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Fatigue Risk Management in Privately Contracted Ambulance Services:

A Countermeasures Approach

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Requirements for the degree  
Doctor of Public Administration

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Fatigue Risk Management in Privately Contracted Ambulance Services:

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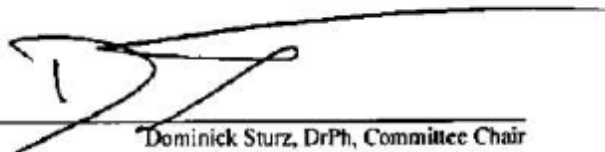
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## ABSTRACT

Fatigue in the transportation industry is a significant threat to the safety of employees and citizens. Ambulance transportation of the sick and injured is not classified as falling under the transportation industry; however, ambulance transport shares many of the same risks as other transportation modes. Fatigue is associated with impaired critical thinking, reaction time, memory, and each of these negative side effects of fatigue can have a direct impact on positive patient outcomes. This research was designed to explore current fatigue risk management (FRM) mechanisms used among privately contracted 911 ambulance providers in California and what, if any, tools are used to monitor and mitigate fatigue among emergency medical technicians (EMT) and paramedics. The significance of the research contributes to public administration theory utilizing complex systems theory through an examination of the problem of relationships and structure of the feedback mechanisms in fatigue monitoring within privately contracted 911 ambulances. The ability of EMS administrators to regulate risks posed to citizens by fatigued private ambulance EMTs and paramedics is a significant concern. The research on fatigue among privately contracted 911 ambulance EMTs and paramedics, as well as the role of local EMS administrators, is required to make certain assumptions about the broader prehospital emergency medical services population as it applies to fatigue risk management.

*Keywords:* fatigue, systems theory, public administration, emergency medical services.

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## DEDICATION

This research is dedicated to my beautiful wife Melissa, daughters Morgan and Mallory, and sons Madden and Maverick, family, friends, and coworkers who have believed in me, sacrificed for me, and supported me through this journey. To my parents, who sacrificed their educational journeys to provide for my sister Jennifer and me, this accomplishment is as much yours as it is mine. I will never forget what you all have given me.

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## CHAPTER 1: INTRODUCTION TO THE STUDY

Fatigue can have a detrimental impact on how well emergency medical service professionals can perform their job. Emergency medical services (EMS) professionals work a variety of shifts to provide service to their communities. EMS shift work includes rotating shift schedules, disrupted sleep patterns, and a decrease in quality of sleep. Sleep deprivation can impair the central nervous system (CNS) functions to include appetite, memory, and attentiveness. Leger (1994) noted that public administrators had urged economists to estimate the real cost of accidents, which extends beyond the fiscal component. The costs attributed to accidents both economically and as a function of the system are useful tools in public health policymaking (Leger, 1994). The analysis of costs through policymaking is an essential mechanism in the education of the public as it applies to the economic costs associated with disasters. This study posits that fatigued emergency medical technicians (EMTs) and paramedics are a function of the system and may have adverse socioeconomic costs associated with unregulated fatigue.

Research suggests that sleep loss and fatigue may impair cognitive function, which could lead to an increase in traffic accidents, medical errors, and decreased productivity (Nuckols et al., 2009; Pack et al., 1995). Shift work that results in loss of sleep is linked to increased rates of medical errors in patient care (Baldwin et al., 2003). Rogers et al. (2004) noted that medical errors are three times more likely among nurses working more than 12.5-hour shifts compared to those working shorter shifts. An additional study noted that among critical care nurses, medical errors occurred twice as often for those working more than 12.5 hours (Dula et al., 2001). Errors in patient care among critical care nurses working extended hours should not be considered isolated to

the nursing profession. EMS shift work mirrors or exceeds the length of shifts worked by nurses. Therefore, the research in this dissertation examined fatigue as a mitigating factor in medical errors in prehospital EMS. As other allied health professions have demonstrated, there is a significant relationship between hours worked, fatigue, and risk of injury associated with shiftwork (Caruso, 2013). Folkard and Lombardi (2006) noted that specific shift patterns are associated with higher risks for errors and accidents. Comparing traditional 8-hour workday schedules, 10-hour and 12-hour shifts resulted in increased error and injury risks by 13% and 28%, respectively (Folkard & Lombardi, 2006).

Similarly, there is a significant relationship between hours worked, fatigue, and risk of injury to the EMS worker (Weaver, 2015). Additionally, the risks posed to EMS providers and citizens from fatigue presents an accountability issue for administrators managing EMS systems using privately contracted 911 ambulance companies. Therefore, there is a need for further research in regard to public EMS administrators who manage privately contracted 911 ambulance EMTs and paramedics and how fatigue is identified, monitored, and/or regulated. This study contributes to the ongoing effort to define fatigue risk management (FRM) in EMS, the accountability of EMS administrators, and the impact on public safety.

### **Background of the Problem**

The current model within California's high-performance paramedic system involves a public-private collaboration in which most fire departments provide "first-responder" capability. A competitively selected private firm offers advanced life support (ALS) paramedic-equipped ambulances, which respond to medical calls for service, treat

the patient, and provide transport to a medical facility when indicated. The current privatization models deployed in California enable higher productivity through proportionate cost savings gained by increasing levels of production (Eisberg, 2018). Additionally, Eisberg (2018) noted, “Outside of public safety services, the courts and policymaking functions, the private sector has proven repeatedly that there is nothing in the routine operations of government—those things that citizens interface with most directly—that cannot be privatized” (p. 1).

A concern facing EMS public administrators managing contracts with private ambulance providers is that a high proportion of EMS workers suffer from fatigue (Patterson et al., 2012). The consequences of fatigue may include poor safety outcomes for employees as well as the patients they serve. Patterson et al. (2012) noted that injuries were 2.3 times higher among respondents with poor sleep than respondents with good sleep while the odds of injury among EMS providers were 2.9 times higher among fatigued respondents than nonfatigued. Fatigue and lack of sleep are precursors to reduced attention and impairment of the central nervous system and have adverse effects on cognition, reaction time, and health (Patterson et al., 2012). The adverse effects associated with fatigue have established detrimental outcomes for the EMS professional. However, the effects of fatigue extend far beyond the employee. The lack of FRM among ambulance employees may result in inferior safety culture along with poor patient outcomes.

Fatigue can impair the responders’ clinical judgment and affect the health outcomes of the citizens they treat. Stressful conditions are standard in the field of EMS and may be unfamiliar to other researched occupations. Dannin (2006) suggested that the

lack of subcontracting oversight can create financial loss and performance issues. The lack of measurement tools available to public administrators may stem from the enthusiasm for shifting public services to the private sector (Dannin, 2006). It is these gaps in oversight that drive the need for research in the regulation of fatigue among private ambulance professionals. Fatigue's prevalence among EMS professionals signifies a credible threat to patient care, employee safety, and EMS administrators' accountability.

The role of fatigue in the transportation industry is a top priority of the U.S. National Transportation Safety Board (NTSB). The role of fatigue in rail, aviation, highway, and marine travel has made the top 10 of NTSB's most wanted transportation safety improvements (Chambers, 2019). The NTSB identifies fatigue as a factor in more than one in every five vehicle accidents resulting in injury or death (Chambers, 2019). The National Safety Council (n.d.) noted that U.S. drivers are more than three times as likely to be in a car crash if fatigued. The NTSB has continued to advocate for continued research, education, training in the areas of sleep disorder treatment, hours-of-service regulations, and on- and off-duty scheduling policies and practices. Despite the increased research and education, EMS has failed to become involved in the broader discussion of fatigue in the transportation industry. As a result, limited research is present on the role of fatigue in EMS. This dissertation is compelled to utilize research on fatigue within various transportation and medical care industries while connecting the principles of evidence-based guidelines of FRM to EMS. FRM in EMS incorporates five guidelines that were founded on evidence-based research in the setting of EMS and best practices in

the mitigation of fatigue. The five recommended evidence-based guidelines by Patterson et al. (2018) in FRM in EMS are

1. Recommend using fatigue/sleepiness survey instruments to measure and monitor fatigue in EMS personnel.
2. Recommend that EMS personnel work shifts shorter than 24 hours in duration.
3. Recommend that EMS personnel have access to caffeine as a fatigue countermeasure.
4. Recommend that EMS personnel have the opportunity to nap while on duty to mitigate fatigue.
5. Recommend that EMS personnel receive education and training to mitigate fatigue and fatigue-related risks. (p. 4)

### **Rail Workers' Perceptions of Safety**

Current research in the field of fatigue management in the transportation industry has focused on data from a quantitative aspect. However, there is a shortage of research on workers' perceptions of risk of injury or death when subjected to fatigue.

Nevertheless, recent research in the United Kingdom (UK) has emerged that addresses the perceptions of rail workers' exposure to injury (Morgan et al., 2016). The research examined pressure, fatigue, decision-making, and errors.

Safety statistics for UK Network Rail workforce safety ranging from 2009 until 2014 reported the death of six employees (Morgan et al., 2016). The research contended that the rate of fatalities in the organization is low. Nonetheless, the rates of significant injuries rose considerably over the same period. From 2009 until 2014, significant



injuries rose from 96 to 122, and injuries causing loss of work rose from 146 to 310 (Morgan et al., 2016). Beyond the pain and suffering of the employees is the economic impact. The losses suffered by the company and employee exceeded \$5.5 billion (Health and Safety Executive [HSE], 2015).

Rail safety researchers in the UK have begun to adapt existing classification models to analytically identify system failures in the rail system to address strategies to minimize errors and reduce injury (Morgan et al., 2016). Researchers have begun to examine an often-overlooked alternative method of reviewing the system failures plaguing the UK rail system: the use of interviews to record workers' perceptions of causes of past injuries (Morgan et al., 2016). Through a systems management approach, rail safety researchers are attempting to mitigate systems features that promote or increase human error. Safety-critical industries have adopted a "systems" approach to the management of safety since the early 1990s (Reason, 1995). Wiegmann and Shappell (2009) recognized that while frontline workers are prone to human error, systems features that promote or exacerbate features such as employee fatigue, environmental factors, and safety practices need to be addressed.

### **Resident Physicians' Work Hours**

Extended working hours and sleeplessness have long been staples of physician training in the United States since the inception of modern residency programs. Much like in the transportation industry, a lengthy examination of fatigue and its role in human performance, accidents, errors, and overall well-being of the medical profession is under scrutiny. Consequently, in late 2007, at the direction of the U.S. Congress, the Institute of Medicine (IOM) embarked on a yearlong examination of the scientific evidence

linking resident physician sleep deprivation with clinical performance deficits in medical errors (Blum et al., 2011).

Residency training in the United States aims to prepare new physicians to provide a safe and independent practice when their residency is complete. During residency training, resident doctors often work more than 60 hours a week, which has typically been necessary to achieve professional competency (Ulmer et al., 2009). However, after the review of the evidence, the IOM recognized that it should increase opportunities for residents to sleep during training to prevent acute and chronic sleep deprivation and to minimize any fatigue-related errors (Ulmer et al., 2009). The most substantial step in the regulation of resident physicians' work hours came in 2003 when the Accreditation Council for Graduate Medical Education (ACGME) adopted program requirements to restrict resident work hours to a total of 80 hours per week averaged over 4 weeks and the most extended consecutive period of work up to 30 hours (Ulmer et al., 2009). In addition to weekly restrictions and consecutive hours worked, the council recommended a protected sleep period of 5 hours during any work shifts beyond 16 hours in duration (Ulmer et al., 2009). The ACGME noted that residency programs should also increase opportunities for sleep by having defined periods off between shifts, increasing the number and regularity of days free from work, and providing safe transportation home to any fatigued resident (Ulmer et al., 2009).

The ACGME's recommendations of limits to resident physician work hours and workload were some of the most progressive policymaking to enhance sleep supervision and safety among medical residents. Parsing the data as they apply to patient mortality and morbidity post 80-hour duty week implementation is nuanced. Three national studies

by Shetty and Bhattacharya (2007) and Volpp, Rosen, Rosenbaum, Romano, Even-Shoshan, Canamucio, et al. (2007) examined mortality trends among medical and surgical patients post-ACGME 2003 duty hour reforms. The data showed some improvements for medical patients, but surgical patients had no significant changes in mortality (Shetty & Bhattacharya, 2007; Volpp, Rosen, Rosenbaum, Romano, Even-Shoshan, Canamucio, et al., 2007; Volpp, Rosen, Rosenbaum, Romano, Even-Shoshan, Wang, et al., 2007). Ulmer et al. (2009) noted the difficulty of deconstructing the impact of reduced duty hours but also the influence on patient outcomes given the variability of staffing and scheduling practices among the various medical disciplines. Although more research is needed in the area of patient outcomes in the wake of duty hour reforms, the implementation of the rules themselves has not led to an increase in mortality rates, and there may be a modest improvement in medical patients versus surgical mortality rates (Ulmer et al., 2009).

Although there is a stark difference between the role of a physician and those of EMS professionals, there are startling similarities when comparing shift work and shift patterns and providing patient care. However, the role of EMTs and paramedics in the setting of prehospital care should demand the same introspective look at patient safety outcomes and provider safety. Despite well-established research on the detriments of sleep deprivation, fatigue, and sleepiness in prehospital EMS, the profession has yet to adopt a systemic policy to address FRM.

### **EMS Mortality**

Most professions that engage in the transportation of humans or transportation that directly or indirectly can affect human life have significant regulations regarding the

amount of sleep needed by those responsible for navigating the machinery. Commercial truck drivers are limited to 14-hour shifts with no more than 11 hours of continuous driving (Lardner, 2019). Commercial airline pilots are limited to 8 hours of flight time in 24 hours, and lastly, flight crews must have a minimum of 10 hours rest between shifts not to include 8 hours of uninterrupted sleep (Federal Aviation Agency [FAA], 2013; Trejos, 2014). Yet, EMS has no federal regulations that define shift duration, sleep requirements, or established rest periods between shifts.

CNBC rated EMS as one of the most dangerous professions in the United States (Morris, 2015). Risks to the worker include soft tissue injuries, vehicle accidents, and assaults (Patterson et al., 2012). Maguire et al. (2005) noted that between 1992 and 1997, 114 EMTs and paramedics were killed on the job, and more than half of them involved ambulance crashes. Of those 114 fatalities, it was estimated that there were at least 67 ground transportation-related fatalities, 19 air ambulance crash fatalities, 13 deaths resulting from cardiovascular incidents, 10 homicides, and five other causes (Maguire et al., 2005). Furthermore, data are anecdotal at best when trying to attribute fatigue to ambulance crash data (Sanddal et al., 2008). According to Studnek and Fernandez (2008), factors that can attribute to ambulance accidents are age, service call type, call volume, time spent in an ambulance, and current sleep problems. Additionally, no central collection point for ambulance crashes exists, making it challenging to draw associations between crash factors and the accidents themselves (Studnek & Fernandez, 2008). Current limitations in the research of EMS fatigue are that EMS data on injuries, vehicle accidents, and medical errors do not delineate between job classifications or whether the employee is in the private or public sector. From the year 2000 until 2017,

1,937 EMS and firefighter line-of-duty deaths (including September 11th, 2001) have occurred (International Public Safety Association [IPSA], 2018). It is within these statistics that this study posits that fatigue could be a contributing factor in injuries, vehicle accidents, and medical errors and hence create accountability concerns for EMS administrators contracting for 911 ambulance services. Despite these data, federal regulations limiting hours of continuous work or mandatory rest periods in prehospital EMS are nonexistent.

### **Purpose of the Study**

The purpose of this dissertation was to determine what, if any, FRM guidelines are implemented among public administrators who manage privately contracted 911 ambulance services within their respective county. The research explored accountability challenges faced by local governments in California when managing emergency service contracts with private ambulance companies. Brodtkin (2008) established that many public organizations favor measures of performance that emphasize efficiency and meet the goals of institutional legitimacy. In general, however, these favorable measures may create poor safety outcomes for the employees as well as for patients under their care.

The current paradigm of ambulance contracting may have created accountability concerns as it applies to FRM among privately contracted 911 paramedics and EMTs. Paramedics and EMTs perform skills that are essential to adequate patient care. Fatigue has dramatic effects on critical thinking, multitasking, and fine motor function, and all are affected by fatigue (Patterson et al., 2012). Therefore, the management of these effects needs to be a part of the administrative monitoring process. Research indicates that local government agencies often lack the capacity to both devise and monitor service delivery

contracts (Brodkin, 2008). The monitoring of private ambulance contracts, and specifically, the prevalence of fatigue in the private sector ambulance delivery model is critical.

Irregular work schedules are common among emergency service workers. The demand for emergency responders to work atypical work hours has individual, environmental, and social impacts that can impede sleep health (Buysse, 2018). The research in sleep medicine indicates that work scheduling interventions can improve performance, reduce fatigue, and enhance safety (Barger et al., 2016). Fatigue education programs are required in commercial aviation and are mirrored in other transportation areas such as railroad and commercial trucking (Quan & Barger, 2015). Barger et al. (2016) noted that a sleep health program in conjunction with a sleep disorder program resulted in a 42% positive behavior change among firefighters as it applies to recognition of undiagnosed sleep disorders, sleep health education, caffeine re-education, and advice on how to deal with shift work. Education about these disorders includes information on sleep health, circadian rhythms, sleep disorders, and fatigue countermeasures such as caffeine.

The research in this dissertation examined several of the evidence-based guidelines recommended by leaders in the FRM field within EMS and perceptions of EMS administrators as they apply to fatigue among contracted 911 ambulance EMTs and paramedics. It was the goal of the research to examine whether some or any of the evidence-based guidelines are implemented as a part of an FRM model in private sector ambulance management. The research in this dissertation focused on examining fatigue among privately contracted 911 ambulance employees through the theoretical lens of

complex systems theory. This study investigated trends in EMS in which private ambulance employees are subjected to the effects of fatigue and how EMS administrators perceive FRM as a solution.

### **Research Question**

How do emergency service administrators in the State of California mitigate fatigue among privately contracted 911 ambulance EMTs and paramedics based on established evidence-based guidelines for fatigue risk management in prehospital emergency medical services?

### **Significance of the Problem**

This research is significant to the field of public administration as it addresses accountability issues facing the private prehospital EMS delivery system. The use of private sector agencies has limited oversight mechanisms for the regulation of rest standards for EMS professionals. This study discusses associated risks to the public from fatigued paramedics and EMTs in the private sector ambulance providers and accountability of EMS administrators thereof. Accountability in public administration is a foundational piece of administration in the public sector. Accountability is the follow-through on actions taken to ensure output, performance, and reliability of the processes (Ingstrup & Crookall, 2014). Consequently, the authority, responsibility, and obligation to explain how responsibility is discharged falls upon the government administrator (Ingstrup & Crookall, 2014). Rivlin and Shalala (2015) argued that the desire to improve service deliveries must be intertwined with developing and implementing improved measures of performance. The standard of production for the delivery of private ambulance services does not consider the risk to public safety from fatigued employees.

The need to establish an FRM program within privately contracted ambulance services is crucial to the accountability of the governmental agency charged with oversight.

This study focused on private sector contracted ambulances that typically operate in a for-profit capitalistic capacity. Seim (2017) described the “lean fleet” concept as an effort to control gains and losses through effective ambulance deployment. Hence, the efforts are focused on accumulating capital and minimizing loss (Seim, 2017). Some of the roots of fatigue may lie in the current ambulance deployment methods used in privately contracted services. As with most ambulance contracts, service delivery benchmarks are established to ensure adequate 911 service delivery to the contracted area. The contracted benchmarks establish required response times to 911 calls with associated financial penalties for failure to comply. Seim noted that compliance fines for a California-based ambulance agency reached nearly \$400,000. The contractual obligations combined with the capitalistic goals of an agency can stress the system and the employee as agencies try to balance the profit motive alongside the restrictive contracts. These balancing acts often manifest themselves in overworked and fatigued employees as they strive to work within the lean fleet model.

The accountability measurement tools available to EMS administrators are limited. There is, however, significant research building in the area of FRM in EMS. In January 2013 the National Emergency Medical Services Advisory Council (NEMSAC) recommended increased research regarding fatigue and its impact on safety as well as current efforts to address the observed problems of fatigue and safety (Martin-Gill et al., 2018). The NEMSAC further advised the formulation of feasible recommendations for



battling the impact of fatigue on EMS patient and provider safety (Martin-Gill et al., 2018).

The recognition of fatigue in private ambulance agencies is not sufficient to address threats to provider and patient safety. The use and implementation of strategies to lessen the exposure to adverse effects of fatigue should be a priority for the EMS administrator. The implementation of FRM is an attempt to discover more effective ways of delivering these EMS and construct incentives that promote their use. Thus, the goal to perform within these constraints needs to examine what is better or worse. Rivlin and Shalala (2015) noted, “One must also deal with the public benefits of social action programs, which are much harder to identify and to measure, though no less important, than the private benefits” (p. 49). Nonetheless, this study explored threats to accountability and patient and provider safety when fatigue in the privately contracted 911 EMT and paramedic is left unregulated. The study examined the functional and foundational idea of accountability of EMS administrators in the oversight of the privately contracted 911 EMS delivery system.

### **Definitions of Terms**

**Emergency medical services practitioner.** The local government decision-maker is responsible for the formation and implementation of the community’s EMS program. These titles vary by jurisdiction and are clearly defined within the research.

**Emergency medical services.** A branch of public safety that responds to medical emergencies reported to 911 dispatchers (Weaver, 2015).

**Government actors.** Elected and appointed public officials entrusted with the governance of the EMS delivery system. This term may also apply to influential

members of the community serving in an advisory capacity to elected or appointed department heads.

**Fatigue risk management (FRM).** FRM is a means of rigorously monitoring and managing fatigue-related safety risks based upon scientific principles and knowledge that aim to ensure relevant personnel perform at adequate alertness levels (International Air Transport Association [IATA], n.d.).

**Prehospital emergency services.** A jurisdictional or organizational unit, whether private or public, that provides care to the sick and injured in a nonhospital setting.

**Private actors.** A jurisdictional or organizational unit that plays a significant role in the delivery of emergency services. This includes private sector businesses and nonprofit organizations.

**Shift work.** Defined as work arranged in any manner that is beyond daylight hours, typically between 7 a.m. and 6 p.m. (Caruso, 2013).

**Sleep deprivation.** Defined as 0 to 6 hours of sleep a night, ranging over one night or consecutive nights.

### **Organization of the Study**

Chapter 1 of the study has presented the introduction, the statement of the problem, the purpose of the study, the question to be answered, the significance of the study, and the definitions of terms. Chapter 2 is a review of the relevant literature. It addresses the following topics: history and background of EMS, fatigue recognition in EMS, FRM in a 24/7 economy, accountability of local EMS administrators, managing fatigue among emergency service workers, evidence-based guidelines for FRM, and the theoretical framework: complex systems of EMS. Chapter 3 presents the methodology

used in the study, including the research design, population and sampling procedure, and the instruments and their selection or development, together with information on validity and reliability. Each of these sections concludes with a rationale, including the strengths and limitations of the design elements. The chapter goes on to describe the procedures for data collection and the plan for data analysis. Chapter 4 presents the findings of the study. Chapter 5 discusses and analyzes the results, culminating in conclusions and recommendations.

