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Effect of 24-Hour Shifts on Fatigue Experienced by Firefighter Paramedics

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Walden University

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Walden University
2020

Abstract

Effect of 24-Hour Shifts on Fatigue Experienced by Firefighter Paramedics

by

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MA, University of Phoenix, 2003

BA, University of Maryland, 1998

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Policy and Administration

Walden University

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Abstract

Fatigue negatively affects numerous people throughout the world and has a number of origins, including shift work. Fatigue experienced by people who work shifts may have a negative impact on carrying out job functions and can pose safety risks. Firefighter paramedics who work 24-hour shifts are expected to respond to calls for service throughout their shifts, even during hours of nighttime sleep. Firefighter paramedics perform medical procedures to save lives, requiring time, attention, and alertness, all of which become reduced with fatigue. Although literature exists on the physical and psychological effects of fatigue for those who work shifts and for firefighter paramedics, there is a gap regarding specific effects experienced by firefighter paramedics working 24-hour shifts and whether call volume influences fatigue experienced and fatigue-related issues. Therefore, the purpose of this phenomenological study was to explore whether more fatigue was experienced by firefighter paramedics working 24-hour shifts in high call volume fire stations versus low call volume fire stations, and if this led to a greater potential for negative cognitive effects that impacted their health and safety and the level of patient care provided. Twelve active career firefighter paramedics were interviewed; 6 worked at high call volume stations and 6 worked at low call volume stations. Guided by the repair and restoration theory of sleep as the theoretical foundation and using NVivo 12 software, data were analyzed for common themes. Thirteen themes emerged related to fatigue, sleep, service calls, cognitive functioning, health issues, personal methods for dealing with fatigue, and departmental awareness and accommodations. Findings of this study could create positive social change by assisting fire rescue organizations in identifying possible risks to the safety of their personnel and the communities they serve.

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Dedication

I dedicate this dissertation to my husband, Mike, and to my children, Chase and Colton. I appreciate all the love and support they give me daily to keep me going and stay focused on achievement. Thank you, Mike, for not letting me quit and continuing to lift me up and encouraging me when I needed it the most and for being the inspiration for the topic of my research study. Thank you for your patience and understanding while my focus was diverted to achieve this goal.

I also dedicate this dissertation to my mother, Nancy. You are always my biggest fan and supporter, constantly encouraging me and making me feel like I can achieve anything. Thank you for always standing behind me in everything I do. I love you, Mom.

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I would like to recognize all those in the fire rescue field for their hard work and dedication to service. What you do on a daily basis is amazing and important. Your willingness to help people and serve the community on a daily basis as first responders is evident from the support and admiration many have for the fire service. Life-saving measures are performed every day and without the quick response and skill of fire rescue personnel, more lives would be lost. Firefighter paramedics are an integral part of the fire service and possess a specialized set of skills that can assist with medical emergencies and save lives.

I would like to thank the firefighter paramedics who volunteered to take part in this study along with their organization, which gave me permission to conduct this study with their personnel. Your participation in this study will hopefully create awareness and make a difference to administrators in the fire service to provide resources and policies to assist with fatigue issues.

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Chapter 1: Introduction to the Study

Introduction

Firefighter paramedics are important first responders to critical incidents requiring first line skilled medical care and treatment of various patients. There are many situations in which the actions of firefighter paramedics can save lives prior to getting their patients to a hospital. In order to treat patients effectively, firefighter paramedics need to be alert and must draw off their knowledge and training from cognitive memory in a variety of different situations. Most fire departments operate on a 24-hour shift schedule with 48 hours off. Within that 24-hour shift, depending on the call volume of the fire station, calls for service are handled anytime during that period. There are nights when fire rescue station personnel are unable to sleep due to calls for service. Shift work has been investigated to determine its effect on workers and sleep patterns and has been shown to cause higher amounts of sleepiness and sleep disorders, such as shift work disorder (Gumenyuk, Howard, Roth, Korzyukov, & Drake, 2014). According to Pirralo, Loomis, Levine, and Woodson (2011) “shift workers that are sleep deprived experience excessive sleepiness that can contribute to deficits in cognitive functioning, work performance, and personnel and patient safety” (p. 150).

Negative effects may be experienced by firefighter paramedics due to the lack of sleep, especially when critical care is required. Proper sleep is crucial for most people to function at normal levels. Firefighter paramedics have a higher level of performance based upon the nature of their job and the life and death situations in which they are involved. A regular lack of sleep can impact cognitive functioning and lead to issues with fatigue, creating sleep disorders in fire rescue personnel. Results of a fatigue study on

ambulance paramedics conducted by Sofianopoulos, Williams, Archer, and Thompson (2011) showed that “poor sleep quality experienced by personnel resulted in feelings of fatigue, tiredness and performing at suboptimal levels” (p. 18). Considering the important nature of their job, firefighter paramedics schedules should be considered more carefully to maximize performance in the field and reduce sleep deprivation that negatively affects personnel and could have fatal consequences for patients. A review of the literature on this topic resulted in many recommendations for further study utilizing a larger population due to the importance of the impact it can have on responding paramedics expected to administer drugs, perform medical care, and also operate transport apparatus (Sofianopoulos et al., 2011).

The purpose of this study was to explore whether more fatigue was experienced by fire rescue personnel, specifically paramedics, working 24-hour shifts in high call volume fire stations versus low call volume fire stations, and if this lead to a greater potential for negative cognitive effects that impacted their health and safety and the level of patient care provided. How firefighter paramedics deal with fatigue experienced from working a 24-hour shift is yet to be determined. Utilizing theoretical-based information on the effects of fatigue can help determine future recommendations and present possible coping strategies for firefighter paramedics.

Background of the Study

Firefighter paramedics are important first responders to life and death situations where they need to be alert and react. Firefighter paramedics provide critical medical care to patients that can impact whether they live or die. Shift work can be detrimental to personnel and can have an impact on fatigue which can lead to decreased levels of

cognitive functioning, injury, and illness. Fire rescue personnel predominantly work on 24-hour shifts straight. Bill Davis, the Vice President of a company named Circadian, stated, “for most people around 2 a.m. to 6 a.m., our ability to respond is decreased” and pointed out that “a person who’s been awake for 24-hours has the same detriment in speed and accuracy of response as a person who has a blood alcohol content of .10” (Busch, 2013, p. 2). This is alarming considering the responsibilities and functions necessary for fire rescue personnel to perform.

Firefighter paramedics receive calls many times during the night, awoken from their sleep or being up without sleep during the time that Davis explained response ability is decreased (Busch, 2013). Patients could suffer the consequences along with the impact it can have on fire rescue personnel. Dick (2011) gave an example of working a 24-hour shift with 25 calls run and reported that patients weren’t receiving the highest quality of care with that many calls handled in one shift (p. 1). According to Swinhart (2007), 7-8 hours of sleep is recommended per night in order to perform at a high level the next day (p. 33). Swinhart (2007) also pointed out that other studies showed that 24-hour shifts lead to degradation in fire rescue personnel physically and mentally and that most reported suffering moderate to severe levels of fatigue. Sleep deprivation and fatigue have been found to be linked to long shifts and overwork (Erich, 2011).

Problem Statement

There is a problem in the fire rescue organization. Despite firefighter paramedics being trained and highly skilled first responders, there are effects from fatigue occurring due to the length of the 24-hour shift combined with the amount of calls for service handled and the amount of adequate sleep they are provided. This problem negatively

impacts firefighter paramedics with severe fatigue and, in turn, can affect the level of service given to patients. Basinka and Wiciak (2012) asserted that prolonged fatigue could lead to burnout in firefighters, limiting their ability to perform their assigned tasks and leading to disengagement (pp. 267-271). A possible cause of this problem is the length of the shift they work. Cohen and Plecas (2012) found that by reviewing the literature, firefighter paramedics working 24-hour shifts had a hard time managing fatigue with high call volumes, which could affect their level of performance on the job (p. 9). Perhaps a study that investigates fatigue experienced by firefighter paramedics working 24-hour shifts in high call volume fire stations versus low call volume fire stations through interviews of personnel can help determine if there are negative impacts on fire rescue personnel and the public they serve. The theoretical foundation for this study was based on the repair and restoration theory of sleep and how it applies to sleep being essential for restoring physiological processes that lead to good health, physically and mentally, in order to function properly on a daily basis to repair any sustained damage (Cherry, 2018; Shapiro & Flanigan, 1993).

Purpose of the Study

The purpose of this qualitative, interpretative phenomenological analysis study was to explore how fatigue affected firefighter paramedics working 24-hour shifts in high call volume fire stations versus those working in low call volume stations. More specifically, the purpose of this study was to discover possible fatigue related problems that resulted in sleep deprivation experienced by firefighter paramedics working 24-hour shifts, without the possibility for proper rest during their shift, and what coping strategies were used by the firefighter paramedics. In order to explore this further, I examined

literature on sleep deprivation and its effects, as well as the need for satisfaction in sleep through the lens of self-determination theory (Campbell et al., 2015). According to Campbell et al. (2015), poor sleep quality contributes to affecting daytime functioning levels. The theoretical foundation for Campbell et al.'s study was based upon co-conditioning theory (Tanaka & Watanabe, 2010), citing the need for proper restorative sleep in order to fight fatigue that is caused by overwork and stress involving lack of sufficient rest. The results of this study demonstrate how sleep impacts cognitive functioning, which is essential for firefighter paramedics to perform at high levels to reduce the chance of error during their shifts.

Research Questions

My intent with this qualitative study was to explore whether or not firefighter paramedics working 24-hour shifts experienced fatigue issues due to lack of sleep during their shift and whether this had a detrimental impact on them and their work in the field. The main question guiding this study was the following: “What is the relationship between fatigue experienced by firefighter paramedics working 24-hour shifts at high call volume stations versus firefighter paramedics working 24- hours shifts at a low call volume station?”

Conceptual Framework

For the purpose of this study, I used an interpretative phenomenological analysis approach based upon in-depth one-on-one interviews as the main method of data collection. The purpose of the in-depth interviews was to gather information directly from participants that related to their personal experiences. Participants recalled and reflected on how their shift hours impacted their levels of fatigue and the ability to

function at work and in their personal lives, while trying to obtain restful sleep off duty. Phenomenological interviews of participants assisted in developing themes from their perceived meaning of the problem (see Creswell, 2009, p. 175). Using the interpretative phenomenological analysis approach (IPA), participants are able to share lived experiences any way that they chose to, without fear, and to assist in narrating research findings (Abayomi, 2017, p. 9).

Nature of the Study

The research method and design for this study was a qualitative, interpretative phenomenological analysis approach which allowed me to explore the experiences of firefighter paramedics in regard to fatigue issues on the job. My role as the researcher in this phenomenological-based study was to investigate and interpret the lived experiences of firefighter paramedics that worked 24-hour shifts. I was able to determine the impact that working 24-hour shifts in two different call volume based fire stations had on experienced fatigue through responses gained in interviews. Their lived experiences helped to address the research question and determine whether fatigue impacted these firefighter paramedics negatively in the course of their shifts.

According to Moustakas (1994), it is more important to focus on the experiences of the participants in the research than it is to focus on the interpretation of the researcher's personal experience. The approach assists the researcher with gathering in-depth descriptions and interpretations from the participants on the research problem through their lived experiences and the direct impact it had on them (Abayomi, 2017). Given the nature of this research study, utilizing this approach helped to gain the most direct and descriptive responses to investigate the impact of fatigue on firefighter

paramedics during their 24-hour shifts at two different types of fire stations with different call volumes.

Utilizing one-on-one in-depth interviews within this interpretative phenomenological analysis approach assisted in exploring how fatigue experienced by firefighter paramedics was related to the concept of restorative sleep theory. The key concepts of this theoretical foundation applied directly to the participants' lived experiences. More specifically, this phenomenological interpretative analysis research study examined how restorative sleep involves a necessary process that helps to restore and repair basic human functions through unbroken sleep and how sleep deprivation can have a negative impact on firefighter paramedics.

Twelve current active duty career firefighter paramedics were interviewed from two different fire stations—one with a high call volume and one with a low call volume. Six firefighter paramedics were selected at each of the two types of fire stations. These firefighter paramedics were from the same county government fire department and serve one specific geographically assigned location, but work in different assigned areas within the county. Data was collected primarily through in-depth interviews with the selected anonymous participants along with review of statistical data that supported the number of calls handled per year by each fire station. Analysis of the data was conducted by transcribing all interview transcripts verbatim and color-coding and categorizing responses which I then transcribed into a shortened statement describing what the participants experienced and how those experiences affected them through the studied phenomenon (see Abayomi, 2017, p. 17).

Definition of Terms

The following includes terms and phrases related to the study:

Acute fatigue: Short-term fatigue as a direct result of excessive physical or mental activity (Cotter, 2011, p. 41).

Chronic fatigue: Fatigue that results over time after multiple missed nights of restorative sleep (Cotter, 2011, p. 41).

Circadian rhythm: A cyclical rhythm that is based off of the 24-hour solar day and aligns with the light/dark cycle (Sofianopoulos et al., 2011, p. 4).

Cognitive impairment: Diminished decision making skills and impulsive decisions as a result of sleep deprivation that can equate to blood alcohol levels in those under the influence (Peterson, 2016, p. 58).

Emergency medical service (EMS): Area services that provide treatment and transport of patients in crisis health situations that could be life-threatening by EMTs (EMS1Staff, 2011).

Emergency medical technician (EMT): A person who is specifically trained and certified to administer basic emergency services to the victims of trauma or acute illness before and during transportation to a hospital or other healthcare facility. The difference between Paramedics and EMTs is the level of education (Oxford Dictionary, 2019).

Firefighter paramedic: Pre-hospital care providers responsible for performing clinical skills, administering drugs, and operating emergency services vehicles safely (Vandale, 2016, p. 21).

Interpretative phenomenological analysis (IPA): Allows interviewees to express their lived experience stories the way they see fit without any distortion and/or prosecution (Abayomi, 2017, p. 10).

Nonrestorative sleep: Sleep that is subjectively experienced as unrefreshing, light, restless, or of poor quality (Wilkinson & Shapiro, 2012).

Shift work: Work assigned shifts that fall outside of normal daytime work hours usually involving rotating between three shifts to include days, evenings, and night shifts (Kecklund & Axelsson, 2016, p. 1).

Shift-work disorder (SWD): When shift work sleep/wake problems become chronic, lasting 3 months or more creating a clinical circadian rhythm sleep disorder (Kecklund & Axelsson, 2016, p. 3). Categorized by excessive sleepiness and sleep disturbances (Gumenyuk et al., 2014, p. 547).

Sleep: A natural state of rest that helps restorative functions for physiological, neurological, and psychological states (Vandale, 2013, p. 18).

Sleep debt: Mental and physical fatigue caused by the lack of cumulative sleep built up over a period of time (Sofianopoulos et al., 2011, p. 4).

Sleep deprivation: “Insufficient deep sleep or restorative sleep for the brain, causes cognitive or brain fatigue that can result in slowed reaction time, decreased vigilance and impairment in complex reasoning skills” (Koen, 2005, p. 1).

