to determine the firefighters' cardiovascular fitness by calculating the maximum oxygen consumption. The Columbus Fire Department is not a small department and has more resources than many smaller departments, so they are able to do this type of testing, The City of Conway Fire Department has its potential and active firefighters run one and half miles under a certain time, perform push-ups, sit-ups, pull-ups, and bench press as their physical fitness test. The Conway Fire Department is a much smaller department with fewer resources than Columbus Fire Department. Each fire department can find a set of procedures that works best for them in the test of a firefighter's fitness. A firefighter that fails the minimum requirements should be notified and potentially pulled from active service until they are able to pass. This set of policy and procedure could lead to fewer sudden cardiac arrests.

Another potential policy and procedure is that all firefighters will be trained in how to properly operate motor vehicles when responding to a call before they are allowed to respond using lights and sirens. Additionally any firefighter observed operating a motor vehicle in an unsafe manner will be subject to disciplinary action. These actions can be loss of lights and sirens, suspension or even termination. Also any firefighter that is disciplined for operating a vehicle in an unsafe manner must be retrained.

For career firefighters a policy and procedure that could be effective in lowering the number of deaths in the “other” category is that any building that is known to be vacant will not be entered, unless the incident commander has deemed it safe to enter. The rank of the incident commander that can make the call should be determined. The department needs to establish if a lieutenant can make the call or if it has to be a captain or even chief. The person making the call on whether the structure is safe to enter should have received additional training in how to recognize the signs that a building is likely to collapse or not. Any firefighter that violates the policy is subject to disciplinary actions.

Each department must look at each recommendation in their own way and decide how best to implement them or their own changes to lower the number of firefighter deaths. There is no one cookie cutter answer for how to reduce the number of deaths. Each department faces its own unique challenges but they need to address these issues. The culture has to change, training needs to be conducted and reviewed, and policies and procedures need to be put into place. Without change, the country will continue to lose firefighters needlessly. By implementing some of these recommendations then the disparity between the death rates of career firefighters and volunteer firefighters can begin to shrink by fewer firefighters dying in both groups.

Firefighters risk their lives for others. It does not matter whether they are career or volunteer, they all do the same job. The United States should not sit back and let approximately 100 firefighters die each year. There needs to be a set of standards put into place to regulate what a new firefighter is taught and how they are taught. Also, there needs to be a physical fitness program put into place. There is no reason that the leading cause of death among firefighters should be heart attacks. Firefighting is a very

physically demanding job, so the individuals performing this job should be in good physical condition. This does not mean good physical condition in the manner of speaking that they are able to perform their duties. This good physical condition refers to overall physical condition. When a firefighter goes down, that puts other firefighters at risk and the peoples who emergency the firefighters were responding to. Keeping firefighters alive is not just an issue that is important to firefighters and their command; it also should be an important issue for all. If there is not a firefighter there to put out the fire or pull you to safety, who is going to do it? That is the question everyone should ask themselves when they are trying to decide if this is an important subject and whether something should be done or not.

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Appendix

Figures and Tables

Table 1. Firefighter Deaths: 1990 to 2007

Year	Career Deaths	Volunteer Deaths	Total Deaths	Number of Career Firefighters	Number of Volunteers Firefighters	Total
1990	26	62	88	253,000	772,650	1,025,650
1991	36	66	102	261,800	771,800	1,033,600
1992	24	44	68	253,000	805,300	1,058,300
1993	21	55	76	259,650	795,400	1,055,050
1994	34	38	72	265,700	807,900	1,073,600
1995	30	59	89	260,850	838,000	1,098,850
1996	27	65	92	266,300	815,500	1,081,800
1997	31	59	90	275,700	803,350	1,079,050
1998	33	49	82	278,300	804,200	1,082,500
1999	37	71	108	279,900	785,250	1,065,150
2000	28	58	86	286,800	777,350	1,064,150
2001	25	66	91	293,600	784,700	1,078,300
2002	29	50	79	291,650	816,600	1,108,250
2003	26	58	84	296,850	800,050	1,096,900
2004	29	65	94	305,150	795,600	1,100,750
2005	25	54	79	313,300	823,650	1,136,950
2006	23	46	69	316,950	823,950	1,140,900
2007	42	53	95	323,350	825,450	1,148,800
Total	526	1018	1544	5,081,850	14,446,700	19,528,550

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Table 2. Death Rates per 100,000: 1990 to 2007

Year	Career DR	Volunteer DR
1990	10.28	8.02
1991	13.75	8.55
1992	9.49	5.46
1993	8.09	6.91
1994	12.8	4.7
1995	11.5	7.04
1996	10.14	7.97
1997	11.24	7.34
1998	11.86	6.09
1999	13.22	9.04
2000	9.76	7.46
2001	8.51	8.41
2002	9.94	6.12
2003	8.76	7.25
2004	9.5	8.17
2005	7.98	6.56
2006	7.26	5.58
2007	12.99	6.42
Total	10.36	7.06