## CHAPTER 2: REVIEW OF THE LITERATURE

### **History and Background of EMS**

Emergency medical service, as constituted today, is vastly different than civilian emergency care provided in the 1950s. The term *emergency medical services* (EMS) did not exist as a familiar expression that would define specific medical care before the 1960s (Robbins, 2015). To fully appreciate the history of American EMS and medical transportation, it is crucial to understand the nature of prehospital medicine in the United States before 1960. The formulation of the first EMS system evolved from the American Revolution, during which a significant need existed for the rapid transportation of wounded soldiers to designated medical facilities (Robbins, 2015). Robbins (2015) noted that the strategic categorization of hospitals between “camp” and “regimental/general” was created as a means of sorting patients according to the severity of their medical needs. The categorization of these hospitals allowed states to get the appropriate response of medical care to the wounded on the battlefield, which included rudimentary triage processes, extrication of the injured, and transportation between camp, regimental, and general hospitals (Robbins, 2015). Despite these advances in the medical care of the soldier, in terms of the ability to maintain an acceptable standard of care, hospitals were notoriously unsanitary and understaffed. Ultimately, following the end of the American Revolution, none of the medical structure established remained.

The next evolution of American EMS and medical transport occurred during the Civil War. Beginning in 1861, Union forces implemented the use of stretchers, horse-drawn wagons as ambulances, and the use of pack animals to pull stretchers (Robbins, 2015). As with the American Revolution, the implementation of triage to separate

soldiers based on the severity of injuries continued as did the strategic transportation of the wounded to field-dressing stations located close to or on the battlefield (Robbins, 2015). Despite the resurgence of this early EMS system, it failed fundamentally to provide transportation of the wounded from the battlefield to camp or regional hospitals.

Post-Civil War, several hospitals continued to maintain the crude ambulance services created during the Civil War. In general, however, this was not universal across the United States. Building on the innovation after the Civil War, the first civilian-run, hospital-based ambulance service was created in 1865 by the Commercial Hospital of Cincinnati in Cincinnati, Ohio (Pozner et al., 2004). Subsequently, New York City developed the first municipal-based EMS service operated by Bellevue Hospital (Pozner et al., 2004). Notwithstanding, until the second half of the 20th century, transportation of the sick and injured was conducted by hearses from local funeral homes, which transported patients to local hospitals (Bledsoe et al., 1995). It was not until 1936 that the American Red Cross established nearly 900 dedicated posts spread across the American highways to render aid to those involved in motor vehicle accidents (Robbins, 2015). By 1939, the American Red Cross was providing first aid training to volunteers, staffing almost 5,000 mobile aid units across the United States (Robbins, 2015). From 1939 until World War II, ambulance services were primarily hospital-based across many large cities throughout the United States. However, a severe workforce shortage from World War II resulted in city governments turning over ambulance services to police and fire departments. Robbins (2015) noted that no laws regarding the standardization of training of ambulance personnel, ambulance construction, or any medical oversight existed.

The framework of EMS is attributed to advances in medical care resulting from periods of war. Nonetheless, the incentive to construct civilian-based EMS stemmed from the invention of the automobile. From the invention of the automobile until the 1950s, fatalities resulting from automobile accidents had reached epic proportions. Automobile accidents became a national problem that prompted then-President Dwight D. Eisenhower to hold a White House Conference on Highway Safety on February 17, 1954. During this conference, President Eisenhower noted, “In the last 50 years, the automobile has killed more people in the United States than we have had fatalities in all our wars: on all the battlefields of all the wars of the United States since its founding 177 years ago” (Weingroff, n.d., para. 9).

Beginning in the 1960s, EMS underwent significant change and growth. The next significant step in the solidification of EMS in the United States was the creation of Medicare in 1965 by an act of Congress. Through this legislation, ambulance transportation was recognized as a covered beneficiary service (Reno & Gluck, 2004). Because of this legislation, the federal government had established a long-term funding mechanism for EMS and transportation of the sick and injured. Following this historic act, the passage of the federal National Highway Safety Act of 1966 highlighted emergency medical care as a critical element to reducing death and disability associated with traffic accidents (Robbins, 2015). This federal legislation provided the first comprehensive description of EMS systems, components, and standards. Robbins (2015) noted that the merger of the National Traffic Safety Agency and the National Highway Safety Advisory Committee through the National Traffic and Motor Vehicle Safety Act

of 1966 allowed for the creation of what we know now as the Department of Transportation (DOT).

Following the historic federal legislation that laid the groundwork for EMS systems as they are known today, extensive research was conducted for the advancement of EMS. The National Research Council and the National Academy of Sciences' (1966) research noted that the epidemic of accidental injuries was the most important environmental health problem to date. In 1965, 52 million accidents injured 107,000 Americans, temporarily disabled 10 million, and permanently disabled 400,000 (National Research Council and National Academy of Sciences, 1966). The research identified that Americans were insensitive to the dangers of accidental injury and death. Additionally, it was found that not only was the public ill-trained in the practices of first aid, but also police, rescue squads, and paramedical workers lacked standardized training (National Research Council and National Academy of Sciences, 1966).

Recommendations stemming from the research included the implementation of traffic safety legislation, adopting policies and regulations at the state level regarding ambulances, and establishment and control at the district, county, and municipal levels for the appropriate surveillance of ambulance services. Finally, the initiation of pilot programs to evaluate automotive and air ambulance services for populated areas and regions with a lack of hospital facilities to care for acutely injured individuals was indicated (National Research Council and National Academy of Sciences, 1966). Subsequently, research spurred the first nationally recognized curriculum for emergency medical technician-ambulance (EMT-A), which was published in 1969 (Edgerly, 2013).

The combination of legislation and research described above became the first empirical evidence that the current structure of the U.S. EMS needed change.

Although, the establishment of the first nationally recognized curriculum for EMTs occurred in 1969, paramedical services were underway in Miami, Florida, in 1968. Dr. Eugene Nagel had developed a vision that blended the training of EMTs with radio technology that allowed for real-time communication with an in-hospital doctor (Robbins, 2015). The addition of radio technology blended with real-time hospital medical direction was the origin of what is known now as the paramedic. Subsequently, similar programs in Columbus, Ohio; Jacksonville, Florida; Seattle, Washington; and Los Angeles, California; followed suit (Robbins, 2015). Shortly after, the National Highway Traffic Safety Association produced the first national standard curriculum for paramedics.

Although the inception of modern American EMS had focused exclusively on trauma associated with motor vehicle accidents, simultaneous medical research on prehospital care for cardiac emergencies was building. The two diverging ideologies would align into a comprehensive construct with the passage of the EMS Systems Act of 1973. The legislative intent was to improve and coordinate emergency medical care throughout the country, and it established millions of dollars for EMS training, equipment, and research (Pozner et al., 2004). Despite the goal of the EMS Systems Act of 1973 being to provide a well-coordinated system of highly trained providers of prehospital care, it continued in a disorganized manner with some systems meeting intended goals and others falling short (Pozner et al., 2004).



The Omnibus Budget Reconciliation Act of 1981 marked the next significant change to EMS as it is known today. The legislation consolidated EMS funding into state preventative health and health services block grants. The act allowed states more considerable discretion in how EMS funding was used for implementation in their current systems. Unintended side effects included many EMS systems allocating money to other areas, resulting in substantial budget cuts (Pozner et al., 2004). Consequently, the act dramatically reduced federal involvement in EMS and left state and local governments to fund EMS system development. Thus, the maturity and sophistication of how emergency care has been delivered across the nation are varied and diverse. As it stands today, there is no single theme or predominant system considered premier within the United States (Robbins, 2015).

Prehospital EMS as constituted today are vastly different from their beginnings, the diversified approach to providing prehospital care may be one manifestation of why FRM is lacking at the local, state, or national level. Most of the current EMS models within California's high-performance paramedic system involve a public-private collaboration in which fire departments provide "first-responder" capability, and a competitively selected private firm offers advanced life support (ALS) paramedic-equipped ambulances that respond to medical calls for service, treat the patient, and provide transport to a medical facility when indicated. However, there is a growing trend of fire departments providing ALS services across the state. Nevertheless, not all ALS fire services provide patient transport; 74% of patient transportation is provided by contracted 911 ambulance providers (California Ambulance Association, 2013).

## **Fatigue Recognition in EMS**

Concerns facing public administrators and citizens alike are that private 911 ambulance EMTs and paramedics suffer from fatigue. The consequences of fatigue may include poor safety outcomes for caregivers as well as for the patients they serve. Fatigue and a lack of sleep are precursors to reduced attention, and impairment of the central nervous system, and they have adverse effects on cognition, reaction time, and health (Patterson et al., 2012). Yet, the effects of fatigue extend far beyond the employee.

The lack of FRM among EMTs and paramedics may result in an inferior safety culture along with poor patient outcomes. Typically, jurisdictions competitively select private firms that provide professionally staffed ambulances that respond to medical calls for service, treat the patient, and provide transport to a medical facility when indicated. Privatization models deployed in California enable higher productivity through proportionate cost savings gained by increasing levels of production through economies of scale (Brennan & Krohmer, 2006). Although the privatization model allows for higher productivity through cost savings, research may suggest that productivity enhancements could be a byproduct of contracted 911 ambulance providers working beyond their capabilities.

## **Fatigue Risk Management in a 24/7 Economy**

The world in which people currently live depends on the operation of several services 24 hours a day and 7 days a week. These services range from manufacturing products, health care, air and rail transportation, and emergency services. The demands of today's society require millions of employees to work nontraditional shift patterns that disrupt sleep cycles and decrease sleep opportunities (Hersman & Whitcomb, 2018).

Shift work and its relation to fatigue are not unique to the professions mentioned above. Nevertheless, the effects of fatigue and sleepiness have significant risk factors for employees and consumers in occupations in which lives are at risk.

Research from the National Transportation Safety Board (NTSB) has yielded a significant amount of data related to fatigue and accidents involving air, rail, highway, and marine transportation. The NTSB noted that nearly 20% of the 182 major NTSB investigations completed between January 1, 2001, and December 31, 2012, identified fatigue as a probable cause or contributing factor (Marcus & Rosekind, 2016). Each year, the NTSB releases a Most Wanted List, which represents the NTSB's activism among the several identified threats to public transportation. The report describes the activities involved in the DOT's mission to enhance the safety of the nation's transportation network for each of the NTSB's Most Wanted List of safety issues. Of the 10 safety issues on the list, fatigue is number 6 (NTSB, 2020). The overwhelming message from the annual report was the needed implementation of fatigue management programs to apply a comprehensive, tailored approach to combating fatigue within an industry or workplace (NTSB, 2020).

Several agencies under the purview of the DOT and the NTSB have already begun to implement policies to address fatigue within their organizations. The Federal Railroad Administration (FRA) is drafting a regulation to include a fatigue management plan in their risk management programs (NTSB, 2020). The Federal Aviation Administration (FAA) has developed a comprehensive fatigue management program in the aviation industry, concentrating on research, education, and training, treatment of sleep disorders, length of work periods, and on- and off-duty scheduling policies and

practices (NTSB, 2020). Despite the various transportation industries implementing fatigue policy, EMS have yet to adopt a comprehensive fatigue management plan. Despite the lack of progress in EMS, several agencies and occupations have made strides in implementing FRM programs. The similarities between the industrial sectors and acute healthcare professions as they apply to shift work and susceptibility to fatigue are significant though the countermeasures to the latter have not translated into EMS. Nevertheless, several acute care professions have begun implementing tools to combat fatigue in the healthcare setting.

Research in the area of nursing has yielded significant data in the area of FRM through the adoption of Sleep Alertness and Fatigue Education in Residency (SAFER) curricula. The development of the Fatigue Countermeasures Program for Nurses (FCMPN) by Scott et al. (2010) established fatigue management strategies intended for unit and individual levels in acute care institutions in Michigan. Strategies used in FCMPN included adequate staffing levels to allow for complete relieved breaks, strategic naps, moderate caffeine use, fatigue management education, and sleep hygiene education to improve sleep duration and minimize sleep loss (Scott et al., 2010). Research in their study focused on the perceptions and experiences of staff nurses after the implementation of the FCMPN (Scott et al., 2010). Additionally, nurse managers were asked about their perceptions of staff nurse behavior changes as they applied to work patterns, staff relationships, and organizational support (Scott et al., 2010). The perceptions of the FCMPN were extracted from focus groups consisting of 54 nurses who included eight nurse managers and 46 staff nurses. The examination of the perceptions of staff nurses identified three overarching themes after the implementation of FCMPN: increased

awareness of health and well-being as it applies to sleep hygiene, increased restfulness and decreased fatigue, and greater confidence in the ability to manage the individual lifestyle habits that impact sleep (Scott et al., 2010).

### **Accountability of Local EMS Administrators**

Changes in governance structure and networks have had significant effects on accountability, both positive and negative. Governance networks are patterns of coordinated action and resource exchanges involving governmental and private actors who interact through a variety of competitive, command-and-control, cooperative, and negotiated arrangements for purposes set forth by public policy (Koliba et al., 2010). The displacements of regulatory control mechanisms occur as agencies increase the privatization of public services. Consequently, accountability challenges may become a significant side effect. These challenges form when administrators relinquish central control to private actors when the privatization of governmental services is deemed more efficient. Although public administrators assume social values, beliefs, and assumptions about the public interest, these private actors, however, may not share these values (Koliba et al., 2010).

Accountability within EMS has become a challenge as the new governance environment is ever-changing, uncertain, and complex, and actors share any given power with relatively equal standing (Yang, 2012). The current privatization models deployed in California enable higher productivity through proportionate cost savings gained by increasing levels of production. Within this model, challenges arise from the value perceptions of contracted actors and the pressure of administrators to maintain accountability. Each local emergency service government authority is responsible for

connecting accountability with behaviors, decisions, outcomes, and the process by which accountability institutions are produced and reproduced by actors (Yang, 2012). It is the current lack of these control mechanisms in FRM that is of concern in this research.

The delivery of human services through the use of competitively procured contracts has long been a commonality in new public management. Often, the cited rationales from policymakers are cost savings, efficiency, innovation, and the shrinking of government (Lamothe & Lamothe, 2008). Under this umbrella of human services is the often-overlooked area of contracted 911 ambulance services. Much like other areas of human services, contracting brings the anticipated cost savings and efficiency of private 911 ambulance services. Conversely, the anticipated benefits of contracting may have negative consequences for the accountability of local government EMS administrators. These negative consequences are the focus of this dissertation.

Inherently, the demands placed on public administrators to understand the powerful and pervasive impacts of politics versus markets have a significant effect on public policy and administration (Barrett, 2000). That is to say, the competitive market that the private EMS operates within is vastly different from that of state and local governments. The concept that state and local governments can facilitate the outsourcing of human services through competitive markets is more rhetoric than reality (Van Slyke, 2006). Traditional market models of contracting assume that contractors will deliver high-quality, cost-effective services because market forces such as competition will ensure the desired performance of the contracted agency (Johnston et al., 2004). In the case of private ambulance contracting, research would suggest that no actual private market exists because of the low number of potential 911 private

ambulance contractors. Hence, the transferring of 911 ambulance transport to a noncompetitive market offers limited, if any, economic benefits (Johnston et al., 2004). If this argument holds, the lack of control mechanisms and threats to accountability need to be measured against the perceived economic savings of the market forces of competition within the public safety domain.

Research is limited on the accountability of government administrators as they govern privately contracted 911 ambulances. Yet, there are cases in which local governments have acted against underperforming contractors. In the 1980s, inequalities in the service delivery model employed by the private contractor were noticed in Kansas City, Missouri (Johnston et al., 2004). The city's answer was to create a nonprofit agency called the Metropolitan Ambulance Services Trust (MAST) to oversee services. MAST was charged with contracting with a private 911 ambulance service provider to operate ambulance service for the residents of Kansas City. The function of MAST was to provide independence and separation of duties and to ensure that one organization did not control all aspects of service delivery (Johnston et al., 2004). Although the action taken by Kansas City demonstrates the diligence of the local EMS administrators, it was not without complications. The definition of efficiency and other contractual languages that incorporated specific performance standards and penalties for failure to meet those standards created significant barriers to future contractual bids, so much so that MAST eventually chose to take over the operation of the service in 2003 and has assumed the more rigorous performance standards it had planned to impose on the private ambulance provider (Johnston et al., 2004).

The quality of prehospital medical services provided by the EMT and paramedic is the shared responsibility of the contracted ambulance provider and the EMS administrator governing the contract. Nevertheless, the public agency is responsible not only for the quality of services but also for the efficient use of public finances (Zimmerman, 2014). The concern of this research is the ability of the privately contracted 911 ambulance provider to maintain quality of services without monitoring fatigue. If fatigue management is not a part of the quality analysis within the contracted agency, accountability for local EMS administrators may suffer.

### **Managing Fatigue Among Emergency Service Workers**

Among the leaders in EMS reform is the International Association of Fire Chiefs (IAFC) and the United States Fire Administration (USFA). Their research study entitled *The Effects of Sleep Deprivation on Fire Fighters and EMS Responders* (Elliot & Kuehl, 2007) is one of the seminal articles from the EMS street-level bureaucrats. EMS operate 24 hours a day, 7 days a week, and 365 days a year. Despite this is standard practice in EMS, societal trends in American work culture are mirroring these trends. Thus, EMS providers are sleeping less and attempting to accomplish more to accommodate this 24/7 society (Elliot & Kuehl, 2007). Over 70 million Americans are sleep deprived, and studies have shown that automobile accidents caused by drowsy drivers outnumber those caused by drunk drivers (Rolston et al., 2008). Several definitions exist of sleep deprivation (SD), but in general, it is a condition resulting from the lack of adequate sleep (Mednick & Ehrman, 2006).

Patterson, Suffoletto, et al. (2010) noted that EMS workers engage in a variety of shifts to provide continuous 24-hour service to their communities. The nature of



EMS work includes overnight duty, rotating schedules, early wakening, and interrupted nocturnal sleep (Patterson, Suffoletto, et al., 2010). A lack of sleep is linked to an increased rate of medical errors among nurses (De Castro et al., 2010). Nevertheless, limited research exists as it applies to prehospital medical errors. Prehospital research and examination are challenging to complete. In an emergency setting, time may not allow for proper consent from patients (Nichol & Huszti, 2007). Misasi and Keebler (2019) noted, “One component of prehospital care that is particularly understudied, yet highly influential to patient safety is medication administration” (p. 1).

The risk of SD among emergency service workers is due to the likelihood of being awakened at night. Engaging in prolonged periods of SD can result in mental fatigue, sleep debt, and decreased reaction time (Elliot & Kuehl, 2007). Literature has suggested that sleeping 8 hours a night provides adequate nocturnal rest, allowing the body to enter the deep sleep that is necessary for the well-being and physical health, allowing the body and mind to rebuild and recover (Caldwell, 1997). The inability to obtain at least 7 hours of sleep can cause the failure of the brain to recuperate and increased sleeplessness, resulting in SD (Mednick & Ehrman, 2006).

### **Evidence-Based Guidelines for Fatigue Risk Management**

EMS fatigue mitigation strategies have fallen far behind their counterparts in the transportation industry. The aviation, rail, and trucking industries have implemented several restrictions limiting the number of hours worked by employees; however, administrators in EMS have lacked guidance on how to mitigate workplace fatigue, which affects more than half of all EMS personnel (Patterson et al., 2018). New guidelines have been written by a team led by the NHTSA’s Office of

Behavioral Research and academic partners at the University of Pittsburgh School of Medicine. The University of Pittsburgh School of Medicine's science focuses on the mitigation of fatigue by addressing the impact of shift work and scheduling. The research is led by Daniel Patterson, Ph.D., who is the lead author and assistant professor at the University of Pittsburgh's School of Medicine. Patterson and his team have established evidence-based guidelines for FRM among EMS personnel.

FRM is a critical component of safety management systems; industries such as aviation, rail, and nuclear power agencies have implemented and applied processes for fatigue detection and mitigation. However, none of these agencies have developed guidelines for FRM based on scientifically data-driven evidence (Patterson, Huang, et al., 2010). Evidence-based guidelines aid in the normalization of practice and policies for managing fatigue using a review of the best available evidence. Evidence-based guidelines are widely used across the spectrum of medical care in the United States. Nevertheless, in the prehospital setting, most practices are based on preclinical research or clinical studies performed in the hospital setting and lack validation from EMS clinicians. Thus, there is a need for established evidence-based guidelines vetted through professionals active in EMS.

Patterson's research team began the formulation of these guidelines following recommendations of the national eight-step model process that includes the use of a rigorous methodology consisting of grading of recommendations, assessment, development, and evaluation framework (Patterson et al., 2018). The eight-step national model process was shaped by the Institute of Medicine's (IOM) Committee on the Future of Emergency Care. The IOM's committee recommended that a

multidisciplinary panel establish a model for developing evidence-based protocols for the treatment of EMS patients (Lang et al., 2012). In 2016 and 2017, researchers reviewed 30,000 publications relevant to fatigue shiftwork (Patterson & Robinson, 2018). In the following year, a panel of experts reached an agreement on five recommendations that comprise evidence-based guidelines for fatigue risk management. The goal of the five recommendations is to aid in the decision-making process for EMS administrators in the development of FRM systems and programs at the local level (Patterson & Robinson, 2018).

### **Evidence-Based Guideline Recommendations**

#### ***Fatigue/Sleep Survey Instruments***

Recommendations by the expert panel were each preceded by associated research questions. The first recommendation was the implementation of sleepiness survey instruments to measure and monitor fatigue in EMS personnel. The panel considered evidence from several experimental and observational studies, which interpreted 14 different fatigue and sleepiness survey instruments. Surveys such as the Emotional Exhaustion subscale (EE scale), the Energy and Fatigue subscale from the World Health Organization Quality of Life assessment instrument, the 11-item Fatigue Scale, the Need for Recovery scale (NRS), and the 10-item Fatigue Assessment Scale were all researched in terms of validity in the setting of non-EMS shiftwork. All fatigue questionnaires analyzed used measured fatigue in the shift worker in a reliable and valid way (Vries et al., 2003). Several of these studies researched the validity of fatigue and sleepiness surveys in the setting of non-EMS shiftwork. However, the absence of a gold standard and consensus objective for

assessment of occupational fatigue accounted for the lack of validity in the testing under prehospital settings (Patterson et al., 2018). Despite the support of the instruments, the most significant limitation of the instruments is the lack of utilization in the setting of prehospital EMS. To date, no prehospital EMS have implemented any such fatigue and sleepiness survey instruments.

Nevertheless, despite the low quality of evidence, the expert panel concluded that these instruments consistently measured fatigue in workers similar to those in prehospital EMS (Patterson et al., 2018). Panel members raised concerns about the accuracy of the surveys within the setting of EMS. Panel members also reported concerns about the accuracy of fatigue instruments when personnel reported high levels of fatigue to leverage fatigue mitigation policies that limit or eliminate work and invoke mandatory rest (Patterson et al., 2018). Additionally, the manipulation of the surveys to report low levels of fatigue to increase opportunities for overtime was an added concern. Despite these underlying concerns, the expert panel believed the benefits of using fatigue and sleepiness survey instruments outweigh the potential manipulation and decrease the liability of taking no action.