Sleep stages: How sleep occurs divided into four stages and two categories. The two categories are: Rapid eye movement (REM) and nonrapid eye movement (NREM). Each sleep cycle lasts 90 minutes and repeats 4-5 times a night. Alertness is affected based on what stage someone is awakened in (Vandale, 2013, p. 18).

Assumptions

Based on the focus of this study, there was an assumption that 24-hour shifts worked by firefighter paramedics cause issues with fatigue that may affect personnel negatively. It has been documented that fatigue is experienced by firefighter paramedics working 24-hour shifts based on the lack of solid sleep due to service calls, which causes sleep deprivation that can result in errors and injury to personnel and patients due to impaired cognitive functioning. Another assumption was that interviews with firefighter paramedics would provide insight into their personal experiences that could provide essential information regarding the possible problem.

It was assumed that the participants would meet the criteria for this study based upon being an active firefighter paramedic working at the two types of stations for 24-hour shifts. I assumed that the participants would provide honest, real life experienced-based responses that explain how they were impacted. Using the interpretative phenomenological analysis approach, participant answers help researchers to obtain in-depth descriptions and interpretations on the phenomenon being explored (see Abayomi, 2017, p. 12).

There is an assumption when using the interpretative phenomenological analysis approach that participants will be able to share their “lived experiences without fear of distortions and/or prosecutions” (Abayomi, 2017, p. 13). This helps give a more in-depth understanding and interpretation of the problem. It was assumed that participants who volunteered in this study had an interest in the topic being explored, which could be beneficial for them. The final assumption was that this study could lead to positive social change through awareness and education through organizational policy. Based on the

findings, it was assumed that fire rescue organizations would consider structuring shift schedules that would not negatively impact personnel as well as the public they serve. I assumed that shift hours worked and fatigue-impacts on personnel would be taken into consideration to find the proper balance that would maximize alertness and performance and reduce fatigue in firefighter paramedics.

Scope of the Study

The scope of this qualitative, interpretative phenomenological analysis study was to understand how working 24-hour shifts impacted the amount of fatigue experienced by firefighter paramedics working in high call volume fire stations as compared to firefighter paramedics working at low call volume fire stations. I used a purposeful sampling to select active full-time firefighter paramedics who worked on each type of shift schedule to volunteer for this study. The phenomenological design was chosen for this study because it gave participants the opportunity to describe their lived experiences (see Creswell, 2009, p. 13). Firefighter paramedics could speak of their lived experiences through one-on-one interviews to assist with identifying developing patterns and meanings (see Moustakas, 1994). Statistical data regarding calls for service were also reviewed from the fire stations at which each participant worked.

Delimitations

In this study, I interviewed 12 active duty career firefighter paramedics in a county fire department in the state of Maryland. Six firefighter paramedics interviewed worked at high call volume fire stations and six firefighter paramedics interviewed worked at low call volume fire stations in the same county for 24-hour shift rotations. This study was limited to obtaining information about fatigue experienced by the

firefighter paramedics who worked the 24-hour shift schedule in two different fire stations. Statistical data on calls for service per year assisted in determining the selection of the two fire stations from which personnel were selected for interviews. This was a small group representative of a large field and their personal experiences. The only focus was on the effects of fatigue due to the workload experienced during their shifts specific to the two different types of fire stations.

Limitations

This qualitative, interpretative phenomenological analysis study was limited to active duty career firefighter paramedics who worked 24-hour shifts in a county fire department in the state of Maryland. Firefighter paramedics who work in other geographical areas or departments may have different perceptions than this group and it was only a small representation of a very large group, which makes it hard to generalize findings to a larger population. Firefighters who were not paramedics were not interviewed for this study. The study was limited only to male or female firefighter paramedics who worked 24-hour shifts in the two different types of fire stations within the same county and department.

Significance of the Study

By describing and analyzing how fatigue affects firefighter paramedics working 24-hour shifts at high call volume fire stations versus low call volume fire stations, the results of this study can help to provide an understanding of possible negative impacts of fatigue on personnel. Considering the level of skill required for firefighter paramedics serving the community in medical emergencies, studying the effects of fatigue

experienced from working 24- hour shifts without proper rest and how it impacts fire rescue personnel and their patient care is an important topic worth exploring.

In reviewing journal articles on the topic of fatigue and firefighter paramedic schedules by Gumenyuk et al. (2014), Pirallo et al. (2011), Sofianopoulos et al. (2011), and Swinhart (2007), I found numerous recommendations for further studies to be conducted on the effects of the 24-hour shift schedule on firefighter paramedics due to a lack of research. The results of my study can benefit the participants and other firefighter paramedics who have similar experiences and schedules. Fire rescue organizations can also benefit from the information gathered in this study to help improve the health and safety of their employees. This study was significant as well for focusing on what other researchers stated needed to be explored, which will hopefully lead to further studies on this topic. This is an important issue and concerns first responders who serve the community in a variety of life and death situations.

Social Change

It has been documented that firefighter paramedics working 24-hour shifts experience fatigue that can impact them negatively in numerous ways. Acknowledging that firefighter paramedics can experience detrimental levels of fatigue from working busy 24-hour shifts helps to educate the fire rescue community and provides insight that some changes should be made. These changes can positively benefit the health and wellness of fire rescue personnel and the patients they serve. This will increase the level of service provided to the community by ensuring that fire rescue personnel are receiving proper rest in order to function without fatigue and to increase optimal performance levels.

Positive social change can come from recognition from fire rescue organizations that fatigue issues affect their personnel negatively in a number of ways that put their safety and health at risk along with the patients they serve. The goal of this study was to demonstrate for organizations the impact that working 24-hour shifts with high call volumes can have on firefighter paramedics' fatigue and their performance levels. These negative effects can impact personal safety and health of employees as well as the level of care they are able to provide the community. As a result of this study, administrators and firefighter paramedics can be educated on negative impacts that may be experienced due to fatigue from working busy 24-hour shifts. Administrators and policy makers can examine shift schedules and work on providing alternatives that can help to maximize performance and reduce fatigue and health issues for firefighter paramedics. This benefits not only fire rescue personnel, but the community they serve.

Summary

The focus of this chapter was to introduce this study. Understanding the impacts of fatigue on firefighter paramedics working 24-hour shifts in high call volume fire stations as compared to firefighter paramedics working the same shift at low call volume fire stations was the focus of this phenomenological study. In this chapter, I also covered the following aspects of the study: the background of the study, problem statement, purpose of the study, research questions, conceptual framework, nature of the study, definitions of terms, assumptions, scope of the study, delimitations, limitations, significance of the study, social change, and a summary. In Chapter 2, I provide a review of the literature gathered to support this study.

Chapter 2: Literature Review

Introduction

The purpose of this research study was to better understand the impact that fatigue can have on firefighter paramedics in the field. It was important to review past studies conducted on fatigue and shift work schedules that are relevant to this issue to support this study. In order to examine the research problem, it was important to gather prior information by other researchers and their findings regarding the phenomenon of fatigue and its effects on firefighter paramedics. This information helped to address the gap in the literature pertaining to the topic of this study.

In this literature review, I examined studies focusing on 24-hour firefighter paramedic shift schedules, sleep theories, physiological side effects of inadequate sleep, shift work, shift work disorder, possible negative outcomes in field performance due to the lack of proper sleep, and possible suggestions to assist in combating negative effects on firefighter paramedics personnel. This study utilized the repair and restoration theory of sleep as the theoretical foundation. Firefighter paramedics are prone to suffering from sleep disorders due to their 24-shift schedule involving the possibility of waking during the prime sleep cycle hours.

Poor sleep or lack of sleep can affect cognitive functioning which is necessary to perform duties on calls that could involve life-saving measures. Call volumes vary at each fire station within a given organization based upon the demographic area. Poor memory skills were shown in a study involving subjects that were awakened from recovery sleep after sleep deprivation versus those awakened from normal sleep (Naitoh, Englund, & Ryman, 1982). Some firefighter paramedics working at busy fire stations

could end up with no sleep in their overnight shift or limited to a couple of hours. Naitoh et al.'s (1982) study results showed that four hours of recovery sleep had the most restorative power to help with cognitive functioning.

Literature Search Strategy

I used the Walden University online library database, EMS publications, and Google for the purpose of conducting this literature review. The following databases were searched to gather literature: ProQuest, PsycArticles, Sage premier, medline with full text, Ebsco, Google Scholar, PubMed, Taylor and Francis, Prehospital Emergency Care, Acta Psychologica, Emsworld, and Sleep Medicine. I used the following key words to search the databases: *firefighters, medical errors, ambulance paramedics, fatigue and physiological function, paramedics and fatigue, nap, night shift, occupational stress, shift work, sleep deprivation, sleep theory, fatigue theory, shiftwork, and fatigue.*

Because the focus of this research was on firefighter paramedics, I focused on prior research that dealt with shift schedules and fatigue issues with firefighter paramedics. The literature reviewed included peer-reviewed articles and journals, as well as EMS publications. Some of the literature involving sleep studies were not current studies, but could still be applied to the current problem and served as a foundation for the literature review.

Theoretical Foundation

The theoretical foundation for this study was based upon the repair and restoration theory of sleep. For this study, the participants were asked to share their experiences with working 24-hour shifts and how the shifts affected their fatigue and any negative results they encountered on the job. Oswald, who first conducted studies about the restoration

theory of sleep and numerous sleep deprivation theories, first discussed how sleep restores depleted resources of energy in 1966 (Waring, 2006). Oswald went on to further discuss NREM sleep and REM sleep patterns. Cherry (2018) noted that the repair and restoration theory of sleep suggests that NREM sleep restores physiological functions and REM sleep restores mental functions (p. 1). In this phenomenological study, I explored the lived experiences of firefighter paramedics to better understand and interpret common meanings from their responses.

According to Cherry (2018), the repair and restoration theory of sleep proposes that “sleeping is essential for revitalizing and restoring the physiological processes that keep the body and mind healthy and properly functioning” (p. 1). Further sleep studies involved the background of the circadian rhythm, which is an inner cyclical rhythm that syncs with the 24-hour solar day and operates off the light and dark cycle, thus helping to regulate biological, physiological, and metabolic activities (Sofianopoulos et al., 2011). When this rhythm is out of sync—for example, with the firefighter paramedic 24-hour schedule of handling calls when it is time to sleep—it can negatively affect them by forcing the body to adjust to being awake and alert when it should be at rest, sleeping.

Walker (2008) pointed out that sleep is important for strengthening and regulating our memory functions. Sleep debt is another issue that firefighter paramedics can face working a busy 24-hour shift. If there is a constant lack of sleep over time, it can build up and lead to mental and physical fatigue (Sofianopoulos et al., 2011). Fatigue affects individuals functioning at their normal levels, which can be caused by numerous factors that contributed to this study to include: lack of restorative sleep, sleep disturbances, occupational stress, and shift work (Sofianopoulos et al., 2011).

Firefighter paramedics have a very important job that requires them to function at an acute level of accuracy and skill. The majority of the research points to lack of sleep being an extremely detrimental factor that can negatively affect people physically, mentally, and physiologically. This inspired my research into this topic to explore how lack of proper sleep and working a 24-hour shift could negatively affect firefighter paramedics, which in turn, could impact the public they serve. Swinhart (2007) listed some medical impacts from working 24-hour shifts as a firefighter-paramedic: increased risk for obesity, high risk for cardiovascular disease, high risk for mood swings, gastrointestinal problems, high risks of motor vehicle crashes, increased risk for persons with diabetes for issues, chronic fatigue, poor motor function, memory loss, and loss of attention (p. 32).

Working shifts can cause cognitive performance to deteriorate when one is forced to endure being awake and not gaining any sleep (Kecklund & Axelsson, 2016). Cognitive performance is critical to firefighter paramedics in their daily duties. Firefighter paramedics are expected to rely on their learned skillset to make critical decisions in seconds. When firefighter paramedics working 24-hour shifts are not receiving regular amounts of sleep during the shift and responding to calls, their performance may suffer. Sofianopoulos, Williams, and Archer (2012) asserted that fatigue experienced by paramedics could cause patient errors, health complaints, an increased usage of sick leave, motor vehicle crashes, and incorrect administration of drugs to patients.

Providing naps to personnel on shiftwork schedules and rotating calls would be beneficial to fatigue and performance issues (Naitoh et al., 1982; Sofianopoulos et al.,

2012; Takeyama et al., n.d.). There is little research on trying alternatives at higher call volume fire stations to working a 24-hour shift schedule to see if it helps with fatigue. Rotating calls and providing assigned hours of sleep to be restorative could assist firefighter paramedics with fatigue issues, as well as assist them at operating at higher levels of cognitive functioning when required.

Literature Review

Shift Work

Shift work provides round the clock coverage of employees in various organizations. Shift work can be described as, “work performed outside standard working hours” (Fass, 2015, p. 6). One of the main causes of sleep disorders is shift work and has been shown to affect more than 60% of those who do shift work (Abbasi, Rajabi, Yazdim & Shafikhani, 2018). Shift work has been studied for its link to causing various health and sleep issues on personnel. Working shifts can increase issues with fatigue and can affect levels of alertness in firefighter paramedics (Koen, 2005).

According to Costa (2010), shiftwork can cause disruption to the circadian rhythm and sleep amounts, resulting in high levels of fatigue and sleepiness while working, possibly leading to performance errors (p. 114). Without proper restorative sleep, working shifts can have negative results on firefighter paramedics depending on the amount of time they spend awake in their 24-hour shift. Normal periods of alertness are naturally high in the morning and early afternoon on a regular sleep schedule, with alertness decreasing during the late afternoon and night hours (Costa, 2010). The longer one stays awake when they are naturally expected to be asleep, the worse the effects can be. For example, fatigue and effects on cognitive and physiological functioning. Fass

(2015) referenced that in order to support the body's biological rhythm, 7-8 hours of sleep during the night are required. This is not the case in most fire stations where personnel work 24 hour shifts due to the possibility of service calls throughout the night, waking personnel and breaking sleep.

According to Swinhart (2007), more than 55% of EMS employees surveyed reported they worked 24-hour shifts and in some surveyed they reported running as many as 240,000 calls annually (p. 32). Swinhart further stated that the national highway traffic safety administration attributed more than 100,000 traffic accidents per year to be caused by drivers suffering from fatigue and 20% of fire department fatalities are caused each year by vehicle crashes while in route or returning from calls (p. 32). Courtney, Francis, and Paxton (2012) pointed out that, "elevated fatigue is strongly associated with shiftwork, and causally linked to sleep disruption" (p. 183). Courtney et al. (2012) found that paramedics were at risk of suffering occupational fatigue, depression, and poor quality sleep.

The studies cited of shiftwork have found that it has negative effects physically, cognitively, and physiologically on personnel. Requiring firefighter paramedics to work 24-hour shifts at a high level of mental acuity without proper restorative sleep during their shift can lead to errors. In slower call volume stations where the firefighter paramedics are able to get regular sleep overnight the majority of the time, personnel may not experience the level of fatigue as those working in higher call volume stations. Shiftwork poses some serious risks to firefighter paramedics working 24-hour shifts based upon their duties that involve making life or death decisions within seconds and their ability to draw on knowledge and memory while reacting to the situation. Mental

clarity is of the utmost importance in the performance of their jobs. Slow reaction time or failure to recall medical information needed to treat a patient can have catastrophic results. Organizations should consider possible alternatives to 24-hour shifts when the call volume will not allow for a chance at proper restorative sleep in order for personnel to perform their duties at the highest expected level.