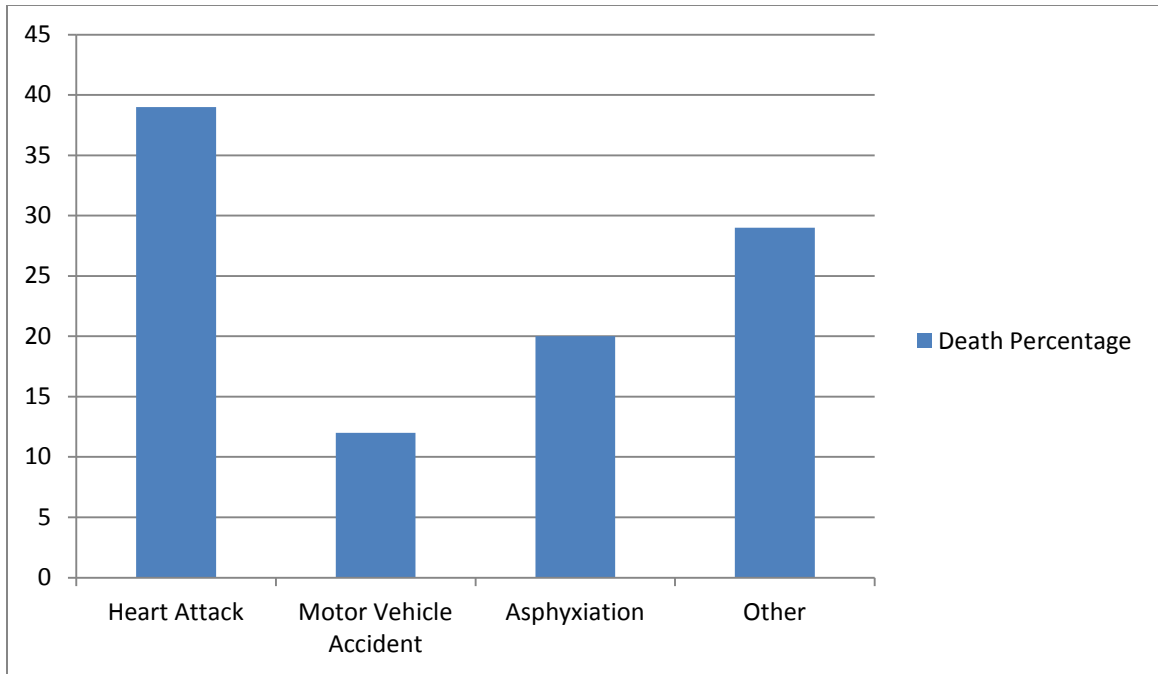


Figure 1. Career Death Percentage – 1994 to 2004

Table 3. Career Deaths: 1994 to 2004

Cause/Contributing Cause	Number	Percent
Heart Attack	142	39
Stress/Overexertion	138	97
Other	4	3
Motor Vehicle	44	12
Vehicle Accident	30	68
Struck by Vehicle	12	27
Other	2	5
Asphyxiation	74	20
Caught/Trapped	56	26
Other	18	24
Other	108	29
Caught/Trapped	32	30
Fall	8	7
Exposure	9	8
Stress/Overexertion	16	15
Structure Collapse	8	7
Other	35	32