The benefits of such surveys are the ability to be implemented with limited effort within the EMS environment and to serve as a potentially useful tool for EMS administrators. In all, the panel determined that the instruments used in the FRM program will do more harm than good (Patterson et al., 2018). The expert panel considered the burden placed on personnel along with the feasibility of distributing survey instruments. The panel determined that randomly sampling specific shift patterns may provide the optimal balance of effectiveness and feasibility. The

panel's target population are those who work shifts longer than 12 hours in length and occur overnight or are close in proximity. The participation among the specific shifts may provide a more representative picture of fatigue and the workforce (Patterson et al., 2018).

### ***Shift Scheduling Interventions***

The next evidence-based recommendation was that EMS personnel work shifts shorter than 24 hours in duration. The expert panel considered over 100 studies that researched critical outcomes based on shift patterns. Twenty-four different shift patterns were compared across the 100 studies and sorted into three main groups. The sample groups consisted of less than 24-hour shifts, greater than 24-hour shifts, 12-hour shifts, and 8-hour shifts. Because of a large number of studies, the expert panel combined studies with favorable findings on critically important outcomes and compared them to studies with unfavorable or mixed/inconclusive findings. As noted by Patterson et al. (2018), critical outcomes are defined as a threat to patient safety and personal safety. Patterson et al. defined these critical outcomes in nine separate categories: patient safety, personal safety, personnel performance, acute fatigue, sleep and sleep quality, retention/turnover, long-term health, burnout/stress, and cost to the system. The expert panel selected eight different shift comparisons and 15 experimental and nonexperimental studies from the 100 total studies into a new category. The new category focused on shifts less than 24 hours in duration and those that exceeded 24 hours in duration (Patterson et al., 2018). Of the 15 studies grouped into this category, findings were reported for critical outcomes of patient and personal safety. As Patterson et al. noted, nine of the

studies were favorable for at least one of the seven essential outcomes for shift patterns less than 24 hours in length.

Additionally, none of the findings extracted from any of the 15 studies linked to critical outcomes of patient and personal safety categories were found unfavorable toward shifts shorter than 24 hours in duration (Patterson et al., 2018). Although the panel's findings strongly favored shifts shorter than 24 hours versus those longer than 24 hours, the research did not support correspondingly when comparing 8-hour shifts versus 12-hour shifts or the composite thereof (Patterson et al., 2018). The expert EMS panel noted that there would be an ongoing debate regarding the safety and impact when comparing shift duration in the field of EMS. Nonetheless, the desired effects of EMS personnel working shifts of a shorter duration than 24 hours include fatigue reduction, increased alertness, better sleep and sleep quality, and an increase in the health and well-being of EMS personnel. Additionally, the improved safety for patients and EMS personnel is the leading driver of the FRM movement.

The panel acknowledged the possible undesirable effects of the implementation of shorter shift patterns. Specifically, numerous factors may impact the costs associated with implementing shorter durations. The costs can vary from system to system. The expert panel recognized that longer shifts might be more beneficial for EMS agencies located in remote locations. The longer shift durations allow for additional employment because less time is spent traveling to and from work. The change in work schedule in remote locations may provide barriers of the ability to recruit individuals to work in these distant locations. Also, transitioning to shorter shift patterns may lead to the need to hire additional employees to staff the added shifts created from the change in work schedule.

The panel recognized that EMS personnel may favor longer shifts. Employees may value the recovery between shifts as well for the opportunity for additional employment outside of their regular schedule. The expert EMS panel acknowledges the concerns and challenges in the context of shifts of less than 24 hours though the concern should be weighed against the empirical findings from numerous studies on the potential critical outcomes of patient and employee safety.

### *Access to Caffeine*

The third recommendation from the expert EMS panel was that EMS personnel have access to caffeine as a fatigue countermeasure. The panel recommended that EMS administrators provide access to caffeine regardless of system deployment configuration or whether it was provided by the contracted agency (Patterson et al., 2018). The expert EMS panel conducted an evidence review on the effects of caffeine on psychomotor vigilance, which is an integral component in performance, and on acute fatigue and sleepiness. However, the promotion of caffeine use should align with the current U.S. Food and Drug Administration's (FDA) recommended dose. The FDA-approved dose in healthy individuals should be limited to about 400 mg, which is about four to five cups of coffee (FDA, 2018). Caffeine has been and continues to be readily available in many EMS settings, yet its use may not be proactively considered as a countermeasure tool to mitigate fatigue. Several reasons for the availability or lack thereof of caffeine to EMS personnel can vary system to system. EMTs and paramedics who are in a system status management scheme versus those who operate out of fixed bases may have different access opportunities to caffeine. Lastly, the cost attributed to providing caffeine can vary based on the size of various EMS operations, with costs associated with providing

caffeine to moderate or large organizations exceeding thousands (Patterson et al., 2018). Caffeine's use in the setting of EMS should be integrated with a plan to monitor consumption and its impact on EMS performance. Additionally, the panel called for further research and training in the use of caffeine built around the dynamic EMS shift schedules and operations.

### ***Permissive Napping on Duty***

The fourth recommendation was the promotion of EMS personnel to nap while on duty to mitigate fatigue. Several factors have made this practice taboo. Although the panel understood that the public perception of EMS personnel napping on duty may be undesirable, it is a specific strategy to impact fatigue-related outcomes. The strategy of napping has shown improved alertness, personal performance, and reduced sleepiness (Patterson et al., 2018). The panel's research noted, "Naps ranging from 15 to 120 minutes during shift work have been associated with better performance and reduce levels of acute fatigue/sleepiness" (Patterson et al., 2018, p. 95). The panel noted the possibility of undesirable effects while supporting napping on duty, such as sleep inertia, a period of reduced alertness, or impaired cognition after waking (Kovac, et al., 2020)

The consequences of sleep inertia may consist of decreased en route times and total response times. However, naps of less than 10 minutes may reduce sleep inertia (Tietzel & Lack, 2001). The panel maintained that EMS organizations should be able to develop innovative policies and procedures that promote napping while minimizing the risks to response times. The shift in public perception of EMS personnel napping on duty should be rooted in education. Several EMS operations work shifts that are 24 hours or longer in duration. In such operations, nighttime sleeping is required while not



responding to emergency calls. It is within the public education component that enables the shift of negative public perception. Despite these recommendations, the permissive use of napping does not relieve EMS personnel of arriving at work well-rested and ready to perform at peak performance (Patterson et al., 2018).

### ***Fatigue Education and Training.***

The fifth recommendation by the EMS panel was that EMS personnel receive education training to mitigate fatigue and fatigue-related risks. The panel's review of 18 studies showed a positive relationship between education and training in fatigue along with favorable outcomes regarding patient and personal safety (Patterson, 2019). It was the position of the panel that EMS personnel should receive fatigue education and training during new employee orientations as well as every 2 years to promote knowledge retention. As with other areas of EMS, required educational programs such as cardiopulmonary resuscitation and advanced cardiac life support require training every 2 years. It was the position of the panel that education training and fatigue and sleep health become ingrained in the education component of the EMS provider, much like other significant medical training in the profession (Patterson et al., 2018).

### **Theoretical Framework: Complex Systems of EMS**

This study describes the threat to the leadership within EMS, the public, and the emergency responders who provide these coveted services through the researcher's lens of examination utilizing complex systems theory. There are numerous versions of systems theory; however, complex systems theory may be most helpful in understanding FRM guidelines and the difficulties of managing fatigue in the sophisticated setting of EMS. The potential danger to the local emergency system stems from the lack of

feedback mechanisms in most emergency systems today. The primary feedback loops that are of concern in this research are those that monitor sleep deprivation and fatigue in the privately contracted 911 ambulance provider. Limited research has been conducted on the relationship between sleep and fatigue while providing EMS. However, a significant amount of research exists on fatigue and its link to substantial human errors related to industrial accidents.

The profession of EMS is a complex system composed of distinct actors (e.g., physicians, paramedics, EMTs, nurses, firefighters, administrators, etc.) who function together to perform predetermined goals (Swanson et al., 2012). This dissertation's aim was to analyze the role of the EMS administrator in FRM and to discover what, if any, system mechanisms are in place to monitor sleep deprivation and fatigue in contracted private 911 ambulance EMTs and paramedics. The theoretical framework for this dissertation derives from complex systems theory, which focuses on problems of relationships, structure, and interdependence rather than the constant attributes of objects (Shafritz et al., 2004). Systems theory is described as the exploration of "wholes and wholeness" (Von Bertalanffy, 1972, p. 411). Systems theory evolved from the basic sciences; however, it is utilized in the social sciences. When evaluating the EMS delivery system, the significance of the local emergency medical system is that it is a part of a larger, interdependent arrangement. Von Bertalanffy (1972) noted that systems theory is centered on clarifying the whole, its elements, and the relations between them. It is the interrelated and interdependent parts of fatigue management that have perhaps gone unnoticed.

The role of the local emergency medical system comprises several parts, including local, state, national, and private actors. Each of these actors operates in independent ways while working in an open environment limited only by specific organizational policies, rules, and procedures. Local emergency medical system managers act as part of an extensive open system. However, when using contracted private ambulance services, complex systems theory would suggest the need to clarify the relationship between the local EMS administrator as it pertains to the management of fatigue in the contracted employee. Applying complex systems theory and its appropriate use of FRM in EMS requires an investigation of the various factors that contribute to fatigue. Traditionally, workplace fatigue has been treated almost exclusively as an individual issue. Nevertheless, limited attention has been paid to organizational factors in system design within various EMS organizations.

EMS is a highly complex system of interconnected components. EMS is a complex organization of recurring activities that requires energetic input into the system and the transformation of that energy that result in effective and efficient medical care. EMS, as a complex system, is degrading because of the lack of fatigue risk management. To understand EMS as a complex open system, there is a need to break down the components of the privately contracted 911 ambulance service. For instance, the import of energy in the open system as applied to EMS consists of raw materials and labor needed to provide service. The effectiveness of the privately contracted 911 ambulance service is heavily dependent on renewed supplies of energy in the form of labor and raw materials at a self-sustaining level. The role of the EMT and paramedic as an input into this open system is critical. Without labor, the raw material and energy of the workforce

cannot be transformed into the production of service, which in this case is the delivery of prehospital emergency medical care.

The transformation of raw materials and labor energy occurs in the open system as the “throughput.” The outcome of the cycle of activities within EMS furnishes new energy for the initiation of a renewed cycle. By providing emergency medical care, the complex system changes the means of securing new raw materials, compensating the workforce, and continuing activity patterns (Katz & Kahn, 1978). The concern is the ability of the cycle to continue to provide effective and efficient prehospital medical care when the workers of the organization are subject to unnoticed effects of fatigue. The transformation of raw materials and labor output within the throughput portion of the open system can be affected by the fatigue of the workforce. Fatigue can endanger the worker’s health and well-being and put society at risk, particularly for patients needing prehospital emergency service (Lee et al., 2014). Research conducted by the *American Journal of Public Health* in 1992 reported that nurses in Massachusetts who worked variable schedules to include mandatory overtime shifts were twice as likely to report an accident or error and 2.5 times as likely to report near-miss accidents (De Castro et al., 2010).

### **EMS as a Complex System**

Prehospital EMS is a complex and dynamic system. Yet, based on the scale, it can look unsophisticated. Prehospital EMS in its simplest form consists of first responders who operate as mobile intensive care units (MICU), which patients call upon with acute medical and traumatic emergencies in which they will be assessed, treated, and transferred to the emergency room (Hanfling et al., 2012). The assessment and

treatment of patients that occur in the prehospital setting can occur in residential homes, vehicles, street corners, or clinics. In essence, the operations of prehospital clinicians mimic a scaled-down version of an emergency department (Smith & Feied, 2002). In the prehospital setting, each patient goes through a very similar process. Each 911 call initiates a preplanned response, which includes gathering demographic data, chief complaint, patient assessment and treatment if indicated, and transportation to the emergency room if needed (Hanfling et al., 2012).

When looking at EMS as a large-scale operation, it can look simplistic. Yet, when considering the unique and diverse variety of calls for service, the process appears more complicated (Smith & Feied, 2002). When prehospital EMS is examined thoroughly, it begins to display some of the complexities of the system. Prehospital EMS occupies many component parts (e.g., 911 dispatch, fire departments, police, ambulance service, government oversight) that interact with each other to mitigate complicated social and psychological dimensions in addition to the original medical call for service (Smith & Feied, 2002). The prehospital healthcare system comprises components that interact nonlinearly on different scales (the patient, family, prehospital provider, hospital, and government). It can produce unintended consequences such as vehicle accidents, infections, and drug errors (Lipsitz, 2012). The output of such a complex system is dynamic and behaves erratically according to its initial conditions and feedback.

The examination of the complex EMS system as an organization requires administrative leaders to identify gaps in defensive processes. Reason (2016) noted, “Difficult though they may be to model, we have to struggle to find some way of understanding the development of organizational accidents if we are to achieve any

further gains in limiting their occurrence” (p. 1). When leaders explore the processes of FRM in the EMS setting, the need to understand the development of fatigue-related incidents is critical to limiting losses of production. Every organization produces some form of a product, whether it be manufactured goods, transportation of people, or other services (Reason, 2016). The lack of defensive processes as it applies to FRM may be the problem in privately contracted 911 ambulances.

The human condition is riddled with imperfection, and people working in complex systems make errors or violate procedures for purposes that generally go beyond the scope of individual consciousness. Such purposes or motives are considered latent conditions (Reason, 2016). Latent conditions are the result of poor design, poor decision-making, and poor processes often developed by those not working on the frontlines (World Health Organization [WHO] & WHO Patient Safety, 2011). For instance, Reason (2016) created the Swiss cheese model to explain how deficits in each layer of a system can lead to organizational accidents.

### **The Swiss Cheese Model of System Accidents**

Human error has typically been classified in two ways: a personal approach and systems approach (Reason, 2000). The personal approach attempts to understand human error from the aspect of faulty mental processes. Reason (2000) described this as “unsafe acts . . . arising primarily from aberrant mental processes such as forgetfulness, poor motivation, carelessness, negligence, and recklessness” (p. 768). The personal approach focuses on the individual or individuals responsible for the breakdown of the procedural process. The focus on the individual is a blame-oriented approach, likely to create fear and involve disciplinary actions while also holding individuals responsible and liable for

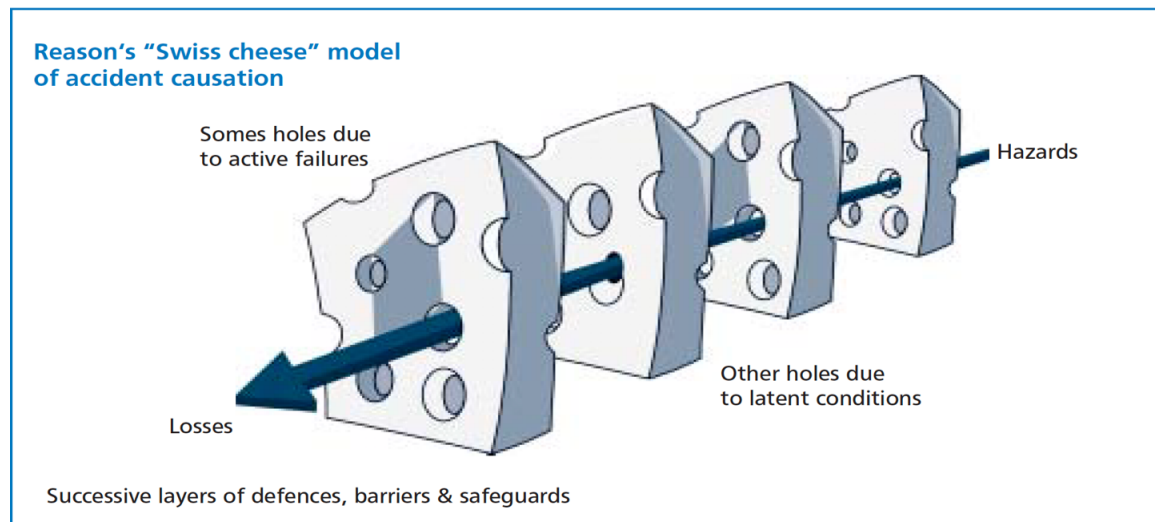
errors (Garfield & Franklin, 2016). The personal approach to understanding human error has inadequacies and is ill-equipped for the medical field (Reason, 2000).

EMS accidents should be viewed through the lens of a complex system to understand that errors are often a repercussion of multiple factors, where each plays a role but only in combination with system failures are they sufficient to cause a catastrophe. Reason (2016) noted that critical factors such as defense, barriers, and safeguards are foundations of the systems approach. The systems approach defense mechanisms can be engineered, rely on people, or depend on procedural or administrative mechanisms (Reason, 2016). According to Reason, the Swiss-cheese model explains weaknesses in these defensive processes as layers of protection that have vulnerabilities (i.e., holes in the cheese).

Reason (2000) noted that the holes in the defensive operations arise for two reasons: active and latent failures. Much like the personal approach, active faults are the unsafe acts committed by individuals within the system. In contrast, latent failures are systemic factors that arise from designers, builders, policy and procedure creators, and administrators (Reason, 2000). When active and latent failures have the opportunity to combine, it creates an accident opportunity. Active and latent failure alignments are represented in the Swiss cheese when holes bring into line the opportunity for multiple failures within the system to permeate. Usually, no one single fault in the layer is enough to cause an adverse event. However, using an example from EMS, a fatigued paramedic, mechanical malfunction, and speeding can align faults that would permit an opportunity for an organization accident (as indicated by Figure 1).

## Figure 1

### *Swiss Cheese Model*



*Note.* From "Human Error: Models and Management," by J. Reason, 2000, *BMJ*, 320(7237), p. 769.

### **Output of EMS as an Open System**

The delivery of effective and efficient prehospital emergency care is the goal of any privately contracted 911 service. The threat to that service in an open system model is any degradation of service provided. Without comprehensive FRM guidelines in place, the dilapidation of the level of care is imminent. Persistent fatigue can be associated with frequent lapses of attention and increased reaction time, eventually leading to increased error rates during the performance of tasks (De Castro et al., 2010). Privately contracted 911 ambulance services utilize raw materials and human labor to turn out a product that is marketed to the public as exceptional prehospital emergency care. The returns on the marketed product revolve around monetary reimbursements from insurance or private payers. These financial returns are used as inputs back to the open system to perpetuate the cycle within privately contracted 911 ambulance services. Limited data exist on the



costs related to prehospital medical errors. However, in 2008, preventable harm such as hospital-acquired infections, surgical error, medication errors, in-hospital injury, and misdiagnosis was estimated to cost the United States \$19.5 billion (Bernazzani, 2018). Medical errors are the third-leading cause of death in the United States, ranking just behind heart disease and cancer (Allen & Pierce, 2016). Evidence suggests that the lack of FRM within EMS could increase the chances of medical errors and thus pose a threat to the resiliency of the open system.

Several other factors contributing to the degradation of EMS as an open system are a result of unregulated overtime and forced mandated overtime. Mandatory overtime hours are generally considered hours above the standard workweek (usually 40 hours). The Fair Labor Standards Act of 1938 (FLSA), which regulates overtime, currently implements no restrictions on the number of overtime hours worked except for the airline, railroad, and trucking industries (Golden & Jorgenson, 2002). Overtime is particularly prevalent among emergency service workers. Ambulance services are provided on a 24-hour-a-day, 7-days-a-week, 365-days-a-year basis. Because of operational needs, overtime is not only prevalent—it is mandated. Often, ambulance organizations do not have sufficient staff to cover vacancies as a result of sick calls, vacancies, or vacation (Berard, 2019). The vacancies automatically dictate some form of overtime if not covered by other means. The combination of rigorous workload and voluntary or mandatory overtime contributes to the fatigue epidemic. For example, a German study noted that after 9 hours at work, the vehicle accident rates begin to rise. After 12 hours of work, the vehicle accident rate was twice as high as the rate for the first

9 hours after data examination of 1.2 million car accidents among the German workforce (Hänecke et al.,1998).

In systems theory, the functioning of EMS is heavily dependent upon the continuous influx of stimulation from the environment. Under systems theory, the environment is a permeable barrier in which resources and information flow in and out. The environment is often unpredictable, which requires management to scan and analyze the events, trends, and relationships of the environmental boundary. In terms of EMS labor, the environment plays a significant role in the management of fatigue.

Environmental and sociocultural influences can have a considerable role on fatigue in EMS providers. EMS workers who conduct shift work and sleep during the day can be subjected to higher risks of fatigue if forced to work overtime during the day. The dynamic nature of EMS can expose employees to stressors that many other occupations never experience. The chronic exposure to scenes of pediatric trauma, sex crimes, and cardiac arrests can take a physical and mental toll on the first responder. These environmental factors can contribute to fatigue regardless of shift length.

For EMS to survive as an open system, it must move to arrest the entropic process. The entropic process is a universal law of nature in which all forms of the organization tend to move toward disorganization or death (Katz & Kahn, 1978). EMS, as an open system, combats entropy by importing more energy from its environment, storing that energy, and acquiring negative entropy. EMS labor provides a pivotal role in combating entropy, which is completed through the effective and efficient treatment of prehospital calls for service, transport to the hospital, clearing the hospital, and reporting available for service. The goal of the privately contracted 911 ambulance provider is to

conduct as many transports as possible within the shift. The high volume of ambulance transports generates incredible amounts of revenue for the agency. The negative entropy generated from a high-volume transporting EMS system is a means to arrest the entropic process. Despite the positive effects of combating the entropic process, there will be unfortunate trade-offs or higher incident rates of fatigue and medical errors.

The feedback mechanism within the open system of EMS is broken. In systems theory, there is a positive and negative feedback loop. The simplest type of information input found in open systems is negative feedback (Katz & Kahn, 1978). The negative feedback process enables the system to correct its deviations from homeostasis. The positive feedback mechanism grows the system in desired ways that amplify and improve the current processes. The positive feedback mechanism in EMS may be a significant contributor to fatigue. EMS employees' efforts to disregard fatigue, work overtime, and maintain the same level of output enable the open system to amplify its processes despite any building environmental factors that are degrading the quality of service. What should be a negative feedback process through the recognition of fatigued EMTs and paramedics, is instead being masked by the efforts of employees to subvert their fatigue and submit to the overtime demands of the agency.

The underlying problem of fatigue within the open-systems model of EMS is obscured by the efforts of the field-level EMTs and paramedics. Senge (1990) described this effect as "shifting the burden" (p. 104). The underlying problem of fatigue can be attributed to the processes within the open system as well as environmental effects. Often, EMS employees endure long hours, rapid work pace, and mental and physical stress. The demands of the high-volume 911 system are relentless. As vacancies present

themselves resulting from sick calls and vacations, the system must adapt and overcome. Most often, the burden on the system is shifted to the employee. The shifting of this burden only addresses the symptomatic problem. Senge noted, “In the long-term the problem resurfaces, and there is increased pressure for symptomatic response” (p. 104). EMS workers’ taking on increased workloads and overtime is merely a symptom, but the underlying fundamental causes are not addressed. Over time, management and employees rely more and more on the symptomatic solution, which commonly becomes the only solution (Senge, 1990).