Taylor (1997) pointed out that personnel don't always adjust to the disruptions caused by shiftwork and will suffer with sleep issues, physical and mental health issues, absenteeism from work, decreased performance in the field and an increased risk for accidents on the job. This is concerning given the nature of the skillful duties involving medical decisions and procedures that firefighter paramedics must perform working 24-hour shifts. "Fatigue and sleep disturbances can compromise the effectiveness of the emergency workers and their performance, putting at risk not only the patient but also emergency worker's health and well-being" (Vandale, 2013, p. 24).

Organizations need to consider the negative effects of shiftwork and the possible risks they can have among firefighter paramedics, focusing on policy creation that would alleviate sleep deprivation and work towards improving the quality and quantity of sleep received in a 24-hour shift. According to Patterson et al. (2016), medical errors, injury and illness, negative safety outcomes, and poor performance were found to be linked to working longer or extended shifts. There are numerous side effects that can result from working shift work. Fatigue is the most notable side effect of shift work that is found in numerous studies according to Swinhart (2007). Swinhart cited other common side effects as: "increased likelihood of obesity; high risk for cardiovascular disease; high risk of mood swings; gastrointestinal problems; higher risk of motor vehicle crashes;

increased likelihood of family problems/divorce; in persons with diabetes, trouble controlling blood sugar levels; increased risk of substance abuse; and chronic fatigue” (p. 32).

Shiftwork Disorder

Shiftwork disorder involves negative side effects experienced by personnel who work night shift schedules. It can be characterized as a mismatch between the sleep-wake schedule and the circadian rhythmic clock. The most common symptom is excessive sleepiness or sleep issues lasting more than a short time that becomes chronic over months. Night shift work is considered to be between the hours of 9:00 p.m. through 8:00 a.m. This also aligns with the normal sleep/rest times which coincide with our circadian timing that our help to regulate proper functioning in our bodies through the matching of the internal biological timing and the sleep-wake cycle. Night work shortens the length of the sleep time and leads to increased sleepiness and decreased functioning while changes in the circadian timing lead to excessive sleepiness, impaired function, and sleep issues (Gumenyuk et al., 2014). Costa (1996) pointed out that shift work, such as night work, impacts the normal circadian rhythms of the sleep/wake cycle, interferes with work performance and effectiveness over a 24-hour period resulting in errors and accidents, difficulties with personal and professional relationships, and deterioration in health by developing; gastrointestinal issues, anxiety, chronic fatigue, depression, and cardiovascular issues (p. 9).

People that suffer from shiftwork disorder experience excessive sleepiness that can have a negative impact on personal safety, job safety, and quality of life. Patients diagnosed with shiftwork disorder have reported experiencing poor concentration and

attention at work, reported mistakes at work, and compromised care to dependents (Baney, 2011). Gumenyuk et al. (2014) also found that attention reorientation was impaired in night workers that had shiftwork disorder. Baney (2011) further referred to shift workers experiencing effects in their energy levels, social lives, moods, and the ability to fall asleep. Further study is needed to focus on recognition of the symptoms of shiftwork disorder by healthcare providers. There are also implications that functionality and wakefulness need to be improved in those that suffer from the disorder to ensure their personal safety as well as others around them (see Baney, 2011).

Gumenyuk, Belcher, Drake, and Roth (n.d.), studied groups suffering shiftwork disorder that involved sleep problems experienced due to circadian misalignment versus vulnerability to insomnia caused by circadian issues created by shiftwork. They classified two subgroups: insomnia only and insomnia with excessive sleepiness. They further researched how those with insomnia experienced sleep disruption at night on days off from work and those with combines insomnia and excessive sleepiness slept well when they had the chance to sleep at night when off work. They concluded that there were differences in what patients suffered as a result of working night work and in their experienced symptoms showing two types of insomnia that can result.

Those who suffer from shiftwork disorder experience quality of life issues, have increased work absences, missed time with family or attending social functions, and increased work or motor vehicle accidents compared to those who work day work or do not suffer from shiftwork disorder (Roth, 2012, p. 335). Roth found that management of shiftwork disorder is dependent upon proper diagnosis and use of pharmacological options as well as interventions to realign the circadian rhythm. Roth suggested that sleep

schedules be planned, use of timed light exposure in order to increase alertness at night and planned naps to help manage symptoms better and realign the circadian clock.

Gumenyuk et al. (2012) noted that shiftwork disorder has a direct link to melatonin secretion due to night work, creating circadian disruption and impacting memory and attention and focus (p. 934). firefighter paramedics have to wake up periodically throughout the night as calls demand, putting them at high risk for developing sleep disorders which can lead to suffering from shiftwork disorder.

Wright, Bogan, and Wyatt (2013) found options to manage shiftwork disorder and list them as the following: adjusting the work schedule when possible, circadian adaptation where possible, using sleep promoting strategies, protected time for sleep, ensuring adequate time for sleep before and following work shifts, use of melatonin, napping and caffeine consumption, reduction in work hours, and bright light exposure (p. 50). They further suggest the prescribed use of sleep agents if necessary in certain cases and call for future studies focused on consequences of shift work.

Sleep Theory

Sleep provides a restorative function for the body to recover and rest in order to perform tasks in our daily lives. Without the proper amount of sleep one does not have a chance to reset their system and how they function can be affected. Cherry (2018) examined four theories of sleep: repair and restoration theory of sleep, evolutionary theory of sleep, information consolidation theory of sleep, and the clean-up theory of sleep. The repair and restoration theory of sleep stated that getting adequate sleep helped to restore and revitalize the body and mind and that NREM sleep was important for

restoration of physiological functions whereas REM sleep was important for restoration of mental functionality (Cherry, 2018).

According to Chokroverty (2010) sleep is divided into two cycles with NREM and REM sleep that alternate for a total of 4 to 6 cycles while we are sleeping and each cycle lasts 90 to 110 minutes (p. 127). Slow-wave sleep is the initial third experienced when we are asleep and REM sleep is the final third (Chokroverty, 2010, p. 127). NREM sleep makes up 75-80% of sleep time while REM sleep is 20-25% of sleep time (Chokroverty, 2010, p. 127). Chokroverty stated that the most at risk times for increased sleepiness are between 2:00 a.m.-6:00 a.m. and 2:00 p.m.-6:00 p.m. (p. 128).

The evolutionary theory of sleep which is also referred to as the adaptive theory of sleep, pointed out that having periods of being active and inactive are necessary for conserving energy and that most people sleep at night and being awake during that time can be dangerous to functioning (Cherry, 2018). The information regarding the consolidation theory of sleep involved the thought that when people are sleeping, information is processed that they learned in their day and allows the brain to rest for the next day, supporting long-term memory (Cherry, 2018). The clean-up theory of sleep suggested that sleep allowed the brain to cleanse itself of toxins and waste that the brain cells produce throughout the day (Cherry, 2018). Shapiro and Flanigan (1993) summarized two main theories of sleep considered to be restoration of energy and conservation of energy. They accounted for the benefits of proper sleep for the brain and body to rest and recover, pointing out that many who experienced sleep disorders also suffered from other types of mental or physical problems that affected their quality of life and life span in general (p. 384).

The central idea that all the theories share is that sleep has a restorative power that the body needs in order to assist with functioning and that without proper sleep problems can occur. Knowing that sleep is required to help us function and be alert and vigilant, firefighter- paramedics working 24-hour shifts where sleep is hit or miss depending on the call volume, puts them and their patients at risk. If there isn't an adequate amount of time where recovery sleep can be obtained during a 24-hour shift, firefighter paramedics will suffer the effects of fatigue. According to Peterson (2016) Dr. Koen, of Round-The-Clock, stated, "that two or more emergency calls between 10 p.m. and 6 a.m. would have a moderate effect at the end of the 24 hour shift whereas three or more calls in that time period would cause severe sleep deprivation" (p. 59).

Abbasi et al. (2018) referenced a prior study conducted by Carey, Al-Zaiti, Dean, Sessanna, and Finnell from 2011 that found about 60% of firefighters in the United States suffered from sleep disorders. Kim et al. (2017) conducted a study involving Korean firefighters which revealed that 80% of their subjects were found to have sleep problems. Based up Naitoh et al.'s (1982) study, nothing less than a 4-hour long nap had the most restorative power. The fatigue experienced by firefighter paramedics can increase when they do not get enough restorative sleep during their 24-hour shifts resulting in sleep deprivation. According to Tsai, Young, Hsieh, and Lee (2005), sleep deprivation caused cognitive functions to deteriorate and one night of sleep deprivation resulted in slower reaction times as well as performance errors (p.707).

Roca et al. (2012) attributed effects such as poor cognitive function, issues with perception, memory, attention, processing abilities and performance of special duties from sleep deprivation. These are all important areas that firefighter paramedics need to

have functioning in order to provide good service to the public and do their jobs effectively. Swinhart (2007), referenced that sleep deprivation can cause increased reaction times, lapse in attention, poor motor function, memory loss, a depressed immune system, hallucinations, and psychosis which in turn can involve legal liability for performance errors (p. 32). firefighter paramedics working 24-hour shifts are constantly exposed to suffering from sleep deprivation. Organizations should consider other shift possibilities, knowing that these possible side effects could occur without proper sleep. The possibility for performance errors to occur are detrimental to personnel and the public.

Sleep debt can result when the lack of sleep is experienced regularly and builds up over time which results in mental and physical fatigue issues (Sofianopoulos, 2011). Patterson, Buysse, Weaver, Callaway, and Yealy (2015) found that 80% of EMS workers, worked other jobs on their days off which is another issue for obtaining restorative sleep. According to Patterson et al. (2015) there is, “little research on EMS worker sleep, fatigue, shift work, and intershift recovery” (p. 365). Rotating shifts can be more detrimental than fixed shifts because of the effect it can have on the circadian rhythm being able to adjust in order for one to get restorative sleep to better recover and function (see Cotter, 2011). This can cause an increased risk for errors and accidents for personnel and the public when firefighter paramedics are not well rested.

Physical Side Effects

The concept of the circadian rhythm is often considered for the disruption of a natural pattern of sleep that results in disorders and fatigue. The concept of the circadian rhythm states that forcing the body to be awake during the time when it wants to be

asleep can have negative consequences (Sofianopolous, 2011). Considering that firefighter paramedics are expected to respond at any time during their 24-hour shift, especially during 10:00 p.m.-6:00 a.m. when others are asleep, they are at constant risk to experience performance errors. Cognitive errors relating to memory can be very problematic when performing medical procedures while suffering from fatigue. Walker (2008), found that one night of sleep deprivation was shown to impair the long-term memory function, causing a decreased ability to remember new experiences in order to commit them to memory.

Busch (2013) referred to the circadian factor studies that showed from 2:00 a.m. to 6:00 a.m., our ability to respond is decreased (p. 1). Decreased cognitive functioning of the brain can affect memory, making it hard to draw on recall which is important in the field for firefighter paramedics to perform medical procedures under stress and time constraints. Firefighter paramedics may experience sleep quality issues on and off duty. Nonrestorative sleep involves the feeling that sleep gained has not been refreshing (Wilkinson & Shapiro, n.d.). Firefighter paramedics working 24-hour shifts that do not have the opportunity to gain restorative sleep may suffer not only at work but on their off days as well. Lack of proper restorative sleep can decrease the quality of life for those who suffer with it.

Kecklund and Axelsson (2016) listed the following health risks from working shift work: sleep loss, occupational accidents, obesity/weight gain, type 2 diabetes, coronary heart disease, breast/prostate/colorectal cancer, cardiovascular disease (p. 5). Numerous articles referred to the cardiovascular strain and how firefighter paramedics are at higher risk than others working 24-hour shifts. Choi et al. (2014) developed a

theoretical framework for studying cardiovascular strain in firefighters working consecutive 24-hour shifts and they pointed out further studies are needed and that rest schedules should be implemented to decrease stress on the cardiovascular system. It has been shown that shift workers get less sleep than those working day work schedules and more information needs to be obtained regarding a relationship between lack of sleep and cardiovascular disease (see Boggild & Knutsson, 1999). However, shift work can cause changes in the circadian rhythm, creating an imbalance which can contribute to heart disease and that men and women working shift work increase their risk by 40 percent of suffering from cardiovascular disease (see Boggild & Knutsson, 1999, p. 95). Caruso (n.d.) also cited that long work hours put personnel at risk for coronary artery disease by 40 percent (p. 19). Life-style has often been a focus of cardiovascular disease, but Boggild and Knutsson (1999) noted that factors such as social support, stress, and sleepiness had not been focused on which are side effects of shift work and risk factors for cardiovascular disease developing (p. 95).

According to Fass (2015), 7-8 hours of sleep per night is the best amount to support the biological rhythm is associated with helping to increase the chances of better long-term health (p. 6). firefighter paramedics working 24-hour shifts may get as little as 1-3 hours of sleep overnight, depending on the call volume. Cohen and Plecas (2015) referred to firefighter- paramedics working 24-hour shift experiencing the following: increased family life strain, increased sleep deprivation at dangerous levels, increase of on-the-job injuries, and impairment of cognitive abilities while performing critical and demanding physical and mental tasks.

Fatigue experienced can be acute or chronic. Acute fatigue is short term and results from excessive physical/mental activity without adequate sleep, while chronic fatigue involves increased levels of tiredness that build up over numerous times in which restorative sleep is not gained (Cotter, 2011). Some of the indicators of fatigue are: feeling unrefreshed after sleep, tendency to fall asleep at work, frequent naps during days off, increased errors and loss of concentration, impaired memory, irritability, reduced hand-eye coordination, slowed reaction times, and increases in risk-taking behavior (Cotter, 2011, p. 41). All these factors not only have negative health affects but increase the chance of performance errors occurring on the job.

Sleep disorders can be the most common physical effect that people working long hours and shift work experience. Swanson et al. (2011) found that shift workers experienced insomnia or excessive sleepiness which also resulted in ulcers, more than twice the rate of depression, and more frequent fatigue related accidents (p. 488). Swanson et al. pointed out that gaps in the literature exist involving liberal definitions of sleep disorders, some studies do not capture the scope of the work-related impairments experienced, and no studies published address work performance issues for those at risk for restless leg syndrome and shiftwork disorder (p. 488). Most workers do not get the proper amount of sleep in order to function effectively at work (Swanson et al., 2011).

Shift workers are at a higher risk of developing sleep disorders due to not obtaining enough sleep which leads to difficulties on the job with concentration, organization, relationships with others, daytime sleepiness, and declines in effective work performance. Firefighter paramedics working 24-hour shifts that do not get enough sleep will experience these issues. Effects on sleep can also impact firefighter paramedics on

their days off, making recovery difficult before turning around and going back to work another shift (see Akerstedt, 2003). Employers can combat these issues by paying attention and implementing procedures and policies to address and eliminate the risk for sleep issues in their employees.