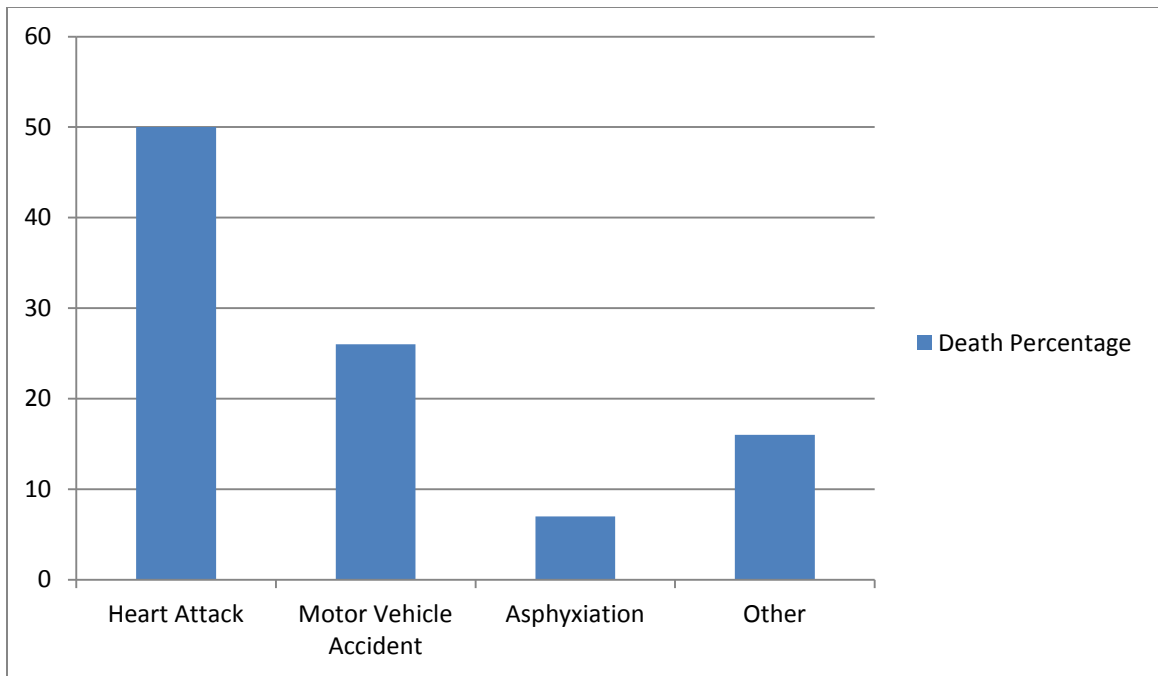


Figure 2. Volunteer Death Percentage – 1994 to 2004

Table 4. Volunteer Deaths: 1994 to 2004

Cause/Contributing Cause	Number	Percent
Heart Attack	306	50
Stress/Overexertion	301	98
Other	5	2
Motor Vehicle	160	26
Vehicle Accident	116	73
Struck by Vehicle	33	20
Other	11	7
Asphyxiation	45	7
Caught/Trapped	31	69
Other	14	31
Other	99	16
Caught/Trapped	19	19
Fall	15	15
Exposure	14	14
Stress/Overexertion	14	14
Structure Collapse	3	3
Other	34	34

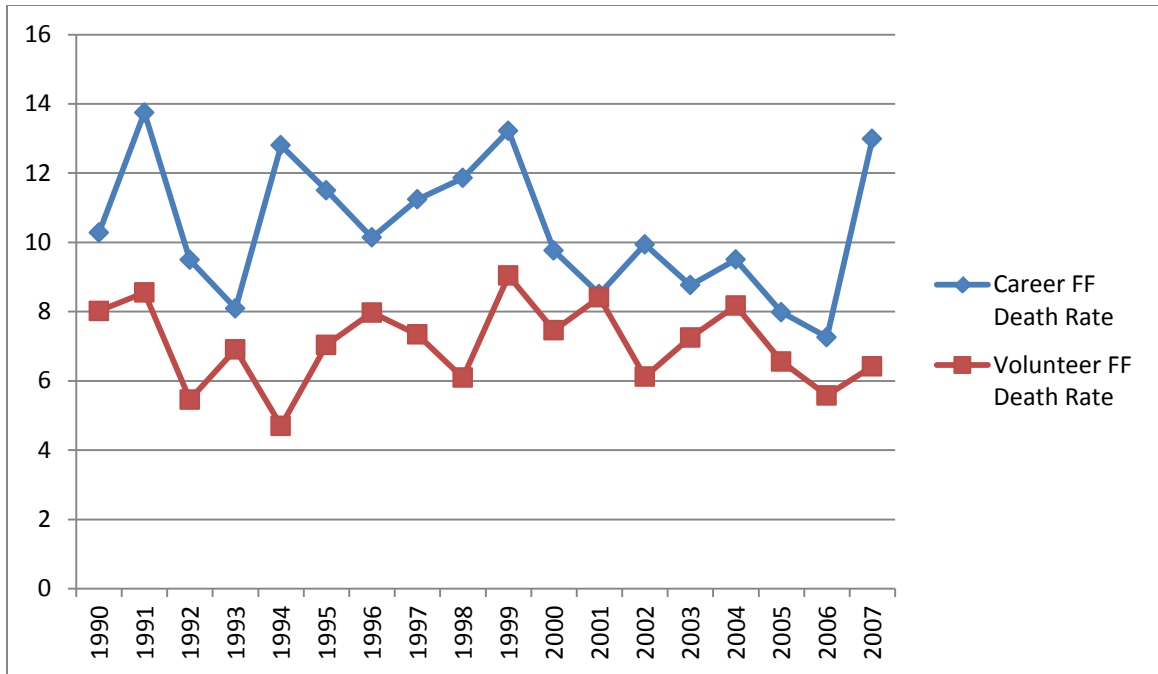


Figure 3. Firefighter Death Rates Per 100,000 Firefighters