Over the last 2 decades, American workers have been working more hours on the job and now work more hours than any other industrialized country (Ward, 2017). The growth of overtime work takes a toll not only on the EMS worker but also on the family, communities, and ultimately, patient care. In today’s economy, individuals and labor unions are faced with the declining quality of life caused by overtime work, particularly mandatory overtime (Wong et al., 2019). The steady increase of overtime demands is a result of pressure exerted by both the EMS employer and the employees. For employers, requiring existing employees to perform overtime work has proven to be significantly cheaper than hiring new workers because of the costs of training, benefits, and unemployment insurance payments that accompany the employment of new workers (Dearth, 2017). The sacrifices made by EMS employees translate into increased risk for accidents and injuries, chronic fatigue, stress, and reduced parenting and family time, and finally, diminished quality of goods and services (Golden & Jorgensen, 2002).

The need for limits on mandatory overtime in EMS is a burgeoning issue. Golden and Jorgenson (2002) noted that workers employed in the transportation and emergency

health services industries face more employer pressure to work overtime than workers in other areas. Lengthy and involuntary mandatory overtime exposes workers to a higher risk of illness and injuries, both acute and cumulative (Golden & Okulicz-Kozaryn, 2015). The effects of variable work hours on EMS employees may affect family, social life, and health. Employees reported that the more significant the individual-based flexibility, the better the health and work satisfaction whereas company-based dictated overtime might have a more negative inference (Costa et al., 2006). Limited research is available on the disaggregation of voluntary overtime versus mandatory overtime among privately contracted 911 ambulance employees. In general however, employee-oriented flexibility is associated with better health conditions than company-based variability (Costa et al., 2006). In the United States, most employment is “at-will,” meaning that the employer can dismiss an employee for any reason or no reason at all except for reasons based on gender, race, age, or disability (Golden & Jorgensen, 2002). Although laws such as FSLA regulate overtime, they currently impose no limits on overtime hours or prohibit dismissal or any other sanction for declining overtime work (Golden & Jorgensen, 2002). For employees classified as “at-will,” this can be problematic. Employees not covered by collective bargaining agreements are under persistent pressure to meet the overtime demands of management for fear of reprisal or job loss.

California has seen a 10 to 17% increase in the work hours of mothers with a child between the ages of 1 and 3; this may be a result of access to paid leave, which allows mothers to balance work and raising young children (Rossin-Slater et al., 2012). Previous research noted that as more women enter the workforce, many have home and family responsibilities that make working overtime difficult. When asked, 40% of 124

mothers in the United States said they would take a pay cut if it bought them more time with their children (Burke, 2008). Additionally, 22% of U.S. working mothers had missed three or more significant events in their children's lives in the past years, and 28% said their jobs negatively affected their relationship with their children (Burke, 2008).

Within privately contracted 911 ambulance providers, organizational pressures to increase profitability remain consistent. As with most for-profit agencies, pressure from shareholders and investors to grow profits do not always align with the current workforce structure. With that organizational pressure comes increased demands on the workforce. The profit motive is significant because achieving more with less has been a core component of business strategy from the onset of reengineering in the early 1990s (Hammer & Champy, 2006). The for-profit contracted 911 ambulance provider shares the same instinctual drive to stretch people and resources as far as possible, close to or past the breaking point. In terms of breaking point, this is often a consequence of private ambulance management's attempt to run a lean fleet. As Seim (2017) noted, management always "focused on two intertwined problems: contract compliance and labor power" (p. 466). Contracted 911 ambulance management has to balance contractual obligations and labor costs with the entity that they serve. Those contractual obligations consist of specific ambulance response times that must be achieved per the contract. If response times exceed contract parameters, the contracted agency could levy extensive fines. Seim noted that these fines could exceed \$400,000 a month. Despite the risk of penalties, private 911 ambulance management's key strategy is to intensify the exploitation of wage labor (Seim, 2017). Consequently, the existing workforce endures the physical, mental, and emotional toll of the increased workload. The continued

pressure to cut costs and focus on core competencies continues while corporate profits are going to shareholders instead of labor at record highs (Levenson, 2017). The objectives of cost containment and higher margins are facilitated in the short term by increasing the volume of tasks per employee while keeping compensation the same, thus lowering compensation while maintaining job responsibilities, or both (Levenson, 2017).

Many privately contracted 911 ambulance organizations are operating using a method similar to that of Frederick Taylor's scientific management approach (Shafritz et al., 2004). Organizational goals of the agency are designed to optimize productivity by taking a sizeable complex 911 system and breaking it down into specific tasks matched with the available ambulance resources at hand. Yet, although the general principles of scientific management are widely used throughout organizations today, the nature of EMS has changed. During the period of Taylor's work, labor did not have high levels of education (Levenson, 2017). During this period, it was the goal of management to systematically study the workforce and develop opportunities for advancement and enable the employee to perform at his or her highest level. The position of Taylor's scientific method is that producing increased output and higher quality services would allow companies to pay higher wages.

Conversely, most contracted 911 ambulance employees are well-trained, highly skilled medical professionals. EMT training consists of not less than 170 hours, which are divided into classroom and laboratory components as well as 24 hours of field training in which students work hands-on with patients in the prehospital setting (Cal. Code Regs., tit. 22 §100074, 2017-a). Once training is completed, the EMT student must successfully complete a national certifying exam, which enables him or her to apply for

state certification. Paramedic certification requires EMT certification along with an additional 1,090 hours. These training hours are a minimum of 450 hours of didactic instruction and skills laboratories along with hospital clinical training not less than 160 hours and the field internship consists of no less than 480 hours (Cal. Code Regs., tit. 22 §100154, 2017-b). The last phase of training requires the student to have a minimum of 40 ALS patient contacts during the field internship (Cal. Code Regs., tit. 22 §100074, 2017-a). Like initial EMT certification, once the paramedic student has completed training, he or she must pass a national certifying exam to be eligible for state licensure.

Despite Frederick Taylor's position on the incentive structure of scientific management, rarely does the output of EMS professionals employed in privately contracted 911 ambulances translate into higher wages. Frederick Taylor's principle of scientific management consists of an almost equal division of the actual work establishment between the ground level employees and management (Shafritz et al., 2004). Under this principle, the workload is distributed among management and labor. It is the sharing of the actual workload between the two sides in which Taylor roots his fourth principle. However, in EMS, the work disbursed among the labor cannot feasibly be shared with management. It is this study's position that EMS may be operating on a model that was intended for a lower educated workforce. Nevertheless, EMS as a profession has grown to encompass the combination of over 2,000 hours of medical education, training, and work experience to maintain competency.

### **Summary**

Fatigue is a public health issue, and when reduced down to individual counties, it becomes a multijurisdictional problem. Chapter 2 reviewed the literature, which strongly



supports the use of FRM guidelines to reduce fatigue-related vehicle accidents and medical errors and to enhance the safety and well-being of EMTs and paramedics. The literature across the transportation industry suggests limiting and monitoring consecutive hours worked, instituting mandatory rest periods, and providing fatigue education and training are necessary if there is to be a reduction of fatigue-related incidents in the setting of EMS. The development of a consistent and comprehensive FRM program by EMS administrators who contract for 911 ambulance services is quintessential for continued accountability of public services outsourced to the private sector. Fatigue continues to threaten the safety of patients, EMTs, and paramedics engaged in prehospital 911 services. The complexities of the EMS system, economic ramifications, and environmental impacts all have a significant role in the advancement of FRM policies. The reviewed literature strongly supports FRM techniques across every transportation industry. EMS administrators may not identify prehospital 911 ambulance services as the transportation industry, but risk similarities are undeniable.

Despite plentiful research in fatigue within the transportation industry, gaps in the literature persist in the field of EMS. Limited research has been conducted on fatigue and fatigue-related consequences in the setting of prehospital 911 ambulance services. Chapter 3 details the exploratory qualitative research method design utilized for this study by focusing on the theoretical perspective of complex systems theory. The research design includes the purpose, approach, research strategy, data collection, and data analysis.

### CHAPTER 3: RESEARCH METHODOLOGY

Understanding the effect of fatigue on emergency medical technicians (EMTs) and paramedics, emergency medical services (EMS) administrator accountability, and the society at large shaped the purpose of this research. An exploratory study design was utilized to gain a better understanding of current perceptions of fatigue and fatigue risk management (FRM) techniques in California's EMS system. Qualitative data concerning FRM among privately contracted 911 ambulance providers in the State of California were utilized to establish trends among EMS administrators who manage California's privately contracted 911 ambulance services and their perceptions of FRM and FRM implementation in their jurisdiction.

Fatigue has been identified as a top threat among transportation industries, and the NTSB identified it as a top 10 most wanted area of change (NTSB, 2020). Yet, limited research has been studied or thoroughly investigated on fatigue in the profession of EMS. California has 33 local EMS agencies that govern EMS for 58 of California's counties. Of those 58 counties, there are seven regional EMS systems and 26 single county agencies that provide EMS to the various regions. Seven of the regional EMS systems in California are multicounty EMS agencies and provide emergency EMS for 30 counties within California (California Emergency Medical Services Authority, n.d.). In the attempt to gain a better understanding of the problem of fatigue in EMS, the study used an exploratory approach to identify whether any EMS administrators in the State of California are using principles found in FRM in the managing of contracted 911 ambulance services.

The research question addresses how fatigue is monitored by EMS administrators who outsource 911 ambulance transportation. The qualitative research question's purpose was to gather current perceptions of EMS administrators as they apply to fatigue among the contracted workforce and how such emergency service administrators may or may not implement evidence-based guidelines for FRM. The following is the research question: "How do emergency service administrators in the State of California mitigate fatigue among privately contracted 911 ambulance EMTs and paramedics based on established evidence-based guidelines for fatigue risk management in pre-hospital emergency medical services?"

### **Research Design**

The study was explorative, qualitative, and self-reporting. The current state of prehospital EMS research is limited. Quantitative data that address fatigue in the prehospital setting, along with quantitative information on fatigue among privately contracted 911 EMTs and paramedics, is absent. Consequently, the goal of the study was to capture qualitative data on the social phenomena of how EMS administrators perceive experienced fatigue among EMTs and paramedics, how EMS agencies mitigate fatigue, and the relationship between EMS administrators and contracted 911 ambulance interactions shape policy. The study included five participants who serve as EMS administrators charged with the oversight of contracted 911 ambulance service providers. The findings of this qualitative research could assist to further the understanding and improvement of accountability within local emergency management agencies that contract for 911 ambulance services.

## **Description of Population and Sample**

The population for the study consisted of 33 EMS agency administrators throughout California who contract for 911 ambulance transport service in their jurisdiction. Each of the 33 EMS agencies was contacted through publicly available emails and phone numbers through public agency directories. Several attempts to recruit participants were made with every single agency within the 33 local EMS agency directory. Of the 33 contacted agencies and administrators, five participants volunteered to be a part of the study. The sample consisted of five full-time EMS administrator volunteers who coordinate, monitor, and provide oversight to privately contracted 911 ambulance service providers in California. The involvement of the participants was voluntary and included an approved Institutional Review Board (IRB) informed consent letter from California Baptist University. Each of the participants in the study was considered a viable candidate by meeting both of the following criteria: (a) is a full-time emergency service administrator or director responsible for EMS and (b) has oversight for contracted 911 ambulance service.

Through this study, data were gathered on the implementation of FRM among five EMS administrators in California who contracted for 911 ambulance services. The data obtained were analyzed based on responses to questions posed in the interview of EMS administrators who have oversight for contracted 911 ambulance services in various counties in California. By analyzing the responses from the qualitative interview of EMS agency administrators, this study intended to extract current trends and themes among EMS administrators as they applied to the implementation of FRM among contracted 911 ambulance services.

## **Contractual Fatigue Language of Private 911 Ambulance Providers**

To coordinate emergency medical care within geographic regions across California, local EMS agencies sign multiyear contract agreements with various private EMS companies to establish and operate 911 ambulance services within their jurisdictional boundaries. Typically, local EMS agencies will select to contract with a privately owned ambulance company to provide ambulance transportation in their region through a competitive bidding process. Once the contract is awarded, exclusive rights to respond to 911 calls in that area are given and allow the contractor to generate revenue by collecting ambulance reimbursements from patients' insurance. In exchange for exclusive operating rights, the contracted 911 ambulance provider must meet specific service requirements such as responding to 911 calls within a specific amount of time (typically between 8 and 12 minutes). This research focused on contractual language involving EMT and paramedic shifts limited to less than 24, mandatory rest periods, napping, caffeine availability, and EMT and paramedic fatigue education and training.

The study examined 18 contracts between California EMS agencies and privately contracted 911 ambulance services. Each contract was examined for any language that addressed FRM. Each of the contracts was examined for language that mirrored the evidence-based FRM guidelines established by Patterson et al. (2018). Examples included verbiage such as caffeine availability, shifts not to exceed 24 hours, permissive napping on duty, and comfort stations. The examination took into consideration the recency of established FRM guidelines and contracts that predated such guidelines. Each contract was examined for three specific contractual languages regarding FRM guidelines. Individually, each contract was examined for defined maximum consecutive

work hours allowed, established mandatory rest periods between shifts, and any established FRM education and training requirements.

Each contract was examined for content-specific language, which established a maximum of consecutive hours worked, mandatory rest periods between shifts, and any contractual language regarding FRM education and training. Each individual contract was analyzed for language relating to fatigue mitigation tools, fatigue management, and education. Based on that analysis, each contract was placed into three tiers that classified each contract based on the strength of the FRM language. Each contract was rated in three categories: maximum consecutive hours worked allowed, mandatory rest periods between shifts, and education and policies.

### **Instrumentation**

The instrument used in this research was a semistructured questionnaire (Appendix A) created by the author. The instrument was used to collect data from the sample population of EMS administrators within selected counties of California. The instrument is a semistructured questionnaire modeled after the five evidence-based guidelines for FRM in EMS. FRM in EMS incorporates five guidelines founded on evidence-based research in the setting of EMS and best practices in the mitigation of fatigue. Following are the five evidence-based guidelines for FRM in EMS recommended by Patterson et al. (2018):

1. Recommend using fatigue/sleepiness survey instruments to measure and monitor fatigue in EMS personnel.
2. Recommend that EMS personnel work shifts shorter than 24 hours in duration.

3. Recommend that EMS personnel have access to caffeine as a fatigue countermeasure.
4. Recommend that EMS personnel have the opportunity to nap while on duty to mitigate fatigue.
5. Recommend that EMS personnel receive education and training to mitigate fatigue and fatigue-related risks. (p. 4)

The purpose of the questionnaire was to examine current practices among EMS administrators as they apply to FRM among privately contracted EMTs and paramedics. The semistructured questionnaire was emailed to participants and discussed via telephone interviews.

### **Data Collection**

The selection of participants started with an email distributed to each of the 33 EMS administrators in California who may contract for 911 ambulance services through private entities. Each of the 33 participants was contacted via phone and email utilizing a public service directory provided by the California Emergency Medical Services Authority (CalEMSA).

Secondary data were gathered on 18 counties in California that contract for 911 ambulance services. The secondary data consisted of publicly available agreements in which the county and the contracted agency agree to respond to 911 calls and other emergencies or urgent medical call requests made through the county's public safety agencies. Each contract researched was obtained through the county's EMS webpage. The study found that 18 of the 33 contracts were readily accessible; however, the remainder of contracts between counties and privately contracted 911 ambulance

providers could not be located publicly despite extensive search of the public agencies' websites. The contracts establish guidelines for the care and/or transport of patients within the EMS system. Within these contracts, language is often included that outlines the working conditions of EMTs and paramedics. Within the language of working conditions, the study extracted qualitative data that outlined the inclusion or exclusion of evidence-based guidelines in FRM.

### **Qualitative Data Collection Procedures**

Upon obtaining permission from the University's IRB, the population of 33 participants were selected based on the following criteria: (a) they have responsibility for managing emergency medical services agency, and (b) they manage contracts with privately owned 911 ambulance services. The research criteria were established to support the research question, formulated to understand current practices on the mitigation of fatigue among privately contracted 911 ambulance providers. The population of 33 administrators was accessed through publicly available email and phone directories utilizing purposeful sampling. Purposeful sampling involves identifying and selecting individuals or groups of individuals who are knowledgeable or experienced in a phenomenon of interest (Creswell & Clark, 2012). Of the 33 EMS administrators contacted, five participants from the purposeful sampling volunteered to participate in the study.

The interview protocol conducted in this research utilized a semistructured interview with the participants that was captured on a password-protected iOS device. Each digital recording was used to preserve data obtained through the review process to be transcribed. The interview protocol was implemented as a tool to document all



consent forms for each interview. Each interview participant was advised that all interview responses, as well as their affiliation with their respective agency, was anonymous. None of the five participants were known to be researching FRM or had regulatory board positions, and no conflicts of interest were deemed to exist. Lastly, each interview was validated by transcribing responses and providing transcripts to each of the participants for their review.

During this study, the researcher attempted to establish a connection with each of the local EMS administrators within the 18 selected counties to research the subject of FRM among privately contracted 911 ambulance services. Each administrator was contacted by email and/or phone calls with requests to participate in the research. The connection with each county's EMS administrator was crucial to the success of the research. Each of the 33 local EMS agencies has one EMS director, administrator, or coordinator charged in the oversight of their respective region. Some of these regions encompass multiple counties. Of the 18 counties, five administrators who (a) have responsibility for managing an EMS agency and (b) manage contracts with privately owned 911 ambulance services agreed to participate in the research. Four EMS administrators declined to participate, and the remaining administrators did not respond to the research requests. It was agreed that the interviews would be held via phone call and would be recorded and transcribed with total anonymity. Each interview used the five-question semistructured questionnaire to identify the current practices or lack thereof in FRM of the contracted 911 ambulance service contract in the administrator's county.

## **Data Analysis**

The objectives of the study were to analyze the prevalence of FRM techniques at the local emergency management agency level within California. The analysis involved semistructured interviews with five EMS administrators who contract for 911 ambulance services. The analysis population consisted of all 33 EMS agencies in the state of California. Of the 33 agencies, five participants identifying as county EMS administrators charged with the oversight of emergency service operations volunteered to participate in the study.

The primary outcome measures for the semistructured interview questionnaire were to gain perceptions of EMS administrators as they apply to FRM techniques in their respective jurisdictions. The perceptions of EMS administrators were measured using a five-part questionnaire adapted from the five evidence-based guidelines for FRM in EMS created by Patterson et al. (2018). Five agency characteristics were assessed for an association with FRM guidelines. They consisted of (a) instruments or mechanisms used to measure and monitor fatigue, (b) maximum permissive consecutive hours of work allowed less than 24 hours, (c) availability of caffeine to EMS personnel, (d) encouragement of napping on duty, and (e) education and training to mitigate fatigue and fatigue-related risks.

Next, an exploratory case study involving 18 contracts between local EMS agencies within California and privately contracted 911 ambulance services was conducted. Each of the contracts was measured and assessed for FRM-related language that aligned with the five evidence-based guidelines for FRM. The contracts were assessed for (a) the directive to use instruments to actively measure and monitor fatigue

in EMS personnel, (b) the directive that EMS personnel work shifts shorter than 24 hours in duration, (c) the directive that EMS personnel have access to caffeine as a fatigue countermeasure, (d) the directive that EMS personnel have the opportunity to nap while on duty to mitigate fatigue, and (e) the directive that EMS personnel receive education and training to mitigate fatigue and fatigue-related risks. Each of the contracts was assessed for language adapted from the five evidence-based guidelines for FRM in EMS created by Patterson et al. (2018).

This research utilized a qualitative exploratory study approach. Data were collected and organized into categories based on themes, patterns, concepts, and similar characteristics. Through the initial phase of open coding, the goal was to extract themes from the initial data presented from the interview question responses. Intensive open coding continued until the process brought about categories and, through axial coding, transformed them into groupings. Lastly, the use of selective coding exposed a theory of understanding of FRM and the accountability issues surrounding local EMS administrators.

### **Description of Population and Sample**

The population for the study focused on EMS administrators throughout California. Of the 33 EMS agencies contacted, a sample of five full-time emergency service administrators who coordinate, monitor, and provide oversight to privately contracted 911 ambulance service providers participated. The agencies selected in California were based on their alliance with privately contracted 911 ambulance providers. Any personal identifiers of the study participants were removed and protected.

The personal names of the agency representatives were not disclosed and are referred to in the study as *emergency service administrators*.

Data collection issues surrounding the study were the willingness of emergency service administrators to participate in research. Four EMS administrators refused to participate, and several other EMS administrators failed to respond to emails or return phone calls despite several attempts. Potential causes of reduced participation in the study may involve EMS administrators who are in the process of conducting or updating existing contracts for 911 ambulance services. Consequently, they may be unable to speak of any potential changes in contractual language within the new agreements. The term length of EMS contracts can be anywhere from 5 to 10 years. EMS administrators who may be introducing FRM guidelines in future agreements may be unable to comment. Yet, of the five participants, none are known to be updating existing contracts.

An analysis comparing characteristics of EMS administrators' perceptions of FRM to existing language within contracts between their counties of jurisdiction and the private 911 ambulance provider revealed gaps in understanding of fatigue language within contracts. The confounding variables in the qualitative data may have causal roots in the growing FRM movement within EMS. Consequently, EMS administrators who knowingly have no FRM policies may not have wanted to participate in the semistructured interview process. Every one of the 33 EMS administrators was contacted to participate in the research study. However, only five of the 33 volunteered to participate.

Chapter 4 presents the findings of the study. The chapter begins with the results of the qualitative research, sample and data collection concerns with EMS agencies, and

the contracts that private 911 ambulance providers operate within, concluding with a summary of findings.

## CHAPTER 4: FINDINGS

The purpose of the study was to examine the available data concerning fatigue risk management (FRM) among privately contracted 911 ambulance providers in various counties within the State of California. The study included five participants who serve as EMS administrators charged with the oversight of contracted 911 ambulance service providers. The qualitative data were obtained based on the selection of emergency medical services (EMS) administrators listed in the CalEMSA public directory. Thirty-three agencies were contacted via email or phone number listed on the CalEMSA public directory. Of those contacted, five EMS administrators were willing to participate in the interview process.

One research question was intended to answer these accountability issues through the examination of qualitative data. The following is the research question: “How do emergency service administrators in the State of California mitigate fatigue among privately contracted 911 ambulance EMTs and paramedics based on established evidence-based guidelines for fatigue risk management in pre-hospital emergency medical services?”

### **Qualitative Data Results**

#### **Interview Question 1**

“What instruments or mechanisms do you use to measure and monitor fatigue in the contracted 911 ambulance provider?” No follow-up questions relevant to FRM guideline implementation or understanding were identified.

Interview Question 1 was utilized to determine the operational procedures employed by government administrators who oversee EMS and how each monitors

fatigue in the privately contracted 911 employee. How administrators conduct oversight of privately contracted 911 ambulance services is of particular interest in this research. Specifically, policies, procedures, and contractual language may be a useful tool in the monitoring and mitigation of fatigue in the privately contracted 911 ambulance provider. Represented in Table 1 are the statements recorded from semistructured interviews of emergency medical administrators in various regions of California. Each response is classified as corresponding with Research Question 1 (RQ 1).