Fatigue Effects on Field Performance

“Fatigue is a state of tiredness, effecting both mind and body, where an individual is unable to function at their normal level of abilities” (Sofianopoulos, 2011, p. 3).

Basinska and Wiciak (2012) pointed out that prolonged fatigue can lead to burnout among firefighting personnel depending upon the different demands per shift and the hours worked. According to Stassen, Van Nugteren, and Stein (2012), burnout experienced among firefighter paramedics could affect the level of patient care delivered as well. Cohen and Plecas (2015) concluded that fatigue is hard to manage with high call volumes on a 24-hour shift schedule which can result in sleep debt, fatigue, and possible negative effects on performance. Gaba and Howard (2002) cited prior data and studied physicians and nurses who acknowledged that on the job errors were a direct result of fatigue and that fatigue directly impairs work performance (p. 1249).

Swanson et al. (2011) also concluded that longer work hours were associated with shorter sleep times which caused more work impairments. Swanson et al. further stated that those working longer hours and obtaining less sleep were at increased risk for sleep disorders and occupational accidents leading to more absences from work or working at a diminished capacity, not taking off when needed (p. 487). Working while at a diminished capacity due to fatigue puts the individual at risk as well as the public.

Suffering from sleep deprivation can reduce the ability to concentrate, slows reaction time, reduces the ability for memory recall and the ability to learn new skills and retain them, can cause irritability, mood issues, a reduction in communication, creates an inability to cope with the demands of the job, affects decision-making abilities, increases risk-taking behaviors, reduces situational awareness, can increase work related injuries and errors, can lead to a decrease in healthy behaviors and diet, and increases poor job performance which also affects the employer (Caruso, n.d., p. 17). These are all important side effects that can occur from sleep loss. The effects on firefighter paramedics working 24-hour shifts will affect the community negatively and in the end could cause potential liability issues.

Cotter (2011) pointed out that there is a relationship between fatigue and performance errors due to cognitive functioning being affected. firefighter paramedics are expected to function at, “high levels of cognition and have precise decision-making abilities”, that requires comprehension in a situation, drawing on prior knowledge, memory and protocol, rendering aid, predicting possible outcomes of applied treatments and movement of patients, and work through fatigue issues while ensuring mental acuity in their performance (Cotter, 2011, p. 41). Ahsberg, Kecklund, Akerstedt, and Gamberale (2000) found that fatigue could be categorized by sleepiness, lack of energy, and lack of motivation finding that the highest reported levels of fatigue were from those working during the night and fatigue accumulated more on the night shift (p. 457).

Firefighter paramedics handle numerous calls for service that involve providing medical treatment or performing medical procedures. Cohen and Plecas (2015), cited research regarding doctors working 24-hour shifts as compared to 16 hour shifts were

found to have made, “substantially more serious medical errors, medication errors, diagnostic errors, and suffered attention lapses” (p. 5). Considering the potential for harm that working 24-hour shifts without proper restorative sleep can have, organizations need to consider the increased risk of liability for their personnel and the public and how they will alleviate it.

A study by Courtney, Francis, and Paxton (2013), found that the levels of elevated fatigue and sleep disruption were associated with shiftwork and that, “early morning shifts, quick returns and the nightshift”, were all contributors to sleep loss and fatigue (p. 183). Erich (2011) pointed out that sleep deprivation can be linked to, “increased errors in tasks that require alertness, vigilance and quick decision-making” (p. 43). Firefighter paramedics are expected to respond to calls expeditiously, perform complicated or time-sensitive procedures, deal with cooperative or uncooperative patients in unknown settings, and operate heavy machinery and equipment under stressful circumstances. Without proper amounts of sleep, this would be a difficult task for anyone. Sleep disorders including insomnia, obstructive sleep apnea, and shift work sleep disorder can develop as a result of not obtaining the proper amount of restorative sleep (Swanson et al., 2011, p. 488).

Firefighter paramedics are expected to work 24-hour shifts and function at the level of performing life and death saving efforts on many calls. Sofianopoulos et al. (2012) pointed out two examples of firefighter-paramedic fatigue issues involving one crew that was dispatched to a chest pain call but never responded and were found sleeping in the front seat of the ambulance and another where the wrong medication was issued to a patient during resuscitation of a cardiac patient (p. 155). Liability is also

something that should be considered for the fire department organizations when errors are made, mistakes can be costly resulting in lawsuits. Once errors are made there is a higher chance that they will continue to occur and that they will be unavoidable (see Tsai, 2005).

Pirrallo et al. (2012) found that excessive sleepiness was shown to effect cognitive functioning, work performance, and safety for both fire rescue personnel and patients (p. 150). The authors also found in their study that some EMS workers responded that they had trouble being able to remember medical protocols due to fatigue. This could be extremely dangerous in a time-sensitive situation where a quick decision needs to be made to save a patient's life. Several studies conducted by Peterson (2016), Pirrallo et al. (2012) and Vindale (2013) referred to the increased risk of motor vehicle accidents involving fire rescue personnel due to fatigue on and off duty. The National Transportation Safety Board identifies fatigue as a major factor that contributes to traffic accidents (Gaba & Howard, 2002). Accidents occurring on duty and off duty should be considered as possible results of fatigue.

Peterson (2016) referenced Dr. Charles Czeisler's recommendations that employees should not work more than 16 hours straight due to a decline in cognitive ability which results from the need for required sleep (p. 58). Department of Labor data collected showed that EMT's and paramedics have a risk of about three times the national average for incurring injuries and fatalities than any other occupation and that females have a larger amount of reports than men (Maguire & Smith, 2013).

Vindale (2013) pointed out that prior studies have shown that, "being awake for 18 hours produces impairment equal to a blood alcohol concentration of 0.05% and reaches a BAC equivalent of 0.10% after 24 hours of wakefulness" (p. 21). This is

alarming considering the alertness and precision skill that is required of firefighter paramedics to respond to calls and treat patients.

Dawson and Reid (1997) conducted a study that involving two subject groups: one that was kept awake for 28 hours straight and the other consumed alcohol to achieve a blood alcohol concentration level of .10. Dawson and Reid utilized hand-eye coordination tests and found that performance decreased in both groups and between the 10th and 26th hours of wakefulness, performance decreased at a rate of 0.74% per hour (p. 235). Their study concluded that cognitive function decreased to the level to equivalent to the performance of someone under the influence of alcohol with a .10 blood alcohol level.

This shows that performance can decrease to a detrimental level from sleep loss and deprivation that is equal to being over the legal limit of intoxication if someone was behind the wheel. Firefighter paramedics are expected to function under these conditions, operating vehicles, performing medical procedures, administering medications, and relying on memory recall and cognitive functioning to perform their duties. Ahsberg et al. (2000) found correlations between reaction times and the different feelings of fatigue experienced to include: lack of energy, lack of motivation, and sleepiness (p. 464). Fatigue can manifest in each person differently and it is must be managed to avoid making errors on the job and possibly causing self-harm or harm to others.

A study conducted by Brachet, David, and Drechsler (2012) found that fatigue does cause a decline in firefighter paramedics at the end of long shifts (p. 244). The conclusion of the study conducted by Sofianopoulos et al. (2012) was that there was an increased risk of accidents or incidents that would affect patient and personal safety as

with medication or procedural errors showcasing a gap in research of sleep deprivation and the results of fatigue and the effect on patient safety (p. 155).

Preventative Measures for Fatigue

Based on the reviewed literature and studies, there did not seem to be any positive implications of working 24-hour shifts for fire rescue personnel as well as for the public they serve. Shift workers that use some type of coping mechanism may have a moderate effect on helping symptoms (Smith et al., n.d.). If there are ways to combat fatigue experienced by firefighter paramedics, those suggestions or ideas should be utilized. They would provide numerous benefits to the safety of firefighter paramedics as well as to their patients. There were some recommendations and limited amounts of studies on the benefits of implementing procedures to combat fatigue on a 24-hour shift through the literature reviewed. Workers that use strategies of drinking caffeine and catching up on sleep proved to be ineffective according to Maneotis, Casey, and Krauss (2013). Many people use these methods when working long hours to stay awake by drinking numerous cups of caffeinated beverages and just catching up on sleep when they have a chance after piling on longer shift hours.

Swinhart (2007) suggested rotating position throughout the shift between riding on the engine unit for half the shift and the medic unit for the other half. Swinhart also suggested different shift schedules that did not involve 24-hour shifts with shifts such as five 8 hour shifts with 2 days off or four 12-hour shifts with 3 days off along with some others (p. 36). Swinhart referred to some departments trying 48-hour shifts with 96 hours off. This still can lead to fatigue issues however depending on the amount of time personnel is awake with calls during that time. If employees are not given the chance to

get 7-8 hours of sleep per 24-hour shifts, Cotter (2011), recommended that they work 12 hour shifts instead of 24-hour shifts. Cotter pointed out that shift start times should not interfere with the circadian clock in order to gain better sleep and that starting at 8am would be preferable to achieve this (p. 43).

Takeyama et al. (n.d.) conducted a study involving firefighter paramedics that utilized a modified night shift in which there was a specific time allotted for personnel to nap and not have to run calls for service. The results of their study showed that by allowing personnel to take dedicated naps fatigue was alleviated and physiological functioning was improved (p. 204). By allowing sufficient opportunity for restorative sleep during a 24-hour shift, firefighter paramedics may be able to benefit which could decrease the risk for performance errors and liability. Maneotis et al. (2013) also asserted that napping on the job was a good recovery strategy to utilize to decrease fatigue and increase energy levels and that organizations should adopt policies and procedures to address fatigue. Firefighter paramedics working 24-hour shifts have an uncertain schedule and are in constant standby for calls. Utilizing time in their shift to take naps may help alleviate fatigue issues and should be considered for a beneficial solution for those who suffer from fatigue related symptoms.

Barger (n.d.) studied a fatigue risk management program that utilized black out shades and policies to permit naps in the late afternoon at fire stations which concluded that sleep quality was improved in firefighter paramedics. These are easy fixes that could have great benefits to personnel. Patterson et al. (2016) found that fatigue, sleepiness, and difficulty with concentration were higher with personnel working 24-hour shifts and they found that the duration of the shift can play a role in sleep health and fatigue. They

recommended firefighter paramedics work 8 hour shifts to reduce fatigue and sleep issues.

Peterson (2016) referenced countermeasure suggestions for organizations to adopt such as: sleep policies around maximum work times; educational programs focused on sleep, health, and safety; having supervisors monitor and promote better sleep practices while at work; keeping sleeping quarters darkened and quiet; screening employees for sleep disorders; allowing naps; changing shift start times; rotating crews through calls to allow some to rest; adding extra units for higher call volume locations; and the possibility of working 48 hour shifts with 96 hours off (pp. 58-59). Folkard, Lombardi, and Tucker (2005) found that shift lengths should be restricted along with the amount of shifts worked before a rest day is provided, and that regular short breaks should be allowed (p. 23). Gaba and Howard (2002) also agreed that limits need to be placed on shift work hours to prevent fatigue and that naps of at least 40 minutes were necessary for the best effect on maintaining better alertness (p. 1253). Hirose (2005) found that blood pressure decreased in night shift workers that took a 2-hour nap (p. 61). A common theme amongst the literature reviewed showed that it is important for organizations to have fatigue management strategies as well as the employee to personally attend to their fatigue issues and manage them effectively (Maneotis et al., 2013). By adopting healthy strategies, the risk of workplace injuries and errors can be reduced.

Caruso (n.d.) suggested that sleep be made a priority by employers for their employees. Caruso stated that in order to reduce risks work schedules needed to be improved, frequent breaks at work should be utilized, positive working relationships between supervisors and subordinates should be established, implementation of policies

and procedures to reduce the risk of fatigue and related health problems should be created, using periodic assessments to measure negative outcomes due to the work schedule and its effects on personnel, and establishing an anonymous and non-blaming reporting system about job error and the role of fatigue (p. 21).

Peterson (2016) found that the 48-hour shifts can be problematic as well and may not be the best option. Busch (2013), Naitoh et al. (1982), Vandale (2013), and Von Thaden (2017), all recommended firefighter paramedics utilizing naps and limiting the length of shifts as positive preventative measures for fatigue. Naps can help to restore performance and functioning issues that result from inadequate sleep. Krueger (1989), referenced studies that in 24-hour periods, 4-5 hours of uninterrupted sleep can help to prevent performance issues and that short periods of sleep over a 24-hour period are not effective. This can be the case in some fire stations based on call volume, where firefighter paramedics are only obtaining short periods of sleep versus a solid stretch of sleep. This can be detrimental to personnel and their patients.

Summary and Conclusion

In this chapter, I reviewed recent and past literature on fatigue associated issues experienced by firefighter paramedics working a 24-hour shift schedule which has established the foundation for this study. Some of the topics reviewed assisted in highlighting the numerous negative effects that firefighter paramedics may experience working a 24-hour shift, depending on the amount of calls they run and sleep obtained. There was plenty of literature to be found documenting the negative effects for firefighter paramedics working shift work and its impact on their mental, physical, and

physiological health. The result of fatigue experienced by firefighter paramedics was shown to affect performance, as well as personal and patient safety.

Firefighter paramedics are at an extremely high risk for fatigue, performance errors due to fatigue, and personal injuries working 24-hour shifts. The gap in the literature identified insufficient studies conducted on adequate recovery time between shifts as well as alternatives at high call volume stations for rest and recovery to prevent sleep deprivation. It is unknown how fire rescue personnel spend their time off and if they have adequate time to restore their systems prior to returning for their next shift. This phenomenological study was designed to further explore the level of fatigue that firefighter paramedics experience and how it impacts them.

The repair and restoration theory of sleep was relevant to this study because it specifically addressed the need for restorative sleep in order to function normally. firefighter paramedics working 24-hour shifts are not afforded regular hours to sleep during their shift and are expected to awaken whenever they receive a call in the middle of the night, preventing proper sleep from being obtained. As pointed out, the body needs a certain amount of sleep and based on the circadian cycle we are supposed to follow, negative effects may be experienced in the form of sleep disorders, decrease of cognitive functioning, and serious health issues. Firefighter- paramedics have to perform at a higher level of precision given the tasks they do. Errors experienced due to fatigue can be reduced by organizations taking measures to ensure better sleep health and the safety of their personnel.

Chapter 3: Research Method

Introduction

In this chapter, I focus on the research approach and methodology, including participants, data collection, and data analysis. The purpose of this qualitative, interpretive phenomenological analysis study was to explore how fatigue affected firefighter paramedics working 24-hour shifts in high call volume fire stations versus low call volume fire stations. More specifically, the purpose of this study was to discover possible fatigue problems as a result of sleep deprivation experienced by firefighter paramedics working 24-hour shifts without the possibility for proper rest during their shift and what coping strategies were utilized. I used open-ended interview questions to understand the perspectives of the participants and how they interpreted their own lived experiences. Using the interpretive phenomenological analysis allows for participants to share their personal experiences to relay their story without distortion or prosecution (see Abayomi, 2017). The results of this study might provide a better understanding of the fatigue levels that are faced by firefighter paramedics working 24-hour shifts. This study also might also offer some implications for policy changes regarding these schedules due to the increased risk of liability to employee health and the public they serve.