**Table 1**

*Interview Question 1: What Instruments or Mechanisms Do You Use to Measure and Monitor Fatigue in the Contracted 911 Ambulance Provider?*

<b>Administrator</b>	<b>IQ</b>	<b>IR</b>
<b>County 1</b>	1	I don't. I cannot honestly say yes, I do know. Anecdotally I do know that they monitor it, or anecdotally I've been told that they monitor it. I know that they've actually just recently adjusted their work schedule to help reduce the amount of time someone's on duty.
<b>County 2</b>	1	I don't think they do. Because last year I contacted a speaker to come to EMS our conference, as part of the EMSAAC conference, because this is a topic of great interest for me.
<b>County 3</b>	1	Yeah, so we really don't have anything other than . . . For our contracted ambulance provider, we have two shift schedules. They run nothing more than 12 or 24 hours. That is it. We don't have any other mechanisms in place to monitor fatigue.
<b>County 4</b>	1	We have no metrics in place.
<b>County 5</b>	1	In our system, in our four-county system, we actually have in each of the agreements, put in a unit utilization ratio limitation, which is it's based on arrivals. So it's basically if you take the number of arrivals they have in a 24-hour period, and if it's over .4 or 40% of the time, then we audit them. Basically, they're not allowed to do that. They've got to run their system so that they're 24-hour cars are not responding to 40% of the time on calls.

The responses from participants fell within their respective areas of expertise and highlighted one emerging theme. The theme developed from participants' responses to RQ1 was that each of the five EMS administrators had no known mechanisms to monitor fatigue in the contracted 911 ambulance provider.

### **Interview Question 2**

“What is the maximum number of consecutive hours a contracted 911 ambulance EMT or paramedic may work?” No follow-up questions relevant to FRM guideline implementation or understanding were identified.

Interview Question 2 was utilized to examine existing perceptions of policies by EMS administrators in limiting consecutive hours worked by contracted 911 ambulance EMTs and paramedics. Evidence-based guidelines have established the need to limit shifts to less than 24 hours (Patterson et al., 2018). The intent of the question was to examine EMS administrators' role in the monitoring of consecutive hours worked by the contracted 911 ambulance service under their respective oversight. Represented in Table 2 are the statements given by the EMS administrator as they apply to the administrator's role in limiting consecutive hours of work by the contracted 911 workforce.

The responses from participants fell within their respective areas of expertise and developed into one emerging theme. The theme developed from participants' responses was that consecutive hours worked by contracted 911 ambulance employees are not thoroughly monitored. As Patterson et al. (2018) noted, shift length should be limited to less than 24 hours. Participants identified shift patterns that meet the evidence-based guidelines; however, the monitoring of employees who are held over, mandated for a double shift, or the combination of both is lacking.



**Table 2**

*Interview Question 2: What Is the Maximum Number of Consecutive Hours a Contracted 911 Ambulance EMT or Paramedic May Work?*

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<b>Administrator</b>	<b>IQ</b>	<b>IR</b>
<b>County 1</b>	2	On the transporting side, 72 hours.
<b>County 2</b>	2	It is by our contract or last contract, which is 12, but like I said, they can be mandated you know to work, two hours over, and we don't have control over the call back system or the 8 hours between shifts. And they have sort of rotating shifts, so you could get off at say 9 o'clock at night, maybe perhaps be held over, and then called back in the morning, so it is feasible that they wouldn't get, say 8 hours between shifts.
<b>County 3</b>	2	We do not monitor that.
<b>County 4</b>	2	I've certainly had experience elsewhere in doing RFPs and subsequent contracts that very specifically have language about how long people can work, but I don't believe we have it in our current contract.
<b>County 5</b>	2	24, and then if they work another shift, they have to be off duty for 8 hours before starting another shift.

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**Interview Question 3**

“Does the contracted 911 ambulance EMT and paramedic have access to caffeine provided by the agency, or readily available for purchase?” No follow up questions relevant to FRM guideline implementation or understanding were identified.

Interview Question 3 was utilized to explore EMS administrators' knowledge of working conditions in which privately contracted 911 ambulance EMTs and paramedics have access to caffeinated beverages while on duty, specifically whether these beverages are readily available and/or provided by the employer. According to Patterson et al. (2018), caffeine has shown positive effects on psychomotor vigilance, which is essential for performance, and on acute fatigue and sleepiness. The use of caffeine is widespread among most EMS professionals though its proactive use by EMS administrators and

employers to mitigate acute fatigue during extended shifts or overnight periods may be lacking in its promotion. Represented in Table 3 are interview responses by participants based on their understanding of the availability and use of caffeine as a fatigue countermeasure used by privately contracted 911 ambulance providers.

**Table 3**

*Interview Question 3: Does the Contracted 911 Ambulance EMT and Paramedic Have Access to Caffeine Provided by the Agency, or Readily Available for Purchase?*

<b>Administrator</b>	<b>IQ</b>	<b>IR</b>
<b>County 1</b>	3	The agency, we don't provide them any.
<b>County 2</b>	3	A lot of the posts currently are located in the hospitals that go above and beyond for having service stations that provides coffee, snacks, and drinks, cold drinks.
<b>County 3</b>	3	I know that they do have access to caffeine as much as they want.
<b>County 4</b>	3	So, the short answer to that is the crews typically are posting versus at a specific station, so the private ambulance providers. And caffeine would at least theoretically be available by stopping in at a 7-Eleven or whatever the case may be. But I don't believe there's any specific regularly available caffeine, like at a station.
<b>County 5</b>	3	I don't know if the provider provides coffee or caffeine to them. I have no idea if that's provided, but I know that it's available to them.

The responses by EMS administrators would indicate that their understanding of the availability of caffeine to the respective contracted 911 ambulance employees is present. The theme that emerged, however, was that the promotion of caffeine use as a tool to mitigate acute fatigue may not be used by EMS administrators. Interview responses indicated that the use of caffeine is a common practice and is readily available to most employees working in the 911 system.

#### **Interview Question 4**

“Are privately contracted 911 EMT’s and paramedics allowed to take naps on duty? If so, do they have quarters where beds or recliner chairs are available?” No follow-up questions relevant to FRM guideline implementation or understanding were identified.

Interview Question 4 was utilized to gather responses from EMS administrators to develop an understanding of the promotion of taking naps while on duty. Evidence-based guidelines have established that the use of naps while on duty is an effective strategy to impact fatigue-related outcomes positively. Napping can improve alertness, reduce sleepiness, and improve personnel performance (Patterson et al., 2018). Represented in Table 4 are the responses from emergency service administrators regarding the promotion of napping while on duty.

The responses from the participants indicated that the promotion of napping on duty is inconclusive among respondents. Although EMS administrators acknowledge that some agencies allow the practice of napping on duty, it would appear that no contractual language exists between EMS administrators and the contracted 911 ambulance providers. The theme that emerged from these responses was the lack of a defined policy that permits the practice of napping as a tool to mitigate fatigue in the workforce.

**Table 4**

*Interview Question 4: Are Privately Contracted 911 EMT's and Paramedics Allowed to Take Naps on Duty? If so, do They Have Quarters Where Beds or Recliner Chairs Are Available?*

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<b>Administrator</b>	<b>IQ</b>	<b>IR</b>
<b>County 1</b>	4	We don't have anything in the contract prohibiting that. That would really be a company policy, an internal policy. From an agency perspective, I mean, I have no way to regulate that. I am definitely not opposed to that.
<b>County 2</b>	4	No. I don't think so. I don't think they are encouraged to do so.
<b>County 3</b>	4	Yeah. They are allowed to take naps. There are a number of comfort stations that are provided throughout the county.
<b>County 4</b>	4	I think the contract is silent on that, and that would likely be something in a union MOU, but I'm not aware that either of those things exist.
<b>County 5</b>	4	Yes. All the above. Yeah. Every post location, we call them posts, as you may recall, and stations have beds and/or recliners where they can, and I think they're encouraged to rest and get downtime whenever they can.

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**Interview Question 5**

“Do contracted 911 ambulance EMT's and paramedics receive education and training to mitigate fatigue and fatigue-related risks?” No follow up questions relevant to FRM guideline implementation or understanding were identified.

Interview Question 5 was utilized to understand current practices as they apply to education training to mitigate fatigue and fatigue-related risks among contracted 911 ambulance EMTs and paramedics. The relationship between education and training in fatigue (and sleep health) have significant roles in the outcomes of patient and personnel safety (Patterson et al., 2018). The intent of this question was to examine current practices among EMS administrators who contract for 911 ambulance services and how education and training to mitigate fatigue and fatigue-related risks are incorporated into their respective oversight responsibilities.

**Table 5**

*Interview Question 5: Do Contracted 911 Ambulance EMT's and Paramedics Receive Education and Training to Mitigate Fatigue and Fatigue-Related Risks?*

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<b>Administrator</b>	<b>IQ</b>	<b>IR</b>
<b>County 1</b>	5	You know, that's a good question. We do not talk about that in a contract. We don't address that contractually, and I really can't say whether or not they do. That's a good question, though.
<b>County 2</b>	5	Specifically, I would say no, I think the only person that was interested in this topic was me.
<b>County 3</b>	5	You know what, I don't know. They do not receive it from us as an EMS agency. I don't know if it's part of their ongoing education that they receive.
<b>County 4</b>	5	None from the county and honestly, I do not know if the providers do that kind of awareness training
<b>County 5</b>	5	So, I know that ***** has it in their response to RFP, they illustrated and told us about a very strict fatigue program, and it's an education system, and I think a lot of it is through their insurance carrier, their wellness center, their wellness carrier. So, our main provider in ***** county does.

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The responses from the participants indicate that little if any language exists in the contractual language with the contracted 911 ambulance service. Additionally, participants demonstrated that the knowledge of existing FRM education and training of the contracted 911 workforce is limited. The theme that emerged was that from an EMS administrators' standpoint, limited language exists within policies, procedures, or contractual language that provides a mechanism for monitoring FRM education and training. Represented in Table 6 are the three tiers that were created to describe the strength of contractual language as it applies to FRM.

**Table 6**

*Strength of Contractual Language*

1 Maximum consecutive hours worked allowed < 24-hrs	2 Mandatory rest periods between shifts	3 FRM policy, education, & training
A  Hours clearly outlined by emergency medical agency authority	Hours clearly outlined in contract by emergency medical agency authority	Clearly outlined in contract by emergency medical agency authority
B  Hours vaguely outlined by emergency medical agency authority	Hours vaguely outlined by emergency medical agency authority	Vaguely outlined by emergency medical agency authority
C  No maximum hours outlined by emergency medical agency authority	Not outlined in contract by emergency medical agency authority	Not outlined in contract by emergency medical agency authority

Each of the 18 agencies examined was placed into tiers (A, B, and C) graded on the strength of their contractual language based on Table 6, with “A” being the strongest nature. Represented in Table 7 is the breakdown of all 18 contracts as it applies to the strength of contractual language examined in this research.

**Alameda County**

The contractual language regarding working conditions for Alameda County EMS EMTs and paramedics begins to address some of the components of FRM. EMS administrators require “comfort stations” that are located at strategic posts accessible to on-duty field-based personnel 24 hours a day, 7 days a week (Alameda County, 2019). The contract requires that these comfort stations be climate controlled with adequate and comfortable seating, restrooms, sink, microwave, desk, and chairs, with the ability to

**Table 7***Strength of Contractual Language Grades*

EMS agency	Maximum consecutive hours worked allowed < 24-hrs	Mandatory rest periods between shifts	FRM policy, education, & training
Agency 1 (Alameda)	1A	2A	3C
Agency 2 (Butte County)	1A	2B	3B
Agency 3 (Contra Costa)	1B	2B	3C
Agency 4 (Fresno)	1C	2C	3C
Agency 5 (Inland Counties)	1C	2C	3C
Agency 6 (Lassen County)	1C	2C	3C
Agency 7 (L.A. County)	1C	2C	3C
Agency 8 (Merced)	1A	2A	3C
Agency 9 (Monterey)	1A	2A	3A
Agency 10 (Orange County)	1C	2C	3C
Agency 11 (Riverside)	1B	2B	3C
Agency 12 (San Benito)	1C	2C	3C
Agency 13 (San Diego)	1A	2C	3C
Agency 14 (San Joaquin)	1A	2A	3B
Agency 15 (SLO)	1C	2A	3C
Agency 16 (Santa Cruz)	1A	2A	3C
Agency 17 (Solano)	1A	2A	3C
Agency 18 (Yolo)	1A	2A	3B

have data capability to chart and accommodations to meet the needs of nursing mothers.

The requirement of comfort stations is an essential step toward managing acute fatigue.

The implementation of these comfort stations provides accommodations for periodic napping that aligns with evidence-based guidelines for FRM.

Alameda County’s contract outlines requirements of the contractor to employ reasonable work schedules and conditions that limit the provider’s exposure to fatigue—specifically, implementing work schedules and conditions that may place providers at risk for fatigue, or patients, partners, and others in the community in which they serve.

The contractual language specifically notes that patient care must not be compromised by

impaired personnel working extended shifts, voluntary overtime, or mandatory overtime without adequate rest. The contract further stipulates that no EMT, paramedic, EMS supervisor, operations supervisor, or dispatch status supervisor should be scheduled to work shifts longer than 12 hours, and the absolute length of any mandated “holdover” work assignment should not exceed 14 hours except during a locally declared state of emergency in Alameda County. Additionally, employees in those roles must “complete the shift on time without holdover at least 90% of the time,” as measured annually (Alameda County, 2019, p. 61).

Contractual language further dictates that the employees mentioned above have a minimum of at least 8 hours off between assignments to include holdover overtime. In terms of the strength of contractual language, Alameda County resides in the top tier as it applies to maximum consecutive hours worked and mandatory rest periods according to evidence-based guidelines on FRM. The contract dictates that no employee should work past 14 hours and establishes a minimum of 8 hours off between shifts. Under the currently established contract, there is no contractual language that requires the contracted 911 ambulance provider to provide any FRM education or training. Despite lacking the educational component, Alameda County has an aggressive and proactive approach to mitigating fatigue among contracted 911 ambulance employees.

### **Butte County**

The contractual language between the Butte County (2012) and the privately contracted 911 ambulance provider requires “crewmembers working on ambulances in Butte County not be scheduled to work shifts longer than 24 consecutive hours” (p. 7). Additionally, crewmembers “shall not remain on duty for longer than 36 consecutive



hours due to late calls or unscheduled holdovers” (p. 7). Further contractual language stipulates mandatory rest periods of at least 12 consecutive hours between shifts as well as the contractor establishing policies and procedures used to monitor fatigue among EMTs and paramedics.

The contractual language Butte County has established aligns with several FRM guidelines. However, the burden of implementation is placed on the contractor, and benchmarks are not explicitly outlined within the contract. The agreement suggests that the contractor can demonstrate a higher level of commitment in FRM in several ways. Examples may include, but are not limited to, the delineation of monitoring mechanisms, procedures, and policies designed to ensure that employees are not overworked or expected to work for extended periods that may cause fatigue and impair employees’ ability to perform suitably (Butte County, 2012). Consequently, Butte County is in the first tier in one category and the second tier in the remaining two categories as applies to contractual language in FRM.

### **Contra Costa County and Riverside County**

Contra Costa County and Riverside County require the privately contracted 911 ambulance provider to develop a policy that stipulates the maximum amount of time an employee can continuously be on duty. Additionally, the policy must detail rest/sleep requirements that must be followed for all employees who are continuously on-duty for more than 12 hours (Contra Costa County, 2016; Riverside County, 2015). However, the counties do not give any contractual guidance on what would be an acceptable shift length, rest period, or sleep monitoring policy. No contractual language exists as it applies to mandatory fatigue education and training. Despite an attempt to force policy

development, no contractual language that outlines a framework for acceptable policies in regard to FRM is visible in the contracts. When contractual language does not establish benchmarks for the management of the fatigue in the privately contracted 911 ambulance provider, it may provide system features that lead to a catastrophic failure. Consequently, the two counties fall into the third tier in one of the three categories and in the second tier in the remaining categories as it applies to contractual language in FRM.

### **Fresno County**

The contractual language between Fresno County and the privately contracted 911 ambulance provider share similarities with several other EMS agencies across the state. As with other contracts, contractual language dictates that the contractor must utilize reasonable work schedules and shift assignments to provide practical working conditions for ambulance personnel. Fresno County stipulates that it is the contractor's responsibility to utilize sound management principles, which ensures that the field personnel working shifts, voluntary overtime, or mandated overtime are not exhausted to the extent that their judgment or motor skills may be impaired because of fatigue (Fresno County, 2016). No contractual language exists that establishes maximum consecutive hours of allowed work, mandatory rest periods between shifts, or mandatory fatigue training and education for EMTs and paramedics. As a result, Fresno County falls into the third tier in all categories as applies to contractual language in FRM.

### **Inland and Orange Counties**

Through a thorough examination of Inland Counties (2016) and Orange County (2016) contracts with the private 911 ambulance provider, no language as it applies to maximum consecutive hours allowed to work, mandatory rest periods between shifts, or

fatigue education and training was noted. As a result, Orange and Inland Counties fall into the third tier in all categories as applies to contractual language in FRM.

### **Lassen County**

Lassen County's (2016) contract between the private 911 ambulance provider and the county stipulates that the contractor must utilize reasonable work schedules and shift assignments to provide working conditions for personnel, which prevents fatigue from voluntary or mandatory overtime, extended shifts, or part-time jobs that might impair their judgment or motor skills (Lassen County, 2016). The contract further requires that the provider demonstrate that EMS personnel are provided sufficient rest periods to ensure that emergency service personnel remain well rested and alert during their shifts. Despite these requirements, there is no specific language within the contract outlining the maximum hours worked, mandatory rest periods, or any required education and training on FRM. Although Lassen County demonstrates and acknowledges through the language in the contract that mitigation of fatigue is a priority concern, the lack of specific benchmarks on consecutive hours worked, mandatory rest periods, and fatigue education prevent Lassen County from fully aligning with the evidence-based guidelines in FRM. As a result, Lassen County falls into the third tier in all categories as applies to contractual language in FRM.

### **Los Angeles County**

In Los Angeles County (2016), 911 ambulance transportation services are provided by two privately owned ambulance companies. The two contractors cover large response areas throughout Los Angeles County. Existing contractual language stipulates that the contractor include how each private ambulance will measure workload, fatigue,

and fatigue mitigating techniques for emergency response personnel (Los Angeles County, 2016). However, no contractual language within the agreement outlines or highlights best practices as applies to FRM. As a result, Los Angeles County falls into the third tier in all categories as applies to contractual language in FRM.

### **Merced County**

The contract between Merced County (2014) and the privately contacted 911 ambulance is unique in its contractual language compared to other agreements in this study. Merced County established that the contractor is responsible for conducting employment matters with employees, managing personnel and resources equitably. Ultimately, the contract must be executed by the contractor in compliance with the agreement. The contract further stipulates that Merced County will not otherwise be involved in the contractor's management or employee relationships (Merced County, 2014). Yet, contractual language gives examples of ways in which the contractor may demonstrate a higher level of commitment in the area of fatigue. Examples provided include monitoring mechanisms and procedures within policies designed to ensure that employees are not fatigued or impaired so much that the employee's ability to perform safely and appropriately are affected.

Furthermore, the contractual language establishes that employees working on ambulances should not be scheduled to work shifts longer than 24 hours in length. However, if the employee is required to remain on duty, his or her shift may not exceed 36 consecutive hours because of too late calls or unscheduled holdovers (Merced County, 2014). Lastly, the contractual language requires a rest period of at least 12 consecutive hours between shifts with the only exception being a declared disaster by Merced County.

As a result, Merced County is in the top tier in two of three categories as it applies to contractual language in FRM.

### **Monterey County**

In 2018, the County of Monterey (2019) began the process of constructing a new “request for proposal” (RFP), which outlines the contract requirements for private 911 ambulance providers who wish to provide service in Monterey County. The County of Monterey RFP is a publicly available document that solicits a proposal made through a bidding process by ambulance providers who wish to provide sole 911 services to Monterey County. The introduction of the County of Monterey RFP marks a shift in practice and policy implementation from the emergency management perspective. The contractual language within the County of Monterey RFP as it applies to work schedules of FRM is one of the first to specifically identify FRM and most closely align with evidence-based guidelines among all publicly available contracts throughout the state. The contracts require EMTs, paramedics, EMS supervisors, and emergency medical dispatchers “not be scheduled to work shifts longer than 12 hours” in duration, “and the absolute length of any mandated or ‘holdover’ work assignment shall not exceed 14 hours” from the initiation of the shift (County of Monterey, 2019, p. 46). The only exception to these requirements is an outlying rural station in Big Sur, California. The Big Sur ambulance station is in a remote part of the coastline south of the city of Monterey. Generally, because requests for service are low, it has been determined by the County of Monterey (2019) that shifts can be extended up to 24 hours in length and no more than 26 hours in the case of mandated or holdover work assignments.

The contract is strengthened by including contractual language that requires a mandatory rest period between shifts. The contract states that EMTs, paramedics, EMS supervisors, and emergency medical dispatchers “shall have a minimum of at least 10 hours off between assignments to include holdover overtime” (County of Monterey, 2019, p. 47). The only exception is during a locally proclaimed state of emergency in Monterey County. The county reinforces the adherence to maximum hours worked by requiring monthly reports that identify the number of consecutive hours worked for each employee. The implementation of limiting shifts to less than 24 hours in mandatory rest periods between shifts directly aligns with current evidence-based guidelines in FRM.

The County of Monterey (2019) has added contractual language that requires the contractor to develop and maintain a comprehensive FRM program. According to the county’s existing RFP, it is the only emergency service agency whose contract accurately identifies and requires a comprehensive FRM. The contractual language requires the FRM program to be reviewed by the EMS director and encourages the contractor to review the document “Evidence-Based Guidelines for Fatigue Risk Management in Emergency Medical Services” by Patterson et al. (2018).

The progress of FRM contractual language demonstrates an aggressive approach toward aligning with evidence-based guidelines. Unfortunately, the demands placed on the contractor to meet the strict requirements of the RFP have caused significant delays in awarding exclusive operating rights to a new 911 provider in the County of Monterey. During a mandatory bidding meeting in January 2018, seven ambulance companies expressed interest in the county (Marino, 2019). However, once the details of the RFP were released in April of 2018, only one agency placed a bid. The sole bid in the RFP

process came from American Medical Response, which currently provides 911 ambulance services to Monterey County. Despite American Medical Response's bid, the county rejected all bids, claiming that "its needs can be satisfied by a less expensive method" (Johnson, 2019, para. 3). Although the detailed cost calculated in American Medical Response's bid is not publicly available, it is conceivable that new requirements in the contract, such as the limiting of consecutive hours worked, could increase operational costs. Eliminating 24-hour shifts and converting them to shifts not to exceed 12 hours may require additional staffing, which can increase labor costs.