In this study, I examined if firefighter paramedics experience increased issues with fatigue working a 24-hour shift at high call volume stations versus low call volume stations. I interviewed six active duty firefighter paramedics who work in high call volume stations and six active duty firefighter paramedics that work in low call volume stations in a county fire department organization. The purpose of focusing on the amount of calls per 24-hour shift was to determine the effect of fatigue levels on personnel that

had less chance of restorative rest and regular sleep throughout the night due to the numerous calls versus low call volume stations where personnel may have a more restful shift. The results of a study conducted by Takeyama et al. (n.d.) found that fatigue and physiological functions were adversely affected by the amount of workload handled during the night time hours of the 24-hour shifts worked by firefighter paramedics. In this chapter, I cover the rationale for selecting the methodology, the sampling strategy, the instrumentation, and how I collected, organized, and analyzed the data.

Research Design and Rationale

The objective for this qualitative, phenomenological study was to interpret the personal experiences of the 12 participants to see what effect fatigue had on them physically, cognitively, and physiologically during their 24-hour work shift. The purpose of this phenomenological study was to explore the emergent themes of the shared experiences involving fatigue issues experienced working a 24-hour shift. According to Patton (2002), interviews allow us to learn the perspective and experiences of the interviewee and obtain information that cannot be gained through observation such as feelings, thoughts, and intentions (p. 341).

Using standardized open-ended interview questions helped to gather information based on the firefighter paramedics' personal stories working 24-hour shifts and any effects of fatigue they had experienced. They were able to elaborate on their perspectives through the interview questions, describing their real life experiences, which helped to address the research question in this study. The data that were collected from the interviews showed shared commonalities among the participants through identification of

themes and patterns. This was the central focus of the qualitative phenomenological approach.

I focused on gaining insight and understanding of the phenomenon by formulating questions to help answer the main research question. I gained initial demographic information and developed rapport with each participant regarding their age, experience in the department, stations they have worked at, and their current position and time on the department. The main research question in this study was: “What is the relationship between fatigue experienced by firefighter paramedics working 24-hour shifts at high call volume stations versus firefighter paramedics working 24-hour shifts at a low call volume station?”

In order to explore this phenomenon, I focused on standardized open-ended interview questions based upon the following: (a) calls for service handled on average per night during their shift; (b) the amount of sleep obtained during the circadian rhythm hours during their shift, as well as the amount of days off to recover needed to be restorative; (c) personal experiences with fatigue that had a negative impact on their health, safety, and field performance; (d) possible suggestions or policies they believed would help combat fatigue issues; and (e) real life stories and knowledge concerning the research topic that they have experienced. Prior studies from Costa (1996 and 2010), Swinhart (2007), Vandale (2013), Baney (2011), Peterson (2016), Cohen and Plecas (2015) and Wright et al. (2013) addressed the various phenomenon that were the foundation for formulating questions for interviewing the participants.

In this study, I focused on the experiences of active duty career county firefighter paramedics. Using the phenomenological approach helped to discover the meaning of the

lived experiences each participant has had. Based upon the experiences that each participant shared, I was able to develop clear themes and patterns that addressed the research topic. “The quality of the information obtained during the interview is largely dependent on the interviewer” (see Patton, 2002, p. 341).

Standardized open-ended interview questions helped to provide a guide that ensured that each participant was asked the same questions and used probing questions and transitions that assisted in gathering more in-depth information. Patton (2002) summarized the main reasons for using this method: (a) the instrument used can be reviewed by others using the findings, (b) variations won’t occur if different interviewers are used, (c) the interview is focused to use time wisely, and (d) responses are easier to identify for analysis (p. 346).

Meaning can be determined based upon the responses of the participants’ real-life experiences. This helps to understand the phenomenon in question, causing themes and patterns to emerge. The purpose of using this research design and approach was to explore the common themes that would emerge based upon the interviews regarding the effect of fatigue on firefighter paramedics working 24-hour shifts in two types of stations based on call volume.

The phenomenological approach was the best design for this study because the findings would be based on firsthand personal experiences of the population being studied in an area that needed further focus. There have been limited studies on the impact of fatigue on firefighter paramedics working 24-hour shifts focused on call volume. A small sample size was utilized in this qualitative study and insight gained

through the direct interviews. Twelve active duty career firefighter paramedics in a county fire department were interviewed in this study to explore this phenomenon.

Role of the Researcher

My role as the researcher was to interview the participants and ask questions in such a way as to better understand the phenomenon. It was my responsibility as the researcher to collect the data conducting face-to-face informal interviews, taking notes, as well as observing body language and behavior. I recruited participants from contacts within the county fire department organization based upon statistical call data in order to choose the two different types of fire stations. Through the interviews, I was able to gain a clearer understanding of the phenomenon by asking specific questions.

I currently work in the law enforcement field and have had direct contact with firefighter paramedics throughout my career while assisting each other on calls for service. My husband is an active career county firefighter paramedic who works 24-hour shifts in a high call volume station, which predisposes me to certain biases regarding the topic based upon my own observations and experiences. My husband works for the county fire department from which I sampled. I was able to utilize connections with the fire department through my professional association to contact their administration for permission to interview their personnel, as well as gain assistance on statistical call data and firefighter paramedic personnel. There was a good chance that the participants I ended up approaching for this study had some professional connection with my husband because of his station assignment and time on the job. I reached out via email and telephone to contact potential participants.

I gave the participants knowledge of my background and the association with my husband. I had to be extra vigilant to remain objective and not project my own experiences in conversation with the participants. I had to ask questions as if I had no knowledge of what the participants actually experienced. My knowledge of the research topic due to my first hand observations of my husband assisted me with my questions and finding the answers needed to understand the phenomenon in a more detailed way. I did not possess knowledge of what it was like to work at low call volume stations and had preconceived ideas of fatigue issues experienced in high call volume stations. It was beneficial to speak with firefighter paramedics that I did not have a personal connection with in order to listen to their experiences and interpretations.

Methodology

The goal of this phenomenological study was to explore the common themes that would emerge from firefighter paramedics interviewed based upon their personal experiences. I focused on current career firefighter paramedics that were currently working 24-hour shifts in two different types of stations based on call volume. The selection of these participants utilized purposeful sampling based on the criteria for this study to gain an understanding of fatigue experiences and the effects of interrupted sleep during proper and necessary restorative periods. Patton (2002), stated that, “the purpose of purposeful sampling is to select information-rich cases whose study will illuminate the questions under the study” (p. 46). Firefighter paramedics who worked 24-hour shifts were the focus of this study and speaking with current career personnel directly answered the research question and focus of the study. The goal of this study was to gather as much

information from current active duty career firefighter paramedics to understand the effects of fatigue working a 24-hour shift schedule.

Participant Selection

The population of interest in this study was current active duty career firefighter-paramedics that work 24-hour shifts in a county fire department. Twelve participants were interviewed: six from statistically low call volume stations and six from statistically high call volume stations. I used this purposeful sampling to gain insight into differences in sleep patterns and fatigue experienced in these two different environments. Purposeful sampling helps to ensure that the participants selected have an in depth understanding of the phenomenon being studied (Patton, 2002).

I first needed to determine which were the high call volume fire stations which were the low call volume stations. The second step was to identify all the firefighter paramedics that worked in those two stations in order to reach out and seek volunteers for the study. This study addressed a specific population, so only that population could provide knowledge on the research topic. In a qualitative study, there are no specific rules for the sample size except that it should depend on the information you are seeking and what will be most useful and credible to address the research topic within the desired time constraints and resources available (Patton, 2002). Through the use of interviewing a small group, more information rich data may be obtained from direct sources that have the life experience with the phenomenon. Creswell (2013), pointed out that in a phenomenological study, the number of participants have ranged from 1-325, while some recommendations for sample sizes have been for 3-10 individuals (p. 157).

For this qualitative phenomenological study, the population was specific to firefighter paramedics working 24-hour shifts. This group was selected based upon their required skill set and performance in the field and how fatigue may impact that during their 24-hour shift. Creswell (2013), referred to criterion sampling for participants, which is a variation in the purposeful sampling approach. Criterion sampling involves individuals that have experienced the phenomenon being studied. In this study, the criteria for the selected participants is that they are current career firefighter paramedics who work a 24-hour schedule.

Permission to conduct the study was obtained through Walden University's Institutional Review Board (IRB; 10-31-19-0406729). I sent a letter to the County Fire Department explaining my study and the anonymity of not identifying the department by name nor those who participated to gain access to the participants. Through information provided by the county fire department selected, I emailed current career firefighter paramedics in each of the two types of identified fire stations, via statistical data provided by the organization, for possible participation in the study. I included in the email a recruitment letter, detailing the research study and my contact information for follow-up questions. I scheduled interviews with those who agreed to participate at the time and place of their convenience in order to meet face-to-face. All participants were encouraged to ask questions for clarity and were provided a consent form to review and sign prior to beginning the interviews. The participants were provided copies of the consent form for their records and they were informed that the interviews would be audio recorded with two digital recorders. Upon conclusion of the interviews, I addressed any further questions or concerns they may have had. I informed them that I would follow up with

them to review the transcripts of their interviews to ensure validity of the collected data and thanked them for their time and participation.

Instrumentation

The goal of this study was to explore the impact of fatigue on firefighter paramedics working 24-hour shifts. In order to achieve that goal, the process of interviews was utilized to learn about the personal experiences and stories of each of the participants in this phenomenological study. The main tool that was used for obtaining data in this study was conducting interviews to gather information regarding the research topic. The instrumentation used to collect data that was utilized in this qualitative study was through interviews, review of notes, recordings and transcriptions, and analysis of all the data collected.

The following steps were used to collect data:

1. Obtaining approval from the Walden University IRB prior to data collection.
2. I reached out to the organization's statistical analyst to gather data regarding the call volume throughout the county in order to identify the high call volume fire stations and the low call volume fire stations.
3. I reached out to the Chief of the department in order to gain permission to access the population with an explanation of the study as well as utilization of anonymity.
4. I sent emails out to qualifying potential participants gained through the organization.

5. I received some initial information from email and used follow-up phone calls with potential participants and sent out a recruitment letter explaining the study.
6. I set up individual meeting times with each participant at their convenience and a location picked by them to conduct the interview. I provided a consent form for participants to review and sign.
7. I collected the data through face-to-face interviews with each participant through note-taking and audio recording.

The main data collection tool that was used during the interviews was two digital audio tape recording devices. Utilizing two devices helped to account for any technological failures. All interactions between the interviewer and interviewees were recorded for future analysis of the data collected. Using recordings to go back and review ensures the accuracy of the findings. In order to maintain good interview connections with interviewees, note-taking may not always catch everything and disrupting the interviewee by making them repeat themselves takes away from the continuity of the process. In qualitative, phenomenological studies, interviewing is the primary tool and source of data collected.

Data Collection

The target population was active career firefighter paramedics working for a county fire department organization. The main data collection tool for this study was face-to-face in-depth interviews that utilized standardized open-ended interview questions with note-taking and audio recording devices. The sample size consisted of 12 active duty career firefighter paramedics from the same department, 6 from low call

volume fire stations and 6 from high call volume fire stations who work 24-hour shifts. The length of the interviews was set for a maximum of 2 hours with the same format and questions pre-written for each. If there was a need to extend the interview past the 2 hours, the interviewer and interviewee had to agree to continue longer. Each interview took place in the environment that the participant selected. Prior to the interviews, all participants were provided with the consent form to read and sign. All interviews were audio recorded in addition to notes taken for further review to ensure that all information was gathered and not missed. Interviewees were encouraged to ask any questions of the interviewer and did not have to answer questions they did not feel comfortable answering. All interviewees were thanked upon completion for their participation.

Data Analysis

Creswell (2013) defined data analysis in qualitative research as, “preparing and organizing the data for analysis, then reducing the data into themes through a process of coding and condensing codes, and finally representing the data in figures, tables, or discussion” (p. 180). Data analysis assists the researcher in identifying themes in a qualitative study in order to understand the shared experiences and compare them. In order to analyze the data collected in a qualitative, phenomenological study, classification and coding needs to be established to help organize the gathered content. The aim of the analysis in this phenomenological study was to interpret the meanings of the participant’s lived experiences in order to identify common themes (Moser & Korstjens, 2018).

Software programs make this possible in order to identify, code, categorize, classify, and label similar themes found within the collected data (Patton, 2002).

Inputting data into a software program creates generated themes to organize data into

topics and labels them. NVivo 12 software was utilized for the purpose of inputting the transcribed data for analysis. This ensured management and storage of the collected qualitative data in an organized manner that identified the common themes and patterns generated for the study. Clark and Veale (2018), referred to sorting, which involves developing themes by categorizing codes based upon identified patterns such as: similarity, difference, frequency, sequence, correspondence, and causation (p. 484CT).

Content analysis of the data can be achieved following basic steps to serve as a guideline and assist with organization. Mayer (2015), lists the following analysis steps for the data:

Step 1: Preparation of the data.

Step 2: Definition of the unit analysis.

Step 3: Development of categories and a coding scheme.

Step 4: Tests of coding scheme on a sample of text.

Step 5: Coding of the whole text.

Step 6: Assessment of coding consistency.

Step 7: Conclusions from the coded data.

Step 8: Report about methods and findings (p. 62).

Issues of Trustworthiness

Trustworthiness of a research study is one of the most important components because the research conducted develops the findings that address the research question. Without reliance on the verification of the data to be accurate and true, the whole study can be called into questioned or shown to be invalid. Qualitative studies rely on trustworthiness or authenticity gained through balance, fairness, and completeness on the

part of the researcher, according to Patton (2002). Credibility of the researcher can be called into question if data is based upon bias or manipulations regarding the researcher's personal attachment or opinion. Results that are produced as a result are not credible. Addressing bias and personal opinion and forming a neutral position is important for the researcher to achieve trustworthiness.

In order to increase trustworthiness of a study, the researcher needs to provide documentation of the methodology and design utilized, data collection tools, and how the data will be analyzed to account for validity and reliability of the results. Patton (2002) recommended the use of triangulation of the data sources and perspectives gained through analyzation of responses. Truthful value is needed in a qualitative phenomenological study to enhance, "credibility, impartiality, dependence of judgment, consistency, dependability of data, and explainable inconsistencies or instabilities" (p. 93). Transparency of the research should be the priority of the researcher in their study to increase the believability of the phenomenon they are studying.

Data triangulation was the best method to help strengthen this study. In order to best understand the impact fatigue has on firefighter paramedics working 24-hour shifts, data was collected through in-depth face-to-face interviews. By using multiple sources of data collection, triangulation can be achieved to provide further support for the research topic. I used statistical data to ensure proper selection of the high call volume stations and the low call volume stations within the county fire department to ensure proper selection of participants to address the research topic. I used note-taking during the interview process, audio-recording of the interviews, cross checking of responses with the

participants to verify correctness and made clarifications so that the information gathered was corroborated.