Monterey County's decision to reject the bid of American Medical Response was followed by an announcement from the County of Monterey's (2019) EMS administrator. County EMS agency director Michael Petrie stated the goal was to make revisions to the RFP and issue it "as soon as reasonably possible" while meeting "due diligence" requirements (Johnson, 2019, para. 6). Petrie continued by stating the process will be under a "very aggressive timeline" that would be disclosed later (Johnson, 2019, para. 6). The current issues in Monterey County and the RFP process for exclusive operating rights of the 911 ambulance provider in the county are of particular concern in this research. The 250-page RFP has several unique changes from its predecessor that do not relate to FRM and may have affected the RFP bidding process. The most significant concern as applies to this research is how emergency service administrators have now aligned with evidence-based guidelines in FRM and its effects on the competitive bidding process at the local and state levels.

## **San Benito County**

San Benito County (2014) addresses fatigue within the contract by requiring contractors to utilize reasonable work schedules and shift assignments that provide reasonable working conditions for ambulance personnel. However, there are no details or guidance on the definition of reasonable “work schedules” or “shift assignments.” The contract requires the contractor to ensure that all personnel working extended shifts, part-time jobs, and voluntary or mandatory overtime are not fatigued to the extent that would impair their judgment or motor skills. It is further stated that the contractor must demonstrate that personnel is provided sufficient rest periods and that employees remain alert and well rested during these work periods.

Despite the demands of the contract, the vague language on what is considered reasonable work schedules and shift assignments places this contract in the third tier in all categories. There is no stipulated maximum of consecutive hours worked or mandatory rest periods in the contractual language. Additionally, there is no contractual language requiring FRM education and training. As a result, San Benito County falls into the third tier in all categories in terms of the strength of contractual language.

## **San Diego County**

Several attempts were made to access agreements between the county and city of San Diego and the contracted private 911 ambulance provider. Though only one contract could be found outlining working conditions for EMTs and paramedics in Julian, a census-designated place in San Diego County. The contract requires that the privately contracted 911 ambulance provider must not schedule any EMT or paramedic to work continuously for more than 48 hours within any 60-hour period (San Diego County,



2013). No further language was found as it applies to mandatory rest periods or mandatory fatigue education and training. As a result, San Diego County falls into the third tier in two of three categories as applies to contractual language in FRM.

### **San Joaquin County**

San Joaquin County's contract requires the use of reasonable work schedules and shift assignments. The contract further dictates that ambulance personnel working extended shifts, part-time jobs, and voluntary or mandatory overtime are not fatigued to the extent that it might impair the provider's judgment or motor skills (San Joaquin, 2016). San Joaquin County (2016) limits employees to shifts no more than 24 hours in length. If the situation dictates, the contractor may extend that 24-hour shift by 4 hours in cases where a relief employee fails to show or is late. The contract prohibits field personnel working more than 24 consecutive hours without a minimum of a 12-hour break. The contract requires the establishment of a fatigue prevention program, which includes a process to monitor fatigue. Additionally, the contract provides a mechanism for field units to be taken out of service immediately when supervisors are notified by the employee or it has been determined that a field employee is no longer able to perform because of fatigue. There is no contractual language that requires privately contracted 911 ambulance providers to establish FRM training and education.

The strength of contractual language in San Joaquin County falls into the top tier of two of the three categories. The implementation of shifts limited to 24 consecutive hours along with mandatory rest periods of 12 hours between shifts, places them in the top tier in two categories. The third category, which is the requirement of FRM training and education, is in the last tier because there is no contractual verbiage. Yet, the

requirement to establish a fatigue prevention program may include training and education that is not evident in the current contractual language.

### **San Luis Obispo County**

The agreement between San Luis Obispo County (2018) and the privately contracted 911 ambulance provider requires that the contractor must take responsibility “for determining the methods and techniques for achieving” contract compliance (p. 6). However, the contractor “shall utilize reasonable work schedules and work periods” for the contracted employees, so “they are fresh enough to be able to perform safely and provide adequate patient care” (San Luis Obispo County, 2018, p. 6).

The contract outlines the maximum consecutive hours of allowed work explicitly at 72 with no less than 24 hours of consecutive off-duty time immediately following each work period. No contractual language exists for mandatory fatigue training and education for the contracted employees. Although the contract indicates a minimum of 24 hours of continuous off-duty rest, allowing employees to work up to 72 consecutive hours with no monitoring techniques in place is dangerous. It is conceivable that on a busy ambulance shift, EMTs and paramedics may have only a few hours of sleep over the 72 hours. Nevertheless, based on the grading scheme, San Luis Obispo County is in the top tier in one of three categories as applies to contractual language in FRM.

### **Santa Cruz County**

The contractual language between Santa Cruz County and the privately contacted 911 provider establishes that no shifts greater than 48 hours are permitted unless under a written policy approved by the county. Additionally, when employees are required to hold over, that time must not exceed 2.5 hours. The contract further stipulates that the

privately contracted 911 ambulance provider must have a policy and monitoring system in place to prohibit staff working more than 48 hours over the last 60-hour period (Santa Cruz County, 2018). No contractual language explicitly outlines minimum rest periods between shifts or any mandated fatigue education and training. Consequently, Santa Cruz County is in the top tier in two of three categories as applies to contractual language in FRM.

### **Solano County**

The contractual language in Solano County (2020) requires the contractor to take the appropriate steps to ensure that all EMS field employees “are well rested and not unduly fatigued when on duty” (p. 69). Solano County requires the contractor to provide all EMS providers with “a minimum of 8 hours off duty between scheduled shifts, and shall not schedule employees for work” (p. 69) who have been on duty with their agency or any outside employer if they have not had at least 8 hours off between the start of their scheduled shifts. Furthermore, the contract stipulates that the contractor must not schedule employees for shifts above 16 hours unless it is demonstrated to the satisfaction of the EMS agency administrator that EMS field personnel are posted in an area in which sufficient opportunity for rest periods between calls is present (Solano County, 2020).

The strength of contractual language in Solano County (2020) falls into the top tier in two of the three categories. Although the contract does not explicitly stipulate that shifts must be less than 24 hours, it does provide guidance in situations where shifts will extend past 16 hours so that those employees are placed in strategic areas that allow a significant opportunity for rest between calls. Further strengthening the contractual language and unique to this contract is the specific language to require 8 hours off

between shifts to include those working other jobs. The Solano County contract does not have any requirements of the contracted 911 provider to furnish any education or training in FRM.

### **Yolo County**

Yolo County (2013) EMS agency's contract with the 911 ambulance provider requires that patient care must not be hampered or impaired because of personnel's working part-time jobs, voluntary overtime, extended shifts, or mandatory overtime without adequate rest. The contractual language in Yolo County's agreement with the private 911 contractor stipulates that emergency personnel should work reasonable schedules to ensure that fatigue and fatigue-related issues are reduced. However, it is not thoroughly detailed as to what the county considers "reasonable schedules." The Yolo County EMS agency's contract requires the potential contractor to describe its policies and procedures to monitor employee fatigue and impairment.

The Yolo County (2013) EMS agency contract with the private 911 ambulance provider prohibits employees working on ambulances in the county to work shifts longer than 12 consecutive hours, and they "shall not remain on duty longer than 18 consecutive hours due to late calls or unscheduled holdovers" (p. 34). In terms of the strength of contractual language, limitation on consecutive work hours falls under Tier 1. By limiting consecutive hours worked to less than 24, the Yolo County EMS agency is aligning with the most current evidence-based guidelines in FRM. As noted by Patterson et al. (2018), personnel working shifts less than 24 hours in duration have reduced the likelihood of poor outcomes related to safety, performance, acute fatigue, or sleep disturbances. The Yolo County EMS agency has further strengthened its contractual

language as applies to FRM by instituting a mandatory rest period of at least 8 consecutive hours between shifts.

The contract between the private provider and Yolo County (2013) does not require any specific training and education on FRM. However, the contract does provide an example in which the contracted agency can demonstrate a higher level of commitment when implementing reasonable work schedules such as implementing monitoring mechanisms, procedures, and policies designed to ensure that employees are not overworked or expected to work extended periods that may subject EMS providers to undue fatigue and impairment, which can affect employees' ability to perform safely and appropriately (Yolo, 2013). The Yolo County EMS agency has established a contract in which limiting consecutive hours and enacting a mandatory rest period has placed itself in the first tier in two separate categories. The third category, FRM education, is not outlined in the contract. Nevertheless, the broader description provided by the EMS agency, which promotes the use of monitoring mechanisms, procedures, and policies may encompass education and training, which is not evident in the current contractual language.

### **Summary**

The analysis of each of the contracts in the study provided a unique insight into the current management strategy of contracted 911 ambulance services in various counties within California. The majority of the contracts attempt to outline the need for reasonable work schedules and to ensure that EMS field employees are well rested and not unduly fatigued when on duty. Yet, almost all fail to define what those parameters

are or how they will be monitored by the county or the private contractor. Only one of the 18 contracts begins to define reasonable work schedules and FRM principles.

This chapter detailed the findings of the current study, which was intended to contribute to the body of knowledge related to the perception of FRM guidelines among EMS administrators in California who contract for 911 ambulance services. Chapter 5 discusses the results, expands on complex systems theory, and details its implications in prehospital emergency services workplace polices. Recommendations are provided that will aid EMS administrators in maintaining accountability, oversight, and implementation of FRM guidelines in privately contracted 911 ambulance services. The chapter concludes with a discussion of the limitations of the study and areas of further research.

## CHAPTER 5: DISCUSSION

Across the transportation profession, fatigue has a significant impact on the safety of employees and customers when it is not regulated or monitored. The National Transportation Safety Board (NTSB, 2020) has identified fatigue and its role in rail, aviation, highway, and marine accidents as one of the top 10 most-wanted safety improvements. Each transportation industry within the United States has established “hours of service limits” regulations. Rail, trucking, aviation, and marine travel all monitor, record, and regulate continuous hours of work by employees. However, emergency medical services (EMS) has no such regulations established at the federal, state, or local level. Severe threats to the safety of employees, citizens, and public administration accountability have emerged. Despite well-established research, identifying fatigue’s role in the impairment of the central nervous system (CNS), including appetite, memory, and attentiveness, leaders have given little consideration to EMS provider’s job requirements, which require increased situational awareness and cognitive function. The role of the EMS administrator incorporates management and enforcement of rules and regulations and imposing the contractual benchmarks outlined in the agreement between the EMS agency and the private 911 ambulance service. Yet, much of the monitoring mechanisms of fatigue in the contracted 911 EMT and paramedic are unregulated by EMS administrators.

### **EMS Administrator Fatigue Risk Management Awareness Assessment**

Fatigue risk management (FRM) in the setting of EMS is in its infancy. Although many EMS administrators, EMTs, and paramedics acknowledge the prevalence of fatigue, no tangible FRM policies are evident from the study. The reviewed literature,

corresponding with participants' perceptions of FRM guidelines and their implementation, reinforced the issue that a comprehensive FRM program has yet to be adopted by EMS administrators in the State of California. EMS administrators' perceptions of FRM, along with current implementation strategies, establish a blatant gap between evidence-based guidelines in FRM and the actual implementation at the state and local level in California.

The responses from the participants indicate that little, if any, FRM language is a priority within the contractual language among privately contracted 911 ambulance services. Additionally, participant responses suggested that knowledge of existing FRM education and training of the contracted 911 workforce is limited. The qualitative data analyzed suggest the disconnection between EMS administrators' perceptions of how fatigue is managed among contractors, the contractual language established between the public agency and the contractor, and how each aligns with evidence-based guidelines for FRM. The ability of EMS administrators to maintain performance, output, and reliability of contracted services defines the accountability issues facing local and state administrators who contract for 911 ambulance services.

### **Measuring and Monitoring Fatigue**

The use of fatigue and sleeplessness instruments to measure and monitor fatigue in EMS personnel is minimal, as is any contractual language between the private contractor and local emergency management agency, in the role of FRM among EMS workers. The first evidence-based guideline for FRM is the use of fatigue/sleepiness survey instruments to measure and monitor fatigue in EMS personnel. The study adapted the first guideline and gathered data on what, if any, mechanisms or tools were being



used by EMS administrators to monitor fatigue among the contracted 911 EMTs and paramedics. The review of current research suggests fatigue and lack of sleep are precursors to reduced attention and impairment of the CNS and have adverse effects on cognition, reaction time, and health (Patterson et al., 2012).

The study found that although administrators acknowledge the persistent presence of fatigue, the onus of managing that fatigue is placed on the contracted agency. The delegated management of fatigue monitoring to contract agencies lacks specific guidance on limitations of work hours, rest requirements, and accurate reporting to EMS administrators. Of the five administrators interviewed, EMS administrators' perception of FRM is that responsibility lies with the contracting agency. Brodtkin (2008) explained that local government agencies cannot often both devise and monitor service delivery contracts. The authority, responsibility, and obligation to ensure that contracted agencies are adhering to established evidence-based guidelines for FRM falls upon the EMS administrator (Ingstrup & Crookall, 2014). The need of EMS administrators to find more efficient ways to deliver public services through private contractors must be intertwined with developing and implementing improved measures of performance that take into consideration fatigue among contracted emergency services personnel (Rivlin & Shalala, 2015).

Fatigue can have a detrimental impact on how well EMS professionals can perform their job. Each of the participants has contracted with privately managed 911 ambulance services employing EMS professionals who work a variety of shifts to provide service to their communities. Knowing that EMS shift work includes rotating shift schedules, disrupted sleep patterns, and can impair CNS function should drive

administrators to monitor fatigue among the contracted workforce. Implications of the failure to monitor the fatigue in the contractor can best be represented in the medical error rates among fatigued health professionals. Dula et al. (2001) noted that medical errors are 3 times more likely among nurses working more than 12.5-hour shifts compared to those working shorter shifts. It is evident that medical errors are a safety issue to the patient and the EMS provider, and very few studies have analyzed how much the errors cost the U.S. healthcare system (Van Den Bos et al., 2011). Consequently, the cost attributed to accidents, both economically and as a function of the system, is a useful tool in public health policymaking (Leger, 1994). The analysis of the costs through policymaking is an essential mechanism in the education of the public administrators, and all government actors as it applies to the economic costs associated with fatigue in prehospital emergency services care. System failures generated from fatigue can cause inconsistent patient care, failed protocol execution, and increased liability and legal claims (Hodge et al., 2014). Limited research exists on the impact of prehospital 911 medical errors and the associated socioeconomic costs. The fiscal impact on EMS administrators because of medical errors in the setting of prehospital 911 care requires further study.

### **Limiting Consecutive Hours of Work for EMTs and Paramedics**

Qualitative interviews yielded varied responses as they apply to the maximum consecutive hours allowed to work within the participant's jurisdiction of authority. Two of the five administrators interviewed do not monitor consecutive hours of work among privately contracted 911 ambulance employees. The remainder of the administrators have limitations on shift length, but they vary in use while adding an element of how

much rest between shifts is required. Out of the five participants interviewed, one agency limited consecutive hours worked to 72 hours with no mechanisms (physical or procedural) to monitor how much sleep had been obtained within that period.

Consequently, it is plausible that an ambulance crew could be awake for 72 hours with no sleep. Yet, as previous research has suggested, automobile accidents caused by drowsy drivers outnumbered those caused by drunk drivers (Rolston et al., 2007). The threat of accountability shortfalls among EMS administrators, as well as the risk to the safety of contracted employees and their patients, is represented in the lack of regulatory mechanisms in the participants' responses.

The establishment of evidence-based FRM guidelines has identified that shifts should be limited to less than 24 hours (Patterson et al., 2018). Yet, only one county administrator reported instituting a maximum of 24 hours in shift length. However, the participant expressed concern about the lack of oversight of the length of time between shifts citing,

They have sort of rotating shifts, so you could get off at say 9 o'clock at night, maybe perhaps be held over, and then called back in the morning, so it is feasible that they wouldn't get, say 8 hours between shifts. (County Administrator 2)

The ability of administrators to moderate the adverse effects of fatigue are paramount to maintaining accountability. Limiting consecutive hours worked to less than 24 hours benefits EMTs and paramedics through fatigue reduction, increased alertness, sleep quality, and an overall increase in health and well-being (Patterson et al., 2018). Specific shift patterns are associated with higher risks for errors and accidents. When comparing

8-hour shifts, 10-hour shifts increased error and injury risks by 13%, and 12-hour shifts increased risks of injury and mistakes by 28% (Folkard & Lombardi, 2006).

The comparison among participants as it applies to maximum permissive consecutive hours EMTs and paramedics are allowed to work is concerning. While each geographical area may have unique needs and differences in call volume, the lack of monitoring or control in the shift duration of ambulance personnel beyond 24 hours does not align with current evidence-based guidelines in FRM. Additionally, the admitted lack of mechanisms to monitor fatigue by administrators while at the same time deploying employees to work shifts above 24 hours is problematic. Persistent fatigue is associated with frequent lapses in attention and increased reaction time and may eventually lead to increased error rates during the performance of tasks (De Castro et al., 2010).

The responsibility of administrators extends beyond the goal of maximizing efficiency through the contracting of public services to the private sector. The evidence establishes the threat to employee and patient safety when health care workers are fatigued. Medical errors are the third leading cause of death in the United States, ranking just behind heart disease and cancer (Allen & Pierce, 2016). While more research is needed in the area of medical errors in the setting of prehospital EMS, research from Rogers et al. (2004) suggested that fatigue plays a significant role in medical errors among nurses working more than 12.5 hours. It is reasonable to suggest that fatigued EMTs and paramedics have the same propensity for medical errors. EMS administrators who manage and contract with private 911 ambulance services should evaluate their organization's current practices and contrast those with evidence-based guidelines in FRM. The initial research findings, based on participant responses, expose the lack of

oversight by administrators of fatigue and fatigue mitigation techniques among contracted 911 ambulance employees.

### **Promotion of Permissive Napping**

Of the five FRM guidelines evaluated in this research, the guideline that tends to have the greatest stigma appears to be the use of permissive napping while on duty. Shift patterns vary throughout prehospital emergency services. Often, private ambulance employees spend most of their shift in an ambulance moving from post to post and responding to 911 calls for service. Limitations exist for EMS administrators to monitor the number of hours EMTs and paramedics are working per week. The prevalence of mandatory overtime and holdovers may increase the fatigue of the EMT or paramedic who, under normal circumstances, would be well rested. Consequently, the promotion of strategic napping on duty should be promoted by EMS administrators as a tool to mitigate fatigue in the contracted workforce.

In such a dynamic and demanding profession, the implementation of policies and procedures to guarantee providers are alert and operationally efficient is critical. The use of promoting and mandating napping during the provider's shift has been shown to alleviate fatigue (Patterson et al., 2018). Despite napping being established as an evidence-based guideline to mitigate fatigue, responses by EMS administrators demonstrate limited understanding of its importance. Two out of five participants reported that permissive napping was encouraged. However, one EMS administrator reported that not only was it not promoted, but it was discouraged. Several factors make the practice of EMS personal napping on duty difficult to promote. Public perception of EMS personnel napping on duty is a significant factor. Whether public or private, the

perception of citizens is that EMS are funded through the use of taxes. Consequently, negative public perception along with policies against napping on the job may create barriers for EMS administrators' use of this effective fatigue mitigation technique.

### **Caffeine as a Remedy to Combat Fatigue**

All participants expressed the widespread availability of caffeine products to privately contracted 911 ambulance employees. Participants referred to geographical areas that allowed for the purchase of caffeine products, ambulance stations that have coffeemakers, and the prevalent use of energy drinks. While each participant reported on the availability of caffeine, none of the participants reported the promotion or funding of caffeine products to EMS employees. Understandably, the costs associated with providing caffeine to moderate or large organizations could exceed thousands (Patterson et al., 2018). However, the recommendations of this study would be for EMS administrators to develop accessibility policies for ambulances that move from post to post and ensure that those locations have establishments to provide such products.

### **Fatigue Education and Training**

The examination of the participants' responses in the area of FRM education and training yielded limited knowledge of existing FRM education and training. Yet, research in the field of FRM suggests a positive relationship between education and training in fatigue along with favorable outcomes regarding patient and personnel safety (Patterson et al., 2018). Much like other perceptions among EMS administrators in FRM, there is limited understanding of the benefits and importance of FRM education and training as they apply to accountability responsibilities of EMS administrators. The management of fatigue education training is not at the forefront of EMS administrators'

priorities based on the responses of participants. The one positive correlating response was a self-imposed fatigue and education training program by one privately contracted agency within the participant's jurisdiction. However, not one EMS administrator identified mandates that require privately contracted 911 ambulances to provide fatigue education and training. Policies and regulations should be established at the administrative level to ensure compliance with existing evidence-based guidelines in FRM. Further research is needed to capture self-imposed FRM education within privately contracted 911 ambulance companies. It is plausible that some privately contracted ambulance companies are using FRM; however, it was not captured in the research of EMS administrators.

### **Contractual Language Analysis**

Consistent with previous research, the accountability of EMS administrators has become a challenge. A major confirmation evidenced in the study is the lack of oversight among EMS administrators in FRM among privately contracted 911 ambulance services. As suggested by Yang (2012), the governance environment is ever-changing, uncertain, and complex, and power given to private actors should be monitored. When EMS administrators delegate the power to private actors to provide 911 EMS services, regulatory processes should be in place to monitor the fatigued EMTs and paramedics. When performed negligently, government actors who accept the responsibility to provide, care for, and carry out EMS could lead to potential legal claims (Hodge et al., 2014). However, through the release of power to the private actor, central control of EMS oversight is deemed more efficient. The study established that the ability to balance efficiency with accountability has become problematic in EMS administration. The

research suggests that EMS administrators assume social values, beliefs, and assumptions about the public interest; however, private actors may not share the same values (Koliba et al., 2010).

The responses from participants exposed the need to evaluate the contractual language between counties and privately contracted 911 ambulance providers for further detail on policies and procedures for managing fatigue in the contracted 911 ambulance provider. Each of the five semistructured questions resulted in responses that demonstrated the disconnect between EMS administrators' understanding of FRM within the contracts that they govern. Findings from participants' responses to the semistructured interviews suggested that further research was needed in the contractual language between the two actors. The analysis of participants' responses required an examination of 18 contracts between emergency service agencies and the privately contracted 911 ambulance provider.

### **Consecutive Hours of Work Allowed**

Through a qualitative exploratory approach, the study examined 18 publicly available contracts between public agencies in California and privately contracted 911 ambulance services. Each of the 18 contracts was analyzed for language that contained FRM guidelines identifying the maximum consecutive hours of work allowed to 24-hours or less, mandatory rest periods between shifts, and FRM policies and training. Each contract was graded on the three evidence-based guidelines and how those were integrated into the contract. Each of the 18 agencies examined was placed into tiers (A, B, and C). The grade of "A" identified precise controls or language related to FRM



guidelines, “B” represented vaguely outlined controls or language, and “C” represented no contractual controls or language.