Credibility

In a qualitative research design, credibility must be maintained through trust between the researcher and the participants. The importance of expressing to the participants that they will be able to remain anonymous as well as their department not identified, will give them more freedom and ease with answering questions honestly, without fear of facing retribution. Based upon the responses gained from the participants, common themes should emerge, enhancing credibility. Using the standardized open-ended interview questions enhanced credibility because the same set of questions and procedures were used for each participant. Using a standardized form always the researcher to more fully develop the instrument and know the data limitations and considerations prior to data being gathered (Patton, 2002, p. 347). Participants had their answers reviewed once the interview was complete to ensure agreement of their responses given and were allowed to clarify or add any other pertinent information they wanted to share.

Transferability

The participants for this study were purposefully selected in order to gain their perspectives based upon personal experiences in order to gain insight into the phenomenon being studied. In-depth data collection helped to obtain transferability through detail and emergent themes and patterns. Perceptions and descriptions were obtained from each interview, resulting in detailed information that was used to identify common themes.

Dependability

Dependability refers to whether or not the data collection device will measure what is designed to measure within the study (Frankfort-Nachmias & Nachmias, 2008). Dependability in this study was gained through coding of the data obtained from the in-depth face-to-face interviews. Dependability was also achieved through the use of data triangulation and through the research procedures that have been explained in this qualitative, phenomenological approach study. I kept detailed written records of the interviews, to include recordings of the interviews, transcription, participant review of their interviews, and explanation of the data analysis process.

Confirmability

All biases were included and addressed in order to nullify my personal opinions and experiences about the phenomenon to increase objectivity. Confirmability can assist with verification and elaboration of findings that will enhance credibility (Patton, 2002). I ensured confirmability in this qualitative, phenomenological research study by documenting the data gathering process and how the data were analyzed. This enhanced the credibility and objectivity of my findings as they related to the research topic.

Ethical Procedures

Prior to collecting any data, IRB approval from Walden University must be granted. This study was conducted in accordance with Walden University's IRB approval 10-31-19-0406729. Protection of human subjects is paramount in a research study and utilizing the IRB ensured that no harm was done to participants. All federal and Maryland state regulations were followed to ensure proper ethical protections were in place for all the participants. I completed the Collaborative Institutional Training Initiative student

researchers course certificate #33036031 in accordance with the research of human subjects. All guidelines provided by Walden University required to complete this study were adhered to by the researcher prior to collecting data. My goal for this study was to provide protection and safety for the participants and to ensure integrity and credibility of the researcher and the study.

I reached out to the organization that I wished to use during the approval process with the IRB, via an emailed letter for permission. Once I received IRB approval, I provided the organization with my approval letter and I reached out to potential participants to take part in the study. Prior to participating in the research, all of the participants were provided with a copy of the consent form for review, explaining the study and required information. I informed all of the participants about the data collection procedures prior to their interviews so they were aware of the recording devices. The participants were informed that they would receive a copy of their transcript of their interview for review to ensure accuracy. I informed all the participants that the recordings and documents gathered for the study will be kept in a secured safe, accessible only by myself, for a minimum of five years. All participants were informed that once the study has received final approval, I would send them each the summary report of the research findings.

Summary

The focus of this chapter was the methodology and research approach. Understanding the impact that fatigue can have on firefighter paramedics working 24-hour shifts was the focus of this phenomenological study. In this chapter, I also covered the following areas of the study: the research design and approach, the role of the

researcher, the methodology of the qualitative inquiry, sample size and selection, the instrumentation to be used, data collection and analysis, trustworthiness, and ethical strategies for the study.

Chapter 4: Results

Introduction

The purpose of this qualitative, interpretative phenomenological study was to explore how fatigue affected six active career firefighter paramedics working 24-hour shifts at a high call volume fire station versus six active career firefighter paramedics working 24-hour shifts at a low call volume fire station. Through interpretative analysis, common themes emerged based upon the shared experiences of the participants involved in examining this phenomenon. Open-ended interview questions were utilized in this study to gain the perspectives of the participants and their lived experiences regarding this topic.

I collected the data for this study through standardized in-depth, face-to-face interviews with 12 active career county government firefighter paramedics. The interviews were transcribed verbatim and entered into Nvivo 12 software for data analysis and coding. Data was analyzed based upon Mayer's (2015) coding steps. In this chapter, I discuss the setting, participant demographics, how the data was collected, how the data was analyzed, the results of the data analysis, and how these results were deemed trustworthy.

Setting

I used purposeful sampling to collect data through in-depth standardized interviews with 12 active career firefighter paramedics working for a county government fire department. The interviews took place between November 5, 2019 and December 3, 2019 at different locations based upon the preference and availability of the participants. All requirements from the organization and the Walden University IRB were followed

with regard to interviewing the participants and protecting their anonymity. Participants were able to speak freely about their personal experiences and were not influenced by any outside interference, enabling them to relay uninhibited information.

Demographics

There were 12 participants that volunteered for this study out of 21 total individuals contacted. All participants were active career firefighter paramedics that met the selection criteria. Almost one third of the participants were female and the rest were male. There was a mix of African American and Caucasian participants. The demographic questions in this study included age, gender, race, number of years of service in the fire department, number of years serving in their current assignment, marital status, number of children, and their current rank.

Data Collection

Face-to-face, in-depth interviews with standardized open-ended questions were utilized for the data collection strategy in this study. Once I received the approval from Walden University's IRB, I immediately began the data collection phase of the study. The focus of the interview questions was to explore how fatigue affected firefighter paramedics working 24-hour shifts. I served as the data collection instrument for this study by developing the interview questions and conducting the interviews directly with audio recorders and note-taking.

Prior to the interviews, I emailed potential participants based upon the set criteria and received permission for participation through email communication. Each participant was sent the consent form for their review prior to conducting the interview. The consent form informed each participant about the basis of the study and guidelines. After

obtaining agreement for participation, I scheduled face-to-face interview times based upon their availability and locations that were deemed mutually acceptable.

All participants reviewed and signed the consent form and were provided copies and signed copies were retained by me. All demographic data was obtained prior to the start of the interview questions. All participants agreed to the interviews being audio-recorded. The time ranges of the interviews varied based on each participant, spanning from 12 minutes being the shortest to 69 minutes being the longest. Each interview was recorded using two audio recorders and reviewed for accuracy upon completion. In each interview, I also utilized note-taking as a supplemental data collection tool in the event of failure with the audio equipment. No issues occurred during the data collection phase of the study.

Data Analysis

I conducted the standardized interviews using open-ended questions that allowed each participant to share their personal experiences with this phenomenon. The first step in the data analysis plan was to transcribe each interview verbatim in order to prepare it for further analysis. I reviewed the transcripts for any errors and found none. The next step was to use Nvivo 12 software to assist with in-depth data analysis and coding of the collected data. Nvivo 12 software is a recommended tool to assist with analyzing and coding collected data in qualitative research studies. I reviewed the transcripts for the emergence of themes, common shared experiences, and similarities relayed by the 12 participants using interpretative analysis following the data analysis steps set forth by Mayer (2015). Based on this process, similar themes and patterns were identified from the collected data and grouped together.

Evidence of Trustworthiness

I ensured reliability and validity prior to conducting the study in various ways. I went through Walden University's IRB review process to ensure establishment of credibility. I submitted the required documents to Walden University's IRB regarding my intended research and questions, as well as any guidelines and permissions needed and received approval which adds to the credibility and validity of this study. I also sought approval from the organization that I would be requesting participation from to ensure credibility and reliability. Once I received approval from Walden's IRB and the participant's organization, I emailed those individuals who met the study criteria with a recruitment letter explaining the purpose and goal of the study.

Those who chose to participate did not have concerns about any negative backlash or punishment within their workplace. I still made sure to explain the extent of anonymity controls that would be used in the study and how responses would essentially be categorized and paraphrasing would be used in order to ensure that the participants would be protected from direct identification. All participants felt at ease during their interviews and spoke freely. I also made sure to remain objective in each interview, adhering to the set of standardized questions and refraining from injecting any personal knowledge or commentary. This approach helped ensure validity and reliability of the data collected and that it was solely what the participant stated and not subject to any outside influence.

Due to the fact that my husband works for the same organization involved in the study, I chose to utilize the concept of epoche and bracketing, which is used in phenomenological studies. It involves separating any past knowledge and experiences on the topic and provides direct understanding that is authentic, without introducing any

personal knowledge, when personal stories were being relayed by the participants (see Bednall, 2006). This creates objectivity by the researcher and ensures that no influences are cast upon the participants and their responses. This further enhanced the validity of the process and the accuracy of the data that was collected. All participants were informed during the data collection process that they would receive a copy of this study upon completion. Some of the participants did not wish to receive a copy. A copy of this study will also be provided to the organization in which the participants were selected from.

Credibility

Credibility in a qualitative study is maintained through trust between the researcher and the participants. In order to establish credibility in this research study, all candidates informed of the study were advised that their participation was completely voluntary and they were given the informed consent form stating the risks and procedures, along with the steps that would be taken to ensure anonymity. Prior to the interview questions being asked, any concerns were addressed with participants and the topic of anonymity.

The participants were given an explanation of how the data analysis would generate themes or categories and paraphrasing of any statements made as much as possible. I made sure to review the procedures that would be used to protect anonymity to ensure comfort and increase truthfulness in their responses. All of the participants were comfortable answering and did not have any concerns about relaying honest answers. The participants felt no fear of reprisal from their organization and felt comfortable answering honestly based upon their personal experiences.

All of the participants had experienced the phenomenon that they were asked about in the interview questions, which also enhanced the credibility of the study. Data triangulation ensured strength in this study. Utilizing departmental statistics to identify the higher call volume stations and the lower call volume stations in which the participants would be selected from was helpful to see if there was a difference in the level of fatigue experienced by the firefighter paramedics at one type of station versus another. The use of audio-recording, combined with note-taking to help cross check responses and then transcribing interviews verbatim also enhanced the level of accuracy in the responses gathered to give more strength to the data collected, ensuring its trustworthiness. The interviews were transcribed verbatim and review of recordings and notes was conducted by the researcher prior to input into the software program ensuring further credibility.

Transferability

I utilized purposeful sampling for the selection process for this study based upon the criteria of being a current career county firefighter-paramedic working a 24-hour shift either at a high call volume station or at a low call volume station. This helped to ensure that the perspectives were shared by participants ensuring the consistency of the phenomenon being explored in this study. Transferability was gained through in-depth interviews and multiple ways to record the data obtained and then sorted through for identification of emergent themes or patterns manually as well as through the use of Nvivo 12 software.

Dependability

Dependability was achieved through the direct data obtained as a result of the in-depth interviews and transcription methods which all made coding the data possible in order to achieve the study results. Dependability was achieved by keeping detailed interview records via note-taking and audio-recordings of each participant, transcribing each interview and cross checking it with the recordings and notes taken, and utilizing data entry into a data analysis software program for analysis of the data collected.

Confirmability

I excluded biases by addressing my spousal relationship with a firefighter-paramedic currently employed by the same organization involved in the study, and abiding with bracketing to be objective and ensure validity while following the standardized interview questions. I was able to separate any personal knowledge and ask questions as if I had no knowledge about the topic in order to ensure more in-depth answers and explanations. Confirmability was achieved by outlining the data gathering process followed and how data would be analyzed. The research process for this study was documented fully and its connection to the findings was established.

Results

Once each participant's interview was completed, I transcribed it verbatim and then reviewed it with the audio-recording and notes taken during the interviews. Using Nvivo 12 software, I entered the transcriptions in and was able to identify a total of 13 themes that emerged. The following subsections were organized as follows: central research question, sub-question 1, sub-question 2, sub-question 3, and sub-question 4.

Central Research Question

The central research question was: “What is the relationship between fatigue experienced by firefighter paramedics working 24-hour shifts at high call volume stations versus firefighter paramedics working 24-hour shifts at low call volume stations?” From the analyzed data for this central research question, two themes emerged.

Theme 1: Overall fatigue experienced due to the job schedule. All of the participants shared their own personal stories of experiencing fatigue based upon calls for service, overtime worked, family obligations on days off, various station assignments, and sleep issues that they developed as a result of working a 24-hour shift schedule. Four out of the six participants that worked in the high call volume stations referenced having sleep issues that caused them fatigue due to the job schedule with contributing factors being the sleeping environment, anticipation of a call, trouble falling asleep when it was time for bed, trouble falling back asleep after returning from a call, sleep disruption based upon alert tones in the station when they were not the ones being dispatched, problems getting up for calls in the middle of the night, and problems with sleep patterns on days off. The amount of sleep the participants obtained varied from zero to four hours per night on average. Participant 1 commented, “It’s definitely facilitated my laziness and lack of motivation. I come home exhausted.”

The six participants from the low call volume stations reported the amount of sleep obtained from a minimum of four hours to a maximum of ten hours a night. Three out of the six participants had worked at high call volume stations at other times in their careers and noted that they got more rest in their current assignment and felt better overall. Three out of the six participants reported having sleep issues at work and at

home. All of the participants advised that their amount of sleep during their shift would depend on the time of the calls for service, the station alert tones for other units, any overtime worked, and how long the call would take as to whether or not they were able to sleep soundly or return to sleep once woken up for a call. All of the participants with families did advise of increased fatigue due to having children to care for outside of work hours as it contributed to getting sufficient recovery rest on their days off. Participant 11 stated, "It's amazing now," referring to the amount of sleep they got at the lower call volume house compared to a former assignment in a high call volume station.

Most of the participants noted the effects of fatigue in the form of increased irritability with patients or co-workers. Most of the participants noted that they had developed sleep issues such as shift work disorder, sleep apnea, insomnia, or other types of sleep disorders. All of the participants acknowledged a decrease in cognitive thinking skills and decision making abilities involving overnight calls when they were awoken during sleep periods. One participant noted being more susceptible to illness due to being run down from lack of sleep obtained at work. All of the participants stated that the first day off of shift was usually spent trying to recover and they felt somewhat better on their second day depending on how much rest they obtained and the next day they are back to work.

Theme 2: The amount of restful sleep obtained in the two different stations.

The six participants that worked in the high call volume stations reported issues falling asleep at bedtime and then falling back to sleep after late calls with the exception of one. Four out of the six participants at the high call volume stations advised that they had trouble falling asleep at bedtime and the same number stated that they have trouble

falling back asleep after getting up for calls during the night. All participants except two agreed that if the call was at 3:00 a.m. or later, they wouldn't be able to go back to sleep and would just stay awake until the end of their shift. Two out of the six participants advised that hearing alert tones for other units interrupted their sleep. Participant 1 from the high call volume stations stated, "At the end of the day, people are going to work better if they're rested."

Three out of the six participants from the low call volume stations advised that they had trouble initially falling asleep when they laid down for bed. Two of the six participants stated that their trouble falling asleep was related to having things on their mind or thinking of work tasks or felt anxiety anticipating receiving a call for service. Out of these two participants, they both had prior service working at busier stations. Four participants advised that they were usually able to fall back asleep depending on the complexity of the night time call. Two participants noted that they would not be able to sleep again for calls received after 2:00 a.m. Participant 7 from the lower call volume station commented, "Okay, if I lay down, when is the next call going to come in?"

Sub-Question 1

What do you think is the average amount of sleep obtained when you work your 24-hour shift? From the analyzed data for this sub-question, three themes emerged. This section is prearranged as follows: Theme 1: Sleeping environment on the job, Theme: 2: Call dependent based on length of the call, call type, and the time of the call, and Theme 3: Cognitive functioning effects.

Theme 1: Sleeping environment on the job. Three out of the 12 participants referred to the distraction of the alert tones interrupting their sleep for calls for other

units. Four other participants commented that the volume of the alert tones for calls in the middle of the night used to be extremely loud and jolting. These participants advised that the system has been changed and the alert tones are more bearable now. Participant 1 from the high call volume stations stated, “They changed the station alerting so it is no longer the big noise and bright lights and the heart rate from 60-120. We have red lights come on so it’s not as stress inducing and a gentler noise.”

Participant 3 did relay that in the Captain and Master Firefighter bunk rooms, the controls could be switched to only alert for the calls they would run specifically, which was helpful being in a high call volume station. Participant 7 advised that the tones at their low call volume station were turned lower and that if for some reason they were to miss a call, dispatch would call the fire station. Three out of the twelve participants reported having no issues sleeping at their station during their shift. Of those three, one was from a high call volume station. Participant 8 from the low call volume station stated, “It takes a little while because I’m in a small room with six other people, some may snore a little bit or the radio is up at different volumes.” Participant 1 from the high call volume station stated, “I don’t sleep very well at fire houses. I don’t sleep well at home either, but I really don’t sleep well at work.”

Theme 2: Call dependent based on length of the call, call type, and time of the call. Out of the 12 participants, seven reported having issues falling back to sleep after waking up in the night for calls for service. Four out of the seven were from high call volume stations. All of the six participants from the lower call volume station advised that their calls could take up to 2 and a half hours to complete based upon the transport time to and from the hospital. All of the six participants at the high call volume

stations said they have a turnaround time of at most an hour and a half for handling a call. Participant 11 who worked at a low call volume station stated, “I would say it’s station dependent, call-load dependent. I mean, you don’t sleep the best at the fire house anyways, but it’s kind of like a Band-aid, you can get through it.”

All of the 12 participants advised that the serious trauma calls, more care-involved calls, higher profile medical calls, physically demanding calls, and fires contributed to increased adrenaline or re-thinking actions taken, prohibiting them from being able to fall back to sleep after returning from a night time call. Participant 8 from a low call volume station stated, “If it’s something that was a little more intense, got the adrenaline going, it takes a little bit longer. Or if something didn’t go right, or if you’re beating yourself up because you’re thinking, man I could’ve done this or why didn’t I do that.”

The six participants from the high call volume stations and two participants from the low call volume stations agreed that they would not be able to fall back asleep when handling any calls past 2:00 a.m. Participant 5 that worked in a high call volume station said, “After 2:00 a.m., I think there have been a few times where the Captain and I just made a pot of coffee and stayed up and sat around and talked because we knew it was useless to try to go back to sleep.”

Theme 3: Cognitive functioning effects. Two out of the 12 participants reported that they had no issue with memory recall and cognitive functioning when running calls overnight, one was from a high call volume station and the other was from a low call volume station. Ten out of the 12 participants noted that when handling calls during the nighttime hours, their reaction time was slower, their decision-making skills were

affected, they experienced brain fog, they utilized co-workers or cell phones to assist with memory recall in handling certain medical situations involving protocol or dosages, their patient care may not have been as thorough as during the daytime hours, their ability to diagnose was sometimes delayed, and they experienced being disoriented driving. This was evenly distributed on both sides, that is, five participants on each side shared this similar experience.

Participant 8 from the low call volume station stated, “Driving home from the hospital late at night you would literally blow by your exit, and it’s like you’ve taken that exit I don’t know how many times to get back to fire house, and once in a blue moon, you’ll just blow right past it.” Participant 9 from the low call volume station gave an example:

If you’re half asleep and walking into somebody’s house and you’ve got an acute patient that needs immediate care, you’re probably a little bit slower to react to recognize what’s going on, maybe even recall the treatments. I’m not talking long delays, necessarily, but any delay when somebody is suffering is a bad delay.

Participant 2 from the high call volume station said:

In my experience, the calls that go on between midnight to 5:00 a.m., whereas, you would potentially do something a certain way during the daytime, at nighttime without even thinking about it, you can potentially fall into more of a lackadaisical way of doing things, or just thinking that your solution is adequate when looking at it after you’ve gotten sleep, it absolutely wasn’t.

Sub-Question 2

Are you able to sufficiently gain enough recovery sleep/rest on your time off?

From the analyzed data for this sub-question, four themes emerged. Theme 1: Overall sleeping habits due to the job, Theme 2: Sleep disorders, Theme 3: Actual restorative sleep received prior to working their next shift, and Theme 4: Personal methods for dealing with fatigue.

Theme 1: Overall sleeping habits due to the job. Five out of the six high call volume station participants reported not having enough time off to recover and advised that their first day off was usually wasted by feeling exhausted or napping. They reported that their second day was better and felt rested by the third but at that point they were back at work. Only one of the six reported having no issues with their sleeping habits on and off the job. Theme 2 under the central research question topic addressed the type of sleep obtained at the different call volume fire stations.

Three of the six participants from the low call volume stations reported having no issues with their sleeping habits at home and on the job. Three of the six participants from the low call volume stations reported having abnormal sleep schedules at home and at work, sometimes waking up at night and completing tasks at home because they cannot sleep. Participant 8 of the low call volume station did report having the same problem with being exhausted their first day off and having issues with a normal sleep schedule at work and at home. Participant 7 of the low call volume station stated they cannot always sleep well on their days off due to family responsibilities.

Theme 2: Sleep disorders. Eight out of the 12 participants currently have or have had some type of sleep disorder. Out of the eight participants, three were from the high call

volume stations, two from the low call volume stations had a sleep disorder at a prior busy assignment but now have no issues after changing stations, and three from the low call volume stations currently have some type of sleep disorder. Two of the 12 participants were diagnosed with shift work disorder, one was from a high call volume station and the other was from the low call volume station (developed in former high call volume station). Two of the twelve participants were diagnosed with sleep apnea, one was from a higher call volume station and the other was from the lower call volume station(developed in former high call volume station). Two of the 12 participants were diagnosed with insomnia, one was from a high call volume station and the other was from the low call volume station(developed in former high call volume station).

Theme 3: Actual restorative sleep received prior to working their next shift.

Five of the six participants from the high call volume stations advised that they did not feel they had adequate time to recover on their days off. Out of those five, two advised that they felt better the second day and that the first day off was a “wash.” Five out of the six participants from the low call volume stations advised that they did not experience any major issues with recovery on their days off. Two out of those five advised that family responsibilities or other tasks that needed to be done could play a role in getting adequate rest. One of the six participants said that their first day off was usually spent recovering and the second day off was better.

Participant 1 from the high call volume station shared that their acceptable baseline for sufficient recovery time on their day off was not a normal human being’s acceptable base line for sleep, that they don’t like it, but it’s just how it is. Participant 4 from the high call volume station commented, “Sometimes, I’m just like, don’t make me

do anything other than run calls, like don't expect much out of me, I'm here, I showed up.

Theme 4: Personal methods for dealing with fatigue. Three out of the 12 participants advised that they used sleep aid medication to deal with their fatigue, one out of those three was from the low call volume station. Eight out of the 12 participants utilized naps either at work if necessary due to excessive fatigue and at home. Three out of the eight were from the low call volume stations. Two out of the 12 participants mentioned using nicotine products, one from each of the different stations. Nine out of the 12 participants used caffeine to assist with fatigue issues, three of the nine were from the low call volume stations. The use of exercise was cited by three of the participants, two being from the low call volume stations.

The use of alcohol was referenced by two participants, one from each type of station. Trying to get adequate sleep on days off was referenced by all the participants but was based upon tasks or jobs that need to be completed on these days. One of the 12 participants from the high call volume station had tried behavioral therapy to create healthy sleep habits that their doctor recommended.

Sub-Question 3

Have you developed any health problems as a result of working a 24-hour shift schedule? From the analyzed data for this sub-question, one theme emerged. Theme 1: Health issues experienced.

Theme 1: Health issues experienced. Six out of the 12 participants had no physical health issues they currently suffered from, two of the six being from the higher call volume station. Two out of the 12 participants suffered from hypertension and both

were from the high call volume stations. Two of the participants from the low call volume stations advised that they had prior sleep disorders, sleep apnea and weight gain working at a higher call volume stations which improved and disappeared after working at the lower call volume station. Weight gain was also experienced by one of the participants in the high call volume station.

Insomnia was referenced by one participant in the low call volume station and one in the high call volume station. Sleep apnea was experienced by one of the participants in the high call volume station. Two participants were diagnosed with shift work disorder, one from each station type. One participant stated they were more prone to cold-like illnesses from being rundown from fatigue that worked in the low call volume station. One participant advised they suffered from anxiety that worked in the low call volume station.

Sub-Question 4

What is the level of departmental awareness/accommodation for fatigue issues experienced by personnel? From the analyzed data for this sub-question, three themes emerged. Theme 1: Overall departmental awareness, Theme 2: Department accommodations, and Theme 3: Employee suggestions.

Theme 1: Overall departmental awareness. Two out of the 12 participants, one from each station type, were not sure if the department was aware that fatigue could be causing issues for personnel. Five out of the 12 participants did not think that the department was aware of the fatigue issues, three of the five work in the high call volume stations. Five of the 12 participants thought the department had some level of awareness, three of those being from the low call volume stations.

Participant 1 that works in a high call volume station stated, “So I think there is an awareness, per se, but I won’t say there’s been a campaign to make sure anything is done about it.” From participant 3’s perspective working in the high call volume station, they felt that the department was not aware of the problem because nothing catastrophic has happened being associated with sleep issues. Participant 5 from a high call volume station pointed out that as long as the calls are getting answered and things aren’t happening that are detrimental to patient care or the outcome of the call, the department will not intervene. Participant 6 from a high call volume station said, “I don’t think they are aware. I think they know it happens in some of the busier stations, but there’s nothing that they’ve done about it.”

Theme 2: Department accommodations. Ten out of the 12 participants referenced the use of safety naps during the 24-hour shift if needed, four of these being from the high call volume stations. Two of the 12 participants, one from each station type, mentioned the existence of a video from the fire chief saying that safety naps were ok. Nine of the 12 participants, four being from the high call volume stations, advised that being able to take a nap during their shift can be supervisor specific in regards to having permission to do so. With the exception of the two participants that knew of the video from the fire chief allowing naps if needed, none of the other participants were aware that this was an allowable department policy.

Six of the 12 participants mentioned that the department has a nutritionist but there is no fatigue information provided. Two of the 12 participants referred to seeking treatment at their county medical office as a possibility. Three of the 12 participants advised that the department offers counseling/psychological services. All of the

participants acknowledged that there is no clear program, accommodation, or educational information provided to them regarding fatigue or sleep disorders.

Theme 3: Employee suggestions. All 12 participants agreed that naps should be permitted when needed throughout their shift to fight fatigue. Six out of the 12 participants, four being from the high call volume stations, were in favor of working 24-hour shifts with 72 hours off instead of 48 hours off. Five out of the 12 participants, four being from the high call volume stations, thought that having time out of service after a call to eat a meal or have time to restock the unit or decompress would be helpful. Two out of the 12 participants, one from each station, thought that the department needed to push out healthier coping mechanisms for dealing with sleep issues. Five out of the 12 participants, four being from the low call volume stations, were in favor of rotating apparatus each shift to give time off the medic unit and some even suggested rotating apparatus during the shift if the call volume was high to give an adequate amount of time to rest.

Two of the 12 participants were in favor of replacing the firefighter paramedic with the basic life provider on calls that turned out to be downgraded from an advanced life service call that requires a paramedic. The options suggested were to have the paramedic drive instead of administer treatment for a break as well as swapping out seats with a basic life service provider riding the engine for a break.

Participant 1 from the high call volume station noted that the stations vary between rural and not too many calls versus ones that are constantly busy and naps should be a call-dependent type option. Participant 1 from the high call volume station

also commented that there is no time to rest and no time to chew their food when working at a busy station.

Summary

The purpose of this qualitative, interpretative phenomenological study was to explore how fatigue affected six active career firefighter paramedics working 24-hour shifts at high call volume fire stations versus six active career firefighter paramedics working 24-hour shifts at low call volume fire stations. As a result of this study, common themes were developed and explored based upon shared experiences of the participants regarding the phenomenon. One central research question and four sub questions of importance helped to steer the direction of the study and the results. Data collection consisted of face-to-face, in-depth interviews with standardized open-ended questions were utilized for the data collection strategy in this study. I used Nvivo 12, a software program that assists with analyzing qualitative data. I reviewed the transcripts for the emergence of themes, common shared experiences, and similarities relayed by the 12 participants as applied to interpretative analysis following the data analysis steps set forth by Mayer (2015). Similar themes and patterns were identified from the collected data and grouped together. A total of 13 themes emerged in response to the central research question and the four sub questions.

Throughout these listed sections, themes became evident based upon the interview questions which provided information regarding the varying experiences with fatigue by each participant. There were many similarities in the majority of the experiences of the participants with fatigue issues working 24-hour shifts. All the participants shared their personal experiences with sleeping at work, sleeping at home,

how affected they were by fatigue, how they handled fatigue, if they had any sleep or medical issues as a result of fatigue working their 24-hour shift, departmental knowledge of the problem, and suggestions on how to deal with the problem. In this chapter, I covered the setting, demographics, data collection method, data analysis method, the evidence of trustworthiness, the results of the data analysis, and a summary of the findings. In Chapter 5, I reveal my interpretations of the findings, limitations of my study, my recommendation regarding future research studies on this subject, the implications of social change for this research study, and a conclusion.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this qualitative, interpretative phenomenological study was to explore how fatigue affected six active career firefighter paramedics working 24-hour shifts at high call volume fire stations versus six active career firefighter paramedics working 24-hour shifts at low call volume fire stations. Through interpretative analysis, common themes emerged based upon the shared experiences of the participants examining this phenomenon. Open-ended interview questions were utilized in this study to gain the perspectives of the participants and their lived experiences regarding this topic. All of the participants in this study were active career firefighter paramedics working in a county government fire department.

I collected the data for this study through standardized in-depth, face-to-face interviews as part of this qualitative, phenomenological design. All of the participants for this study were chosen using a purposeful sampling strategy which allowed me to understand the phenomenon through interview questions, addressing the research topic and questions. I used the interpretative phenomenological analysis approach because it allowed me to explore the perceptions and common themes that became evident through the responses of the participants. I utilized the analysis concept provided by Mayer (2015) to analyze my data and a total of 13 themes emerged.

All of the 13 themes emerged from asking the participants the prepared interview questions related to the main research question of the relationship between fatigue experienced by firefighter paramedics working 24-hour shifts at high call volume stations versus firefighter paramedics working 24-hour shifts at low call volume stations. The

findings of this study resulted in an understanding of how personnel experienced fatigue based upon their station assignment.

My data sources consisted of statistical data representing the call volume at all the stations for this county government department in order to identify the high call volume stations and the low call volume stations to assist with participant selection. The findings of the study revealed that there were not written policies or resources to assist with fatigue issues or education available for department personnel. According to Sofianopoulos (2011), fatigue affects the ability for an individual to function at their normal level. Prolonged fatigue can lead to burnout among firefighting personnel, depending on the demands of each shift and the total number of hours worked (Basinska & Wiciak, 2012).