Conclusions drawn on the contractual analysis suggested that the adoption of a comprehensive FRM approach to limiting consecutive hours of work to less than 24 was applied in less than half of the contracts analyzed. Only seven public agencies mandated shifts not to exceed 24 hours in duration. Caldwell (1997) noted that sleeping 8 hours a night can provide adequate nocturnal rest allowing the body to enter the deep sleep that is necessary for the well-being and physical health, allowing the body and mind to rebuild and recover. Yet, several EMS agencies have no contractual language that identified the maximum consecutive hours contracted 911 ambulance employees are allowed to work. This study established that limiting shift lengths to less than 24 hours lessens the probability of perpetual sleep loss. The inability to obtain 7 hours or more of sleep can cause the failure of the brain to recuperate and increased sleeplessness, resulting in prolonged fatigue (Mednick & Ehrman, 2006). As more agencies become aware of evidence-based guidelines for FRM and the effects of prolonged fatigue on the employee, contracts will need to adopt and implement policies that mandate shifts not exceed 24 hours in length.

### **Mandated Time Off the Clock Hours Between Shifts**

In the study population of EMS administrators, along with the diverse private EMS organizations, there was no association of evidence-based guidelines for FRM as it applies to rest periods between shifts in response to semistructured interview questions. The qualitative exploratory research of 18 publicly available contracts between privately contracted 911 ambulance companies and local counties in California identified

disparities between agencies on the amount of mandated time EMTs and paramedics have off work before beginning their next shift.

Although research has suggested that personnel working shifts shorter than 24 hours experience reduced fatigue, improved alertness, better sleep quality, increased health and well-being, and improved safety for patients and personnel (Caruso, 2013); contractual language has not established a minimum number of hours that EMTs and paramedics must have off work before beginning their next shift. As EMS administrators continue to benefit from the efficiency and cost saving from outsourcing 911 ambulance services, the need to increase protections for the contracted workforce, as well as the patients that they treat, becomes increasingly critical to the accountability of governmental agencies.

### **Fatigue Education and Training in Contractual Language**

The qualitative exploratory case study of 18 contracts revealed little to no language that required fatigue education or training to the contracted workforce. These findings are supported by semistructured interview responses from EMS administrators. Research has established a favorable relationship between education and training in fatigue, sleep health, and the relationship to positive outcomes of patient and personnel safety (Barger et al., 2016). Yet, analysis of participants' interviews and language in the contracts highlights the disconnect between known FRM guidelines and the management and implementation of those guidelines at the state and local levels. The study suggests the need for EMS administrators to mandate FRM education and training within the contractual language to ensure that EMTs and paramedics have been made aware of the negative consequences of fatigue. The lack of identifiable mandates within contracts that

encourage private contractors to adopt best practices in FRM is a threat to the accountability of EMS administrators who manage privately contracted 911 ambulance services.

### **Implications for Theory and Practice**

Chapter 2 included descriptions of complex systems and, specifically, how EMS is a complex system. Complex systems theory helps in understanding FRM guidelines and the difficulties of managing fatigue in the sophisticated setting of prehospital emergency services. The danger to the local emergency system from the lack of feedback mechanisms in complex emergency medical systems is discussed in the following sections. The theoretical framework for this dissertation derives from complex systems theory, which focuses on problems of relationships, structure, and interdependence rather than the constant attributes of objects (Shafritz et al., 2004). The role of the local emergency medical system comprises several parts including local, state, national, and private actors. Each of these actors operates in independent ways while working in an open environment limited only by specific organizational policies, rules, and procedures. The results of this study identified the relationship of EMS administrators and their role, or lack thereof, of the implementation, monitoring, and role in policy implementation of established evidence-based guidelines in FRM among privately contracted 911 ambulances.

The results of the study suggest that the interrelated and independent parts of the complex system of EMS and the role FRM has in the system have gone unnoticed. Von Bertalanffy (1972) noted that systems theory is centered on clarifying the whole, its elements, and the relationship between them. FRM is an important element within the

complex system of EMS. The common inclinations of an open system are the natural tendencies toward disorder (Katz & Kahn, 1978). If one looks at EMS as a large-scale operation, it can look simplistic. However, when the diversity and uniquely diverse environment from which EMS operates is considered, the process appears more complicated (Smith & Feied, 2002). Knowing that EMS is a complex system, leaders need to put checks in place to monitor the suitability of the output. As fatigue persists through EMS, the need to manage fatigue through evidence-based guidelines in FRM is critical in the prevention of the degradation of the complex system.

Complex systems such as transportation, healthcare, fire services, and law enforcement are all intrinsically hazardous systems. Policy creation and institutional processes attempt to limit exposure to hazards, yet policies and procedures themselves can become hazards. For instance, policies that mandate employees to remain on duty for staffing shortages as a process are a defense mechanism as well as a hazard. The policy itself creates a hazard if fatigued EMS employees are forced to remain on duty. As Berard (2019) noted, ambulance organizations do not have sufficient staff to cover vacancies as a result of sick calls, injuries, or vacation. The results of this study exposed the persistent hazards of unmonitored fatigue of contracted 911 ambulance employees throughout California. None of the 18 counties surveyed had monitoring mechanisms in place by EMS administrators to monitor the fatigue of the contracted 911 workforce that align with current evidence-based guidelines. With EMS as a known complex system, EMS administrators need to understand that the latent failures within the system can be difficult to see before the fact. It is understood that the eradication of all the failures within the system is economically unfeasible. However, the inability of EMS

administrators to monitor and create a policy to mitigate fatigue may create a pass-through for latent failures to morph into a catastrophic failure.

EMS organizations are riddled with policies and standard operating procedures as a result of previous failures within the system. Nevertheless, as small innocuous failures persist in the system, they provide a platform for failures that can lead to systemic failure. As Reason (2016) noted, usually deficits in one layer of the system do not cause an organizational accident. However, multiple deficits in multiple layers of the system can align and cause organization accidents. The establishment of evidence-based guidelines in FRM is a proactive approach in mitigating potential failures in the system. In complex systems theory, policies and procedures are often a result of previous failures within the system. Several transportation industries have established FRM policies as a result of failures within their unique industry. However, the study found that California EMS administrators who manage and contract with private industry involved in the transportation of the sick and injured have yet to adopt any evidence-based guidelines in FRM.

In the setting of EMS, human factors play a significant role in the potential for catastrophic outcomes. It is the culmination of these human factors that together create the circumstances required for a catastrophic event. EMS is a complex system that continues to operate because of the several redundancies in conjunction with employees who make it function despite the flawed system in which they work. EMS operates with organizational, technical, and human components that fail and are being replaced continually. Consequently, adding fatigue in an environment saturated with preexisting

hazards may create an atmosphere in which the linking of several vulnerabilities can create a catastrophic event.

### **Limitations of the Study**

One of the limitations of this study is that results may not generalize the perceptions and policies of all EMS administrators or the individual agencies with whom they contract. California's unique prehospital EMS system made generalizability difficult when promoting the universal adoption of all five evidence-based guidelines in FRM. Limitations to the adoption of evidence-based guidelines in FRM include the generalizability across California's distinctive EMS system. California's EMS is diverse not only in its delivery system model but also in the geographical differences in the various local emergency management agencies (LEMSA). An additional limitation on the generalizability of FRM to all of the 33 EMS agencies is that of geography. Although California has some of the densest cities and counties in the nation, it also has very remote and rural areas where the demand for service is drastically lower. Rural areas may have difficulty recruiting because of longer hours, fewer calls, and longer transport times to hospitals. Each jurisdiction would need to evaluate call volume and decide whether all of the five FRM guidelines are appropriate for its respective response area. Some agencies may have employees who commute to these remote areas of service, the call volume may be extremely low, and as such, shift patterns greater than 24 hours may be required for staffing and workforce retention.

Although this study was primarily concerned with privately contracted 911 ambulance services, fatigue is not exclusive to private contractors. The need to address fatigue and FRM in the prehospital setting is evident. Yet, implementation across public

sector EMS is complicated. FRM application in California is not an “all or nothing” proposition. It is, however, a road map to understanding effective mitigation techniques of fatigue in the prehospital EMT and paramedic.

Across each of the 33 EMS agencies in California, fire departments respond to medical emergencies alongside the contractor and/or provide fire department staffed ambulances for the transportation of the sick and injured. However, this study did not examine FRM in public sector EMS agencies. The implementation of FRM guidelines in the public sector comes with challenges. Typically, fire departments that are a part of city, county, or state agencies have work schedules and shift patterns negotiated through collective bargaining agreements. Consequently, limitations such as restrictions on consecutive hours of work allowed and mandatory rest periods would need to be collectively bargained with public sector unions. Furthermore, fire departments have multiple responsibilities outside of EMS; restricting consecutive hours of work and mandatory rest periods could create barriers to efficient and effective fire services.

Limitations of the study may involve the plausibility that other privately contracted 911 ambulances have self-imposed policies, regulations, and training that are not known to EMS administrators. The sample size may not have captured a large enough participant pool to broadly apply assumptions of EMS administrators’ current perceptions of FRM. Sample size limitations may also persist in the analysis of publicly available contracts for service between LEMSA and the privately contracted 911 ambulance providers as some local or multicounty contracts were not readily available on EMS agencies’ websites.

Another limitation of the study concerns the willingness of EMS administrators to participate in the research. The study supports that fatigue in the setting of EMS is a growing concern among EMS providers, public administrators, and as an emerging research topic. Consequently, EMS administrators who are in the process of constructing new contracts for service or policy changes involving fatigue may not be at liberty to comment. Furthermore, several agreements for private 911 ambulance services contracts have terms exceeding 5 years. Finally, self-reporting presents a limitation to the study as some participants may have answered semistructured interview questions in a manner that they felt would have been expected of them by the researchers or by the public at large.

### **Recommendations**

The practice of California's LEMSA to outsource prehospital EMS to privately owned and operated companies is a policy process targeting greater efficiency while adding increased complexity and accountability issues to all involved. The study's findings, based on the participants' responses, indicate little if any FRM language exists in the agreements with the contracted 911 ambulance service. Additionally, the analysis of the contracts fails to define FRM mechanisms or how fatigue will be monitored by the county or the private contractor. Therefore, based on the results of this study and a review of complex systems theory, it is recommended that California's emergency management agencies develop a comprehensive FRM plan in each of California's 33 local EMS agencies.

Research suggests that fatigue has a dramatic effect on the safety of those involved in the operation of the various types of equipment used in the transportation



industry. Consequently, fatigue in the transportation industry is one of the most significant concerns in the United States (NTSB, 2020). Yet, there is no such regulation to mitigate fatigue among those who transport the sick and injured. With the establishment of evidence-based guidelines in FRM, it is now known that there are methods to regulate, monitor, and mitigate fatigue in the EMS workforce. Unfortunately, the study identified that few, if any, policies exist among California EMS agencies to monitor fatigue among privately contracted 911 ambulance services.

Based on this researcher's findings, it is recommended that a comprehensive FRM plan should be adopted and employed. Ideally, the most appropriate deployment would need to come from the California Emergency Medical Services Authority (CalEMSA). CalEMSA is the state entity that regulates EMS statewide while each LEMSA manages its respective jurisdiction. A top-down approach would force each LEMSA to develop a strategic plan to implement FRM. The recommendations should include limiting shifts to less than 24 hours in duration, mechanisms to monitor fatigue among EMTs and paramedics, promotion of caffeine to combat acute fatigue, promotion of napping when not on a call for service, and fatigue education and training for management and employees.

### **Future Research**

Further research should build on the development of FRM within EMS using the theory of complex systems as a guide to understanding environmental factors that affect EMTs and paramedics and, ultimately, the EMS system. Through the EMS complex systems lens, the examination of policy processes in the setting of contracted 911 ambulance services becomes a more robust and useful tool for EMS administrators to

maintain accountability over services that have been contracted to the private sector. Research should continue to expand on how fatigue affects prehospital EMS medical errors, vehicle accidents, and injuries. Further statistical analysis of employee injuries, accidents, and medical errors believed to be associated with fatigue would add depth to the research currently available in the literature. Continued research in these areas provides a better understanding of how EMS administrators' accountability can be enhanced through mitigation techniques targeting fatigue and the undesirable effects in the contracted prehospital 911 provider.

Further contributions to research may be enhanced through an in-depth mixed-methods approach that would investigate current FRM policies among governmental agencies that contract for 911 ambulance services outside of California. A mixed-methods approach may therefore offer further evidence to strengthen and expand upon the data discovered using exploratory qualitative research. Research in FRM implementation among governmental agencies who contract for 911 ambulance services is critical to understanding accountability issues among EMS administrators.

### **Conclusion**

In this chapter, evidence-based guidelines for FRM, the EMS administrator's role in their implementation and EMS complex systems theory concepts have provided new perspectives on policy processes in the management of fatigue in the setting of contracted 911 ambulance services for local governments in the state of California.

Three specific conclusions are drawn from the qualitative data analysis undertaken in this study:

1. The implications of fatigue and the lack of intervening policy processes create accountability issues with EMS administrators.
2. The influence of complex systems theory and exploration of policy creation will aid EMS administrators understanding of environmental factors that may contribute to fatigue among contracted EMTs and paramedics.
3. California EMS administrators should apply established evidence-based guidelines in the field of FRM to that of contracted 911 ambulance services.

Policy creation, particularly those associated with economic costs attributed to the management of fatigue in the setting of contracted government services, is not simple. Each restriction placed on the contractor can affect the bidding process. As EMS administrators enhance policy on FRM, those policy enhancements can have economic ramifications on the ambulance bidder, patients, and liability and legal expenses. However, the duty of EMS administrators to mitigate system failures that may have direct effects on public goods delivered by private actors is critical to accountability.

EMS administrators must understand the complex nature of EMS systems and the environmental factors contributing to fatigue. The need to implement FRM guidelines with mandated criteria within contractual language is critical to the oversight of such outsourced operations. However, by placing restrictions on consecutive hours worked, access to comfort stations, and FRM training and education, the private ambulance contractor will have to calculate the economic costs and incorporate them into their bid for services. Nevertheless, working in and with complex systems requires EMS administrators to understand the hazards associated with unmonitored fatigue in the contracted 911 ambulance provider.

## REFERENCES

- Alameda County. (2019). *Emergency medical services ambulance transport agreement*, U.S. Emergency Medical Services. <http://ems.acgov.org/ems-assets/docs/Documents-Forms/Provider%20Contracts/Executed%20Falck%20Agreement%202019-07-01%20to%202024-06-30.pdf>
- Allen, M., & Pierce, O. (2016, May 3). Medical errors are No. 3 cause of U.S. deaths, researchers say [Audio podcast]. NPR. <https://www.npr.org/sections/health-shots/2016/05/03/476636183/death-certificates-undercount-toll-of-medical-errors>
- Baldwin, D. C., Daugherty, S. R., Tsai, R., & Scotti, M. J. (2003). A national survey of residents' self-reported work hours: Thinking beyond specialty. *Academic Medicine*, 78(11), 1154–1163. <https://doi.org/10.1097/00001888-200311000-00018>
- Barger, L. K., O'Brien, C. S., Rajaratnam, S. M., Qadri, S., Sullivan, J. P., Wang, W., Czeisler, C. A., & Lockley, S. W. (2016). Implementing a sleep health education and sleep disorders screening program in fire departments. *Journal of Occupational and Environmental Medicine*, 58(6), 601–609. <https://doi.org/10.1097/jom.0000000000000709>
- Barrett, A. P. (2000). Balancing accountability and efficiency in a more competitive public sector environment. *Australian Journal of Public Administration*, 59(3), 58-71. <https://doi.org/10.1111/1467-8500.00167>

- Berard, Y. (2019, October 27). State has critical shortage of paramedics.  
<https://www.ajc.com/news/state-regional/state-has-critical-shortage-paramedics/4qU42KSRj2pM02nRfI2zVP/>
- Bernazzani, S. (2018, October 5). Tallying the high cost of preventable harm.  
<https://costsofcare.org/tallying-the-high-cost-of-preventable-harm/>
- Bledsoe, B. E., Cherry, R. A., & Porter, R. S. (1995). *Brady intermediate emergency care*. Prentice Hall.
- Blum, A., Czeisler, S., Landrigan, C., Leape, L., & Shea, C. (2011). Implementing the 2009 Institute of Medicine recommendations on resident physician work hours, supervision, and safety. *Nature and Science of Sleep, 24*(3), 47-85.  
<https://pubmed.ncbi.nlm.nih.gov/23616719/>
- Brennan, J., & Krohmer, J. (2006). *Principles of EMS systems*. Jones & Bartlett Learning.
- Brodkin, E. Z. (2008). Accountability in street-level organizations. *International Journal of Public Administration, 31*(3), 317-336.  
<https://doi.org/10.1080/01900690701590587>
- Burke, R. (2008). Working to live or living to work: Should individuals and organizations care? *Journal of Business Ethics, 84*(S2), 167-172.
- Butte County. (2012). *Emergency medical services ambulance transport agreement*. U.S. Emergency Medical Services.  
[https://www.ssvems.com/uploads/Butte\\_RFP\\_April2012.pdf](https://www.ssvems.com/uploads/Butte_RFP_April2012.pdf)

- Buysse, D. J. (2018). Evidence-based guidelines for fatigue risk management in emergency medical services: A step in the right direction toward better sleep health. *Prehospital Emergency Care*, 22(Suppl 1), 3–5.  
<https://doi.org/10.1080/10903127.2017.1380099>
- Cal. Code Regs. tit. 22 (2017-a). Chapter 2. Emergency medical technician.  
<https://emsa.ca.gov/wp-content/uploads/sites/71/2017/07/EMT-Regulations-7.1.17.pdf>
- Cal. Code Regs. tit. 22 (2017-b). Chapter 4. Paramedic. <https://emsa.ca.gov/wp-content/uploads/sites/71/2017/07/Chapter4Effective2816.pdf>
- Caldwell, P. (1997). *Sleep: Everything you need to know*. Firefly Books.
- California Ambulance Association (2013). California’s private sector ground ambulance services. <http://www.the-caa.org/docs/Calif-EMS-Safety-Net.pdf>
- California Emergency Medical Services Authority. (n.d.). Local EMS agencies.  
<https://emsa.ca.gov/local-ems-agencies/>
- Caruso, C. C. (2013). Negative impacts of shiftwork and long work hours. *Rehabilitation Nursing*, 39(1), 16-25. <https://doi.org/10.1002/rnj.107>
- Chambers, M. (2019, November 5). Fatigue across the transportation industry. *Fatigue Science*. <https://www.fatiguescience.com/blog/fatigue-across-the-transportation-industry/>
- Contra Costa County. (2016). *Emergency medical services ambulance transport agreement*. U.S. Emergency Medical Services.  
<https://cchealth.org/ems/pdf/cfdcontract.pdf>

- Costa, G., Sartori, S., & Åkerstedt, T. (2006). Influence of flexibility and variability of working hours on health and well-being. *Chronobiology International*, 23(6), 1125–1137. <https://doi.org/10.1080/07420520601087491>
- County of Monterey. (2019). *Request for proposal for ambulance service provider for the Monterey county exclusive operating area*.  
<https://www.co.monterey.ca.us/home/showdocument?id=72023>
- Creswell, J. W., & Clark, V. L. (2012). *Designing and conducting mixed methods research*. Sage.
- Dannin, E. (2006). Red tape or accountability: Privatization, publicization, and public values. *Cornell Journal of Law and Public Policy*, 15.  
<https://ssrn.com/abstract=904380>
- Dearth, D. (2017, December 3). Cheaper to pay overtime or hire more employees? Safety-service managers say overtime wins every time.  
[https://www.heraldmailmedia.com/news/local/cheaper-to-pay-overtime-or-hire-more-employees-safety-service/article\\_3c537aa6-d7a2-11e7-8f90-134370acae0c.html](https://www.heraldmailmedia.com/news/local/cheaper-to-pay-overtime-or-hire-more-employees-safety-service/article_3c537aa6-d7a2-11e7-8f90-134370acae0c.html)
- De Castro, A. D., Fujishiro, K., Rue, T., Tagalog, E., Samaco-Paquiz, L., & Gee, G. (2010). Associations between work schedule characteristics and occupational injury and illness. *International Nursing Review*, 57(2), 188-194.  
<https://doi.org/10.1111/j.1466-7657.2009.00793.x>
- Dula, D. J., Dula, N. L., Hamrick, C., & Wood, G. (2001). The effect of working serial night shifts on the cognitive functioning of emergency physicians. *Annals of Emergency Medicine*, 38(2), 152-155. <https://doi.org/10.1067/mem.2001.116024>

- Ederly, D. (2013, October 8). Birth of EMS: The history of the paramedic.  
<https://www.jems.com/articles/print/volume-38/issue-10/features/birth-ems-history-paramedic.html>
- Eisberg, R. (2018, June 21). *Briefing report: Privatizing California's local governments*.  
<https://cssrc.us/content/briefing-report-privatizing-californias-local-governments>
- Elliot, D. L., & Kuehl, K.S. (2007). *Effects of sleep deprivation on fire fighters and EMS responders*. Final Report. International Fire Chiefs Association.  
[https://www.iafc.org/docs/default-source/1safehealthshs/progssleep\\_sleepdeprivationreport.pdf?sfvrsn=f9e4da0d\\_2](https://www.iafc.org/docs/default-source/1safehealthshs/progssleep_sleepdeprivationreport.pdf?sfvrsn=f9e4da0d_2)
- Federal Aviation Administration. (2013). Crewmember flight time and duty period limitations and rest requirements (Vol. 3).  
<https://www.govinfo.gov/content/pkg/CFR-2013-title14-vol3/xml/CFR-2013-title14-vol3-part135-subpartF.xml>
- Folkard, S., & Lombardi, D. A. (2006). Modeling the impact of the components of long work hours on injuries and “accidents.” *American Journal of Industrial Medicine*, 49(11), 953–963. <https://doi.org/10.1002/ajim.20307>
- Fresno County. (2016). *Emergency medical services ambulance transport agreement*. U.S. Emergency Medical Services.  
<https://fresnocounty.legistar.com/View.ashx?M=F&ID=5153994&GUID=7EDA2050-5089-4047-924A-802805B3137D>



- Garfield, S., & Franklin, B. D. (2016, June 14). Understanding models of error and how they apply in clinical practice. [https://www.pharmaceutical-journal.com/cpd-and-learning/learning-article/understanding-models-of-error-and-how-they-apply-in-clinical-practice/20201110.article?firstPass=false#fn\\_9](https://www.pharmaceutical-journal.com/cpd-and-learning/learning-article/understanding-models-of-error-and-how-they-apply-in-clinical-practice/20201110.article?firstPass=false#fn_9)
- Golden, L., & Jorgenson, H. (2002, January 1). *Time after time: Mandatory overtime in the U.S. economy* (Briefing Paper #120). Economic Policy Institute. [https://www.epi.org/publication/briefingpapers\\_bp120/](https://www.epi.org/publication/briefingpapers_bp120/)
- Golden, L., & Okulicz-Kozaryn, A. (2015). Work hours and worker happiness in the US: Weekly hours, hours preferences and schedule flexibility. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.2563374>
- Hammer, M., & Champy, J. (2006). *Reengineering the corporation: A manifesto for business revolution*. Harper Collins.
- Hänecke, K., Tiedemann, S., Nachreiner, F., & Grzech-Sukalo, H. (1998). Accident risk as a function of hour at work and time of day as determined from accident data and exposure models for the German working population. *Scandinavian Journal of Work, Environment & Health*, 24(Suppl 3), 43-48. <https://www.ncbi.nlm.nih.gov/pubmed/9916816>
- Hanfling, D., Altevogt, B. M., Viswanathan, K., & Gostin, L. O. (2012). *Crisis standards of care: A systems framework for catastrophic disaster response*. The National Academies Press.
- Health and Safety Executive. (2015). *Costs to Britain of workplace fatalities and self-reported injuries and ill health, 2013/14*. <http://www.hse.gov.uk/statistics/pdf/cost-to-britain.pdf>