Interpretation of Findings

I developed a central research question and narrowed the questions into four sub-questions to explore how fatigue affects firefighter paramedics working 24-hour shifts in high call volume stations versus firefighter paramedics working 24-hour shifts in low call volume stations. The central research question and the four sub-questions revealed 13 themes.

Central Research Question

The central research question was: “What is the relationship between fatigue experienced by firefighter paramedics working 24-hour shifts at high call volume stations versus firefighter paramedics working 24-hour shifts at low call volume stations?” The results of this question showed that most of the participants had experienced fatigue due to the job. There was a difference in the amount of sleep obtained in the different stations

which contributed to the level of fatigue experienced and the manifestation of sleep disorders or other medical issues.

Participants in both types of stations made references to having issues with their sleep patterns at the fire stations due to anticipating calls, distractions in the bunk room, alert tones, and awakening during the night for calls and being unable to fall back asleep. Participants from the high call volume stations reported 0-4 hours per night as the average amount of sleep, which varied, while participants from the low call volume stations reported 4-10 hours per night as the average amount, which also varied. Lack of proper restorative sleep while at work was shown to affect firefighter paramedics on their days off. Between 2:00 a.m. and 6:00 a.m., the ability to respond normally is decreased based upon the circadian cycle (see Busch, 2013). Fass (2015) pointed out that 7-8 hours of sleep are required nightly to support the body's biological rhythm.

Several of the participants that worked in the low call volume stations had prior assignments in high call volume stations. What was poignant was that they had suffered previously with sleep issues or medical issues at those prior assignments, but noted that they improved after working at their current assignment. Those who still struggled with sleep issues who worked at the low call volume stations attributed it to lifestyle or family obligations. The participants with children noted that it was not always possible to recover effectively during their time off.

Most of the participants experienced cognitive issues and decreased ability to make decisions as well when handling calls overnight along with increased irritability. The findings supported similar experiences shared by the participants, explaining the main cause of fatigue and the two themes that emerged. The results indicated that the

majority of participants from the high call volume stations experienced more issues with fatigue.

Sub-Question 1

Sub-question 1 was: “What do you think is the average amount of sleep obtained when you work your 24-hour shift?” Understanding the level of fatigue experienced by firefighter paramedics is important and how the amount of sleep they obtain at work perpetuates potential problems with fatigue. The results that came from this sub-question showed that the amount of sleep obtained varied among participants. The themes emerged based upon the sleeping environment, time of the late night call for service, the length of time required to handle an overnight call for service, and the type of call and how it affected their cognitive functioning during this time. Participants from the high call volume stations reported zero to four hours per night as the average amount of sleep, which could vary, while participants from the low call volume station reported four to ten hours per night as the average amount, which also varied.

Some of the participants noted initial issues falling asleep when it was time to go to bed such as distractions in the bunk room or call anxiety due to call anticipation, while others cited the station alerting system would keep them up, hearing other calls that did not require them to respond. Some participants had no trouble falling asleep at bedtime or upon returning from a late night call. The majority of the participants had trouble gaining proper restorative sleep while at work which would then carry over into their days off.

The majority of the participants reported having trouble falling back asleep after a late night call. The participants that worked in the low call volume stations had a longer turnaround time when handling calls based upon the distance from their station to the

hospital, while the participants from the high call volume stations could have a shorter turnaround time by almost an hour or more because of the proximity of the hospital to their assigned station. Participants in the low call volume stations will remain awake longer handling late night calls that require transport to a hospital. All participants noted experiencing some type of adrenaline from certain call types which could contribute to their inability to fall back asleep after returning from a late night call. The results again showed more of the participants from the high call volume stations experienced issues with falling back asleep after being woken up for calls and not getting anywhere near adequate restorative sleep during their shift to improve functioning and decrease fatigue.

Cognitive functioning on late night calls was split between the participants evenly with similar experiences regardless of the call volume, but by being woken up at night to function on a call.

Sub-Question 2

Sub-questions 2 was: “Are you able to sufficiently gain enough recovery sleep/rest on your time off?” This question is one that needs to be investigated further because not much is known on how firefighter paramedics that work 24-hour shifts recover on their days off and if their allotted time off is sufficient to fight fatigue or counteract the formation of sleep disorders and illness. Half of the low call volume stations firefighter paramedics reported not having enough time off to recover on their days off, and all but one of the firefighter paramedics that worked at the high call volume stations reported the same issue. The participants in the high call volume stations were more likely to have an issue obtaining restorative sleep on their days off to sufficiently recover prior to their next shift.

Through review of the shared experiences, four themes emerged involving overall sleeping habits due to the job, sleep disorders, actual restorative rest received prior to working their next shift, and personal methods for dealing with fatigue. This directly links co-conditioning theory and the Repair and Restoration Theory of Sleep as they apply to this study in regards to sleep being essential for restoring physiological functioning and overall mental and physical health (Cherry, 2018; Tanaka & Watanabe, 2010). As stated prior in the background of this study, a person who is awake for 24-hours straight is equivalent to someone with a blood alcohol content of .10 (Busch, 2013, p. 2). Capacity and judgement have been shown to be diminished in those who are under the influence, which is not a good condition to operate under performing medical tasks.

Sleep disorders were present in half of the group of 12 participants, equal on both sides. Family obligations on days off were the cause of some of the participants from the low call volume stations, whereas the amount of calls during the overnight period caused the main issue in those working at the high call volume stations. The majority of the participants agreed that their first day off was wasted by feeling fatigued and trying to rest or nap. That left them with one more night and day off to recover. Some reported not sleeping well the night before going back to work. All of the participants agreed that having enough rest is important prior to going back to work and being able to function at full capacity. The majority of the participants thought they needed an extra day off and were in favor of the 24-hours on and 72-hours off work schedule.

Each participant had different approaches to dealing with their fatigue. Some consulted personal physicians while others did not and just managed on their own. Some have tried sleep aid medications, alcohol, exercise, behavioral therapy to increase healthy

sleep habits, and napping. Only one of the participants had success with medication that assisted them with improving their sleep, while the others who also had seen doctors didn't seem to have as much improvement. It appeared by listening to the shared experiences that chronic fatigue is caused by prolonged exposure to non-restorative rest and is harder to treat than acute fatigue. Cotter (2011) differentiated the two types of fatigue by chronic being multiple missed nights of restorative sleep while acute is short-term fatigue based upon excessive mental and physical activity.

Sub-Question 3

Sub-question 3 was: "Have you developed any health problems as a result of working a 24-hour shift schedule?" This question would be answered more thoroughly from a larger sample set of the population. It was difficult to gauge the exact extent of physical toll the 24-hour work schedule has on current members, whether this will manifest later in their careers or after retirement, is unknown. The main issue that arose in this theme emerged as the health issues experienced were primarily some type of sleep disorder/ shift work disorder.

Half of the participants in this study either had a current health issue or had one in the past that went away once they left a high call volume station and were reassigned or transferred to a low call volume station. As Shapiro and Flanigan (1993) pointed out, sleep disorders can cause mental and physical problems that will affect the overall quality of life and life span. Some of the participants suffered from hypertension and knew others that had the same issue. Weight gain and sleep apnea were also common issues mentioned. It is important to note that the weight gain and sleep apnea were only experienced by participants that worked at the high call volume stations.

The participant that had the sleep apnea and weight gain while working in a high call volume station now works at the low call volume station and no longer has sleep apnea and has lost weight. This directly correlates evidence to show that the quality of life and life span can be improved based upon the amount of calls handled late at night, where increased sleep is gained. When sleep is constantly being disrupted, this in turn disrupts the normal functioning of the body and precludes it from what it needs to recover and what is perceived as the normal sleep cycle.

Sub-Question 4

Sub-question 4 was: “What is the level of departmental awareness/accommodation for fatigue issues experienced by personnel?” All of the participants agreed that whether or not their organization was aware that personnel were suffering with fatigue issues, there were no current well-known resources to assist. None of the participants could advise knowledge of a clear policy regarding accommodations for personnel that may be tired while on the job. The participants noted the existence of a nutritionist, mental health counseling, and their county medical services facility. All the participants agreed that there were no current programs, educational resources or help specifically addressing fatigue due to the job schedule.

Most of the participants stated that taking a nap during their shift was dependent upon the station and the supervisor in charge. All of the participants advised that there was no clear policy in writing that naps were allowed if needed. Overall, there was no real acknowledgement by their organization about the impacts of fatigue based upon the 24-hour shift schedule, more specifically how the amount of calls for service overnight can contribute to disruption of the circadian rhythm and cause the formation of chronic

fatigue after repeated exposure. Once this fatigue becomes chronic, it is harder to eliminate and sleep disorders can form more easily.

While it is hard to accommodate changing work schedules, based upon call volume, participants felt that naps should be allowed as needed to help get rest during their shift to function properly. Another consideration was changing to an operating schedule of 24-hours on and 72-hours off. This ensures enough time to get restorative rest even when you may be awake the majority of the 24-hour shift. Other ideas such as switching the paramedic to different apparatus to give them a break during a busy shift, rotating apparatus each shift, providing temporary assignment changes from a high call volume station to a low call volume station to help combat chronic fatigue, adding more medic units to a busy station to help rotate medics on calls, and downgrading calls that initially went out for a paramedic but only needed basic life support measures that an EMT could perform and take over patient care were all offered up by participants. Administrators have a lot to consider when creating schedules or adding additional units based upon budgeting. This is not an easy task to provide and the participants all understood that fact.

Limitations of the Study

The goal of this study was to explore how fatigue affects firefighter paramedics working 24-hour shifts in high call volume stations versus firefighter paramedics working 24-hour shifts in low call volume stations. All of the participants were current career firefighter paramedics from within the same county government fire department. All of the participants were emailed separately, interviewed separately away from the workplace at a place they felt comfortable, and all did not hold back giving honest

answers or accounts of personal experiences. The findings of this study are limited based upon the number of the participants, which is only a small portion of the department utilized, as well as the overall population of firefighter paramedics working in fire departments throughout the country.

A quantitative study would have utilized a larger sample population which would have gained responses from numerous participants, whereas qualitative studies require a small amount of participants (Patton, 2002). This sample size was helpful in gaining direct face-to-face experiences and feelings being relayed by the participants which is more than a multiple choice survey as in a quantitative study. There was more background and examples provided to help explore the topic that would not have been gained from a quantitative study. Firefighter paramedics also make up a smaller portion of the total firefighter population. There are only so many positions allotted per agency. The main goal of this study was to have that face-to-face interaction in order for themes to emerge from participant responses.

The participants for this study were from Caucasian and African American backgrounds and were made up of mostly males and one-third were females. There were no limitations of gender or race. Emails for recruitment were sent out to the specified population of firefighter paramedics in the pre-determined high call volume stations and the pre-determined low call volume stations. All were of different backgrounds, race and gender. Twelve participants out of the 21 total contacted agreed to participate. The demographic area was a limitation based upon looking at firefighter paramedics only in this particular area and not gaining a broader perspective by utilizing other areas in the region or country, as well as city departments versus county departments.

I am married to an active career firefighter paramedic within the same department as the participants which caused me to have some bias in the form of knowledge of the topic. Some of my knowledge gave me more of an inside advantage and some pre-conceived thoughts, and I had to ensure that I remained objective and this potential bias did not come across to the participants. Although I took measures to ensure that didn't happen, through conversation outside of the questions, it may have unknowingly occurred.

Recommendations

It is recommended that future research be conducted on this topic utilizing a larger sample population and expanded to other parts of the country. Future studies in different geographical regions encompassing both rural and urban areas would be beneficial to gain more information and experiences with this phenomenon. Through review of the existing literature on firefighter paramedics and fatigue, references were made involving sleep disorders and chronic versus acute fatigue; however, there has not been a specific focus on the differences between fatigue experienced from working a busy 24-hour shift versus a slower 24-hour shift and how to address fatigue problems (Cherry, 2018; Costa, 1996; Courtney et al., 2012; Pirallo et al., 2012; Swinhart, 2007;).

Further research needs to be conducted on how firefighter paramedics working 24-hours shifts can be affected by fatigue and if there is a different level experienced working in high call volume stations versus low call volume stations. This would allow researchers to compare other members of the same population to check for similar experiences and to better measure the magnitude of the problem. The results can help

create an awareness in the field and possibly generate solutions for ensuring personnel are healthy and rested.

Implications

Prior research has shown that jobs involving shiftwork focusing on the fire rescue field can cause fatigue and sleep disorders (Baney 2011; Costa, 2010; Courtney et al., 2012; Fass, 2015; Gumenyuk et al., 2014; Vandale, 2013). The goal of this research study was to present findings that would assist in making positive contributions towards social change, provide awareness, and enhance the literature and knowledge that can lead to further studies on this topic. The outcome presents opportunities for improvements to be made within the fire rescue field regarding the health and safety of their personnel based upon the responses obtained.

Administrators in the fire rescue field are being given awareness about a potential problem that their employees face and can enact policies and programs to assist those that need help. They have the ability to provide resources and to monitor personnel that could be at risk. Administrators can ensure that their personnel are provided the tools they would need to stay healthy, remain safe at work, and assist with physical and mental well-being. This information is vital to administrators because they can create the policies and procedures to help their employees succeed and perform at their highest functional level. This benefits the organization in the work product that is returned and the level of service to the community.

Conclusion

The goal of this research study was to explore how fatigue affected firefighter paramedics working 24-hour shifts based upon the amount of calls for service handled

and the time of the calls for service handled in relationship to their level of overall fatigue and its impact on them. To better understand how firefighter paramedics working 24-hour shifts experienced fatigue, it was important to obtain the perceptions and lived experiences of that population. To narrow the focus further in order to get a better measurement, emphasis was placed on call volume during the overnight hours that disrupts the normal sleeping hours and circadian rhythm routine and how it affected the personnel working in low call volume stations versus personnel working in high call volume stations.

Based upon the results of this study, it shows a need to conduct further studies to examine this phenomenon with a specific focus on call volume during the night. Further results will help to provide implications for organizations to create strategies ensuring personnel are given the proper amount of rest needed to perform at a higher level that would be equivalent to their daytime functioning on calls for service. Identification of fatigue issues and their effects on firefighter paramedics working 24-hour shifts is important for awareness, intervention, and education for all personnel to recognize signs and help provide proper accommodations. Personnel advised that they perform better when they receive the proper amount of rest and recovery. The administrators can investigate alternatives to assist with the safety and well-being of their personnel.

The central research question and the sub-questions assisted with better understanding how fatigue can impact firefighter paramedics working 24-hour shifts based upon call volume and the amount of calls for service handled overnight, prohibiting proper sleep. None of the study participants provided any evidence of help or resources available to them from their organization. Outside personal resources were used by some

of the participants to treat their sleep and fatigue issues. The findings revealed that all the participants used their own methods of coping with fatigue, but nothing was through their organization. The results of this study will hopefully provide administrators with an awareness of the problem and possible solutions they can use to address it and assist their personnel, enhancing their job performance, overall job satisfaction, and health.

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