- Hersman, D. A., & Whitcomb, E. A. (2018). Fatigue risk management in high-risk environments: A call to action. *Prehospital Emergency Care*, 22(Suppl 1), 1-2.  
<https://doi.org/10.1080/10903127.2017.1380097>
- Hodge, J. G., Orenstein, D. G., & Weidenaar, K. (2014). *Expanding the roles of emergency medical services providers: A legal analysis*.  
<https://www.astho.org/Preparedness/ASTHO-EMS-and-Law-Report/>
- Ingstrup, O., & Crookall, P. (2014). *The three pillars of public management: Secrets of sustained success*. McGill-Queens University Press.
- Inland Counties. (2016). *Emergency medical services ambulance transport agreement*, Inland Counties, CA: U.S. Emergency Medical Services.  
<https://www.sbcounty.gov/icema/main/ViewFile.aspx?DocID=2833>
- International Air Transport Association. (n.d.). Fatigue management.  
<https://www.iata.org/en/programs/ops-infra/fatigue-risk/>
- International Public Safety Association. (2018). *2017 Line of duty death report*.  
<https://www.joinipsa.org/resources/Documents/International%20Public%20Safety%20Association%202017%20LODD%20Report.pdf>
- Johnson, J. (2019, May 23). County rejects AMR ambulance bid, will issue new RFP.  
<https://www.montereyherald.com/2019/05/22/county-rejects-amr-ambulance-bid-will-issue-new-rfp/>
- Johnston, J. M., Romzek, B. S., & Wood, C. H. (2004). The challenges of contracting and accountability across the federal system: From ambulances to space shuttles. *Publius: The Journal of Federalism*, 34(3), 155-182.  
<https://doi.org/10.1093/oxfordjournals.pubjof.a005035>

- Katz, D., & Kahn, R. L. (1978). *The social psychology of organizations* (2nd ed.). Wiley.
- Koliba, C. J., Mills, R. M., & Zia, A. (2011). Accountability in governance networks: An assessment of public, private, and nonprofit emergency management practices following Hurricane Katrina. *Public Administration Review*, 71(2), 210-220.  
<https://doi.org/10.1111/j.1540-6210.2011.02332.x>
- Kovac, K., Vincent, G. E., Jay, S. M., Sprajcer, M., Aisbett, B., Lack, L., & Ferguson, S. A. (2020). The impact of anticipating a stressful task on sleep inertia when on-call. *Applied Ergonomics*, 82, 102942.  
<https://doi.org/10.1016/j.apergo.2019.102942>
- Lamothe, M., & Lamothe, S. (2008). Beyond the search for competition in social service contracting. *The American Review of Public Administration*, 39(2), 164–188.  
<https://doi.org/10.1177/0275074008316557>
- Lang, E. S., Spaite, D. W., Oliver, Z. J., Gotschall, C. S., Swor, R. A., Dawson, D. E., & Hunt, R. C. (2012). A national model for developing, implementing, and evaluating evidence-based guidelines for prehospital care. *Academic Emergency Medicine*, 19(2), 201-209. <https://doi.org/10.1111/j.1553-2712.2011.01281.x>
- Lardner, R. (2019, August 19). Trump administration moves ahead with revised truckers' hours rules. *Insurance Journal*.  
<https://www.insurancejournal.com/news/national/2019/08/19/536508.htm>
- Lassen County. (2016). *Emergency medical services ambulance transport agreement*. U.S. Emergency Medical Services.  
[https://www.norcalems.org/docs/calendar/20150629-Lassen\\_Ambulance\\_Contract\\_2015\\_final\\_\(2\).pdf](https://www.norcalems.org/docs/calendar/20150629-Lassen_Ambulance_Contract_2015_final_(2).pdf)

- Lee, K. A., Dziadkowiec, O., & Meek, P. (2014). A systems science approach to fatigue management in research and health care. *Nursing Outlook*, 62(5), 313-321.  
<https://doi.org/10.1016/j.outlook.2014.07.002>
- Leger, D. (1994). The cost of sleep-related accidents: A report for the national commission on sleep disorders research. *Sleep*, 17(1), 84-93.  
<https://doi.org/10.1093/sleep/17.1.84>
- Levenson, A. (2017). Workplace fatigue is a systems problem. *Consulting Psychology Journal: Practice and Research*, 69(2), 130–142.  
<https://doi.org/10.1037/cpb0000091>
- Lipsitz, L. A. (2012). Understanding health care as a complex system. *JAMA*, 308(3), 243. <https://doi.org/10.1001/jama.2012.7551>
- Los Angeles County. (2016). *Emergency medical services ambulance transport agreement*. U.S. Emergency Medical Services.
- Maguire, B. J., Hunting, K. L., Guidotti, T. L., & Smith, G. S. (2005). Occupational injuries among emergency medical services personnel. *Prehospital Emergency Care*, 9(4), 405-411. <https://doi.org/10.1080/10903120500255065>
- Marcus, J. H., & Rosekind, M. R. (2016). Fatigue in transportation: NTSB investigations and safety recommendations. *Injury Prevention*, 23(4), 232–238.  
<https://doi.org/10.1136/injuryprev-2015-041791>
- Marino, P. (2019, April 4). County plan for a new ambulance contract has critics calling for a do-over. [http://www.montereycountyweekly.com/news/local\\_news/county-plan-for-a-new-ambulance-contract-has-critics-calling/article\\_67fa6f9a-566b-11e9-ab29-47cf405ebb2d.html](http://www.montereycountyweekly.com/news/local_news/county-plan-for-a-new-ambulance-contract-has-critics-calling/article_67fa6f9a-566b-11e9-ab29-47cf405ebb2d.html)

- Martin-Gill, C., Higgins, J. S., Van Dongen, H. P. A., Buysse, D. J., Thackery, R. W., Kupas, D. F., Becker, D. S., Dean, B. E., Lindbeck, G. H., Guyette, F. X., Penner, J. H., Violanti, J. M., Lang, E. S., & Patterson, P. D. (2018). Proposed performance measures and strategies for implementation of the fatigue risk management guidelines for emergency medical services. *Prehospital Emergency Care*, 22(Suppl 1), 102–109. <https://doi.org/10.1080/10903127.2017.1381791>
- Mednick, S. C., & Ehrman, M. (2006). *Take a nap! Change your life: the scientific plan to make you smarter, healthier, more productive*. Workman.
- Merced County. (2014). *Emergency medical services ambulance transport agreement*. U.S. Emergency Medical Services. <https://www.co.merced.ca.us/DocumentCenter/View/16900/SEMSA-Submitted-Proposal-to-Request-for-Proposal-2013-001-April-15-2014>
- Misasi, P., & Keebler, J. R. (2019). Medication safety in emergency medical services: approaching an evidence-based method of verification to reduce errors. *Therapeutic Advances in Drug Safety*, 10, 204209861882191. <https://doi.org/10.1177/2042098618821916>
- Morgan, J. I., Abbott, R., Furness, P., & Ramsay, J. (2016). UK rail workers' perceptions of accident risk factors: An exploratory study. *International Journal of Industrial Ergonomics*, 55, 103-113. <https://doi.org/10.1016/j.ergon.2016.08.003>
- Morris, C. (2015, September 12). 10 of the most dangerous jobs in America. <https://www.cnbc.com/2015/09/12/10-of-the-most-dangerous-jobs-in-america.html>

- National Research Council and National Academy of Sciences. (1966). *Accidental death and disability: The neglected disease of modern society*. National Academies Press.
- National Safety Council. (n.d.). Drivers are falling asleep behind the wheel.  
<https://www.nsc.org/road-safety/safety-topics/fatigued-driving>
- National Transportation Safety Board. (2020). NTSB 2019-2020 most wanted list. (2020, January 23). <https://www.nts.gov/safety/mwl/Pages/default.aspx>
- Nichol, G., & Huszti, E. (2007). Design and implementation of resuscitation research: Special challenges and potential solutions. *Resuscitation*, 73(3), 337–346.  
<https://doi.org/10.1016/j.resuscitation.2006.10.021>
- Nuckols, T. K., Bhattacharya, J., Wolman, D. M., Ulmer, C., & Escarce, J. J. (2009). Cost implications of reduced work hours and workloads for resident physicians. *New England Journal of Medicine*, 360(21), 2202-2215.
- Orange County. (2016). *Emergency medical services ambulance transport agreement*. U.S. Emergency Medical Services.  
<https://www.healthdisasteroc.org/civicax/filebank/blobdload.aspx?BlobID=46755>
- Pack, A. I., Pack, A. M., Rodgman, E., Cucchiara, A., Dinges, D. F., & Schwab, C. W. (1995). Characteristics of crashes attributed to the driver having fallen asleep. *Accident Analysis & Prevention*, 27(6), 769-775.
- Patterson, P. D. (2019, September 2). Evidence-based guidelines for combatting fatigue in EMS. <https://www.jems.com/2018/02/01/evidence-based-guidelines-for-combatting-fatigue-in-ems/>

- Patterson, P. D., Higgins, J. P., Van Dongen, H. P. A., Buysse, D. J., Thackery, R. W., Kupas, D. F., Becker, D. S., Dean, B. E., Lindbeck, G. H., Guyette, F. X., Penner, J. H., Violanti, J. M., Lang, E. S., & Martin-Gill, C. (2018). Evidence-based guidelines for fatigue risk management in emergency medical services. *Prehospital Emergency Care*, 22(Suppl 1), 889-101.  
<https://doi.org/10.1080/10903127.2017.1376137>
- Patterson, P. D., Huang, D. T., Fairbanks, R. J., Simeone, S., Weaver, M., & Wang, H. E. (2010). Variation in emergency medical services workplace safety culture. *Prehospital Emergency Care*, 14(4), 448-460.  
<https://doi.org/10.3109/10903127.2010.497900>
- Patterson, P. D., & Robinson, K. (2018). *Implementation guidebook: 2018 fatigue risk management guidelines for emergency medical services*. <https://nasemso.org/wp-content/uploads/Fatigue-Guidebook-FINAL-2018Oct.pdf>
- Patterson, P. D., Suffoletto, B. P., Kupas, D. F., Weaver, M. D., & Hostler, D. (2010). Sleep quality and fatigue among prehospital providers. *Prehospital Emergency Care*, 14(2), 187-193. <https://doi.org/10.3109/10903120903524971>
- Patterson, P. D., Weaver, M. D., Frank, R. C., Warner, C. W., Martin-Gill, C., Guyette, F. X., Fairbanks, R., Hubble, M. W., Songer, T. J., Callaway, C. W., Kelsey, S. F., & Hostler, D. (2012). Association between poor sleep, fatigue, and safety outcomes in emergency medical services providers. *Prehospital Emergency Care*, 16(1), 86-97. <https://doi.org/10.3109/10903127.2011.616261>
- Pozner, C., Zane, R., Nelson, S., & Levine, M. (2004). International EMS systems: The United States: Past, present, and future. *Resuscitation*, 60(3), 239-244.

- Quan, S., & Barger, L. (2015). Brief review: Sleep health and safety for transportation workers. *Southwest Journal of Pulmonary and Critical Care*, *10*(3), 130–139.  
<https://doi.org/10.13175/swjpc036-15>
- Reason, J. (1995). A systems approach to organizational error. *Ergonomics*, *38*(8), 1708–1721. <https://doi.org/10.1080/00140139508925221>
- Reason, J. (2000). Human error: Models and management. *BMJ*, *320*(7237), 768–770.  
<https://doi.org/10.1136/bmj.320.7237.768>
- Reason, J. T. (2016). *Managing the risks of organizational accidents*. Routledge Taylor & Francis Group.
- Reno, V. P., & Gluck, M. E. (2004). Reflections on implementing Medicare. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.555634>
- Riverside County. (2015). *Emergency medical services ambulance transport agreement*. U.S. Emergency Medical Services.  
<https://www.rivcoems.org/Portals/13/Documents/DOCUMENTS/CONTRACTS/AMR/Current%20AMR%20Contract%20%202015.pdf>
- Rivlin, A. M., & Shalala, D. E. (2015). *Systematic thinking for social action*. Brookings Institution Press.
- Robbins, V. (2015). *The history of ambulance services and medical transportation systems in the United States*. In J. Lindsey (Ed.), *Management of ambulance services* (pp. 1-10). National EMS Management Association.
- Rogers, A. E., Hwang, W.-T., Scott, L. D., Aiken, L. H., & Dinges, D. F. (2004). The working hours of hospital staff nurses and patient safety. *Health Affairs*, *23*(4), 202–212. <https://doi.org/10.1377/hlthaff.23.4.202>



- Rolston, E., Sandlin, J., Sandlin, M. & Keathley, R. (2007). Power napping: Effects on cognitive ability and stress levels among college students. *Research Quarterly for Exercise and Sport*, 78, A36-A36.
- Rossin-Slater, M., Ruhm, C. J., & Waldfogel, J. (2012). The effects of California's paid family leave program on mothers' leave-taking and subsequent labor market outcomes. *Journal of Policy Analysis and Management*, 32(2), 224–245.  
<https://doi.org/10.1002/pam.21676>
- San Benito County. (2014). *Emergency medical services ambulance transport agreement*. U.S. Emergency Medical Services. [http://www.cosb.us/wp-content/uploads/AMR-Agreement\\_2014-2019\\_Signed.pdf](http://www.cosb.us/wp-content/uploads/AMR-Agreement_2014-2019_Signed.pdf)
- Sanddal, N. D., Albert, S., Hansen, J. D., & Kupas, D. F. (2008). Contributing factors and issues associated with rural ambulance crashes: Literature review and annotated bibliography. *Prehospital Emergency Care*, 12(2), 257–267.  
<https://doi.org/10.1080/10903120801907661>
- San Diego County. (2013). *Emergency medical services ambulance transport agreement*. U.S. Emergency Medical Services. <http://www.san-marcos.net/Home/ShowDocument?id=1677>
- San Joaquin County. (2016). *Emergency medical services ambulance transport agreement*. U.S. Emergency Medical Services.  
[https://www.sjgov.org/ems/pdf/amrcontracteffectivemay2016\(final\).pdf](https://www.sjgov.org/ems/pdf/amrcontracteffectivemay2016(final).pdf)
- San Luis Obispo County. (2018). *Emergency medical services ambulance transport agreement*. U.S. Emergency Medical Services.  
[https://www.sloemsa.org/files/APOC\\_May\\_26\\_2017AgendaPacket.pdf](https://www.sloemsa.org/files/APOC_May_26_2017AgendaPacket.pdf)

- Santa Cruz County. (2018). *Emergency medical services ambulance transport agreement*. U.S. Emergency Medical Services.  
<https://santacruzcountyca.iqm2.com/Citizens/FileOpen.aspx?Type=4&ID=17593>
- Scott, L. D., Hofmeister, N., Rogness, N., & Rogers, A. E. (2010). Implementing a fatigue countermeasures program for nurses. *JONA: The Journal of Nursing Administration*, 40(5), 233-240. <https://doi.org/10.1097/nna.0b013e3181da4078>
- Seim, J. (2017). The ambulance: Toward a labor theory of poverty governance. *American Sociological Review*, 82(3), 451–475. <https://doi.org/10.1177/0003122417702367>
- Senge, P. M. (1990). *The fifth discipline: The art and practice of the learning organization*. Random House Business Books.
- Shafritz, J. M., Hyde, A. C., & Parkes, S. J. (2004). *Classics of public administration*. Cengage Learning.
- Shetty, K. D., & Bhattacharya, J. (2007). Changes in hospital mortality associated with residency work-hour regulations. *Annals of Internal Medicine*, 147(2),73-80.
- Smith, M., & Feied, C. (2002). *The emergency department as a complex system*. New England Complex Systems Institute. <https://necsi.edu/the-emergency-department-as-a-complex-system>.
- Solano County. (2020). *Emergency medical services ambulance transport agreement*. U.S. Emergency Medical Services.  
<http://www.solanocounty.com/civicax/filebank/blobdload.aspx?blobid=29599>
- Studnek, J. R., & Fernandez, A. R. (2008). Characteristics of emergency medical technicians involved in ambulance crashes. *Prehospital and Disaster Medicine*, 23(5), 432–437. <https://doi.org/10.1017/s1049023x00006166>

- Swanson, R. C., Cattaneo, A., Bradley, E., Chunharas, S., Atun, R., Abbas, K. M., Katsaliaki, K., Mustafee, N., Meier, B. M., & Best, A. (2012). Rethinking health systems strengthening: Key systems thinking tools and strategies for transformational change. *Health Policy and Planning, 27*(Suppl 4), iv54–iv61. <https://doi.org/10.1093/heapol/czs090>
- Tietzel, A. J., & Lack, L. C. (2001). The short-term benefits of brief and long naps following nocturnal sleep restriction. *Sleep, 24*(3), 293–300. <https://doi.org/10.1093/sleep/24.3.293>
- Trejos, N. (2014, January 3). New pilot fatigue rules go into effect this weekend. <https://www.usatoday.com/story/todayinthesky/2014/01/03/pilot-fatigue-mandatory-rest-new-faa-rules/4304417/>
- Ulmer, C., Wolman, D., & Johns, M. (2009). *Resident duty hours: Enhancing sleep, supervision, and safety*. National Academies Press.
- U.S. Food and Drug Administration. (2018, December 12). Spilling the beans: How much caffeine is too much? <https://www.fda.gov/consumers/consumer-updates/spilling-beans-how-much-caffeine-too-much>
- Van Den Bos, J., Rustagi, K., Gray, T., Halford, M., Ziemkiewicz, E., & Shreve, J. (2011). The \$17.1 billion problem: The annual cost of measurable medical errors. *Health Affairs, 30*(4). <https://doi.org/10.1377/hlthaff.2011.0084>
- Van Slyke, D. M. (2006). Agents or stewards: Using theory to understand the government-nonprofit social service contracting relationship. *Journal of Public Administration Research and Theory, 17*(2), 157–187. <https://doi.org/10.1093/jopart/mul012>

- Volpp, K. G., Rosen, A. K., Rosenbaum, P. R., Romano, P. S., Even-Shoshan, O., Canamucio, A., Bellini, L., Behringer, T., & Silber, J. H. (2007). Mortality among patients in VA hospitals in the first 2 years following ACGME resident duty hour reform. *JAMA*, *298*(9), 984-992.
- Volpp, K. G., Rosen, A. K., Rosenbaum, P. R., Romano, P. S., Even-Shoshan, O., Wang, Y., Bellini, L., Behringer, T., & Silber, J. H. (2007). Mortality among hospitalized Medicare beneficiaries in the first 2 years following ACGME resident duty hour reform. *JAMA*, *298*(9), 975-983.
- Von Bertalanffy, L. (1972). The history and status of general systems theory. *Academy of Management Journal*, *15*, 407-429.
- Vries, J. D., Michielsen, H. J., & Van Heck, G. I. (2003). Assessment of fatigue among working people: A comparison of six questionnaires. *Occupational and Environmental Medicine*, *60*(>90001), 10i-15.  
[https://doi.org/10.1136/oem.60.suppl\\_1.i10](https://doi.org/10.1136/oem.60.suppl_1.i10)
- Ward, M. (2017, May 5). A brief history of the 8-hour workday, which changed how Americans work. <https://www.cnbc.com/2017/05/03/how-the-8-hour-workday-changed-how-americans-work.html>
- Weaver, M. (2015). *Fatigue, shift work characteristics, and occupational injury and illness in emergency medical services* (Publication No. 3690861) [Doctoral dissertation, University of Pittsburgh]. ProQuest Dissertations and Theses Global.
- Wiegmann, D. A., & Shappell, S. A. (2009). *A human error approach to aviation accident analysis: The human factors analysis and classification system*. Ashgate.

- Weingroff, R. F. (n.d.). Highway history.  
<https://www.fhwa.dot.gov/infrastructure/safety02.cfm>
- Wong, K., Chan, A. H. S., & Ngan, S. C. (2019). The effect of long working hours and overtime on occupational health: A meta-analysis of evidence from 1998 to 2018. *International Journal of Environmental Research and Public Health*, 16(12), 2102. <https://doi.org/10.3390/ijerph16122102>
- World Health Organization & WHO Patient Safety. (2011). Patient safety curriculum guide: Multi-professional edition. <https://apps.who.int/iris/handle/10665/44641>
- Yang, K. (2012). Further understanding accountability in public organizations. *Administration & Society*, 44(3), 255-284.  
<https://doi.org/10.1177/0095399711417699>
- Yolo County. (2013). *Emergency medical services ambulance transport agreement*. U.S. Emergency Medical Services.  
[http://yoloagenda.yolocounty.org:8085/docs/2014/BOS/20140225\\_235/2611\\_Item%20No.%2026%20-%20Health.pdf](http://yoloagenda.yolocounty.org:8085/docs/2014/BOS/20140225_235/2611_Item%20No.%2026%20-%20Health.pdf)
- Zimmerman, J. (2014, May 29). Fiscal responsibility in public administration.  
<https://patimes.org/fiscal-responsibility-public-administration/>

## APPENDICES

## APPENDIX A

### EMS Administrator Survey

1. What instruments or mechanisms do you use to measure and monitor fatigue in the contracted 911 ambulance provider?

Follow-up questions: The researcher will ask appropriate follow-up questions related to the measuring and monitoring devices used by the agency.

2. What is the maximum number of consecutive hours a contracted 911 ambulance EMT or paramedic may work?

Follow-up questions: The researcher will ask appropriate follow-up questions related to the maximum consecutive hours allowed to work.

3. Does the contracted 911 ambulance EMT and paramedic have access to caffeine provided by the agency, or readily available for purchase?

Follow-up questions: The researcher will ask appropriate follow-up questions related to the availability of caffeine to emergency medical service employees.

4. Are privately contracted 911 EMT's and paramedics allowed to take naps on duty?

If so, do they have quarters where beds or recliner chairs are available?

Follow-up questions: The researcher will ask appropriate follow-up questions related to the promotion of taking naps on duty and the availability of stations to take naps.

5. Do contracted 911 ambulance EMT's and paramedics receive education and training to mitigate fatigue and fatigue-related risks?

Follow-up questions: The researcher will ask appropriate follow-up questions related to fatigue education and training

## APPENDIX B

### Institutional Review Board Approval Letter

**RE:** IRB Review  
**IRB No.:** 060-1819-EXP

**Project:** Fatigue Risk Management in Privately Contracted Ambulance Services: A Countermeasures Approach

**Date Complete Application Received:** 11/27  
**Date Final Revision Received:** 12/13

**Principle Investigator:** Matthew McElhenie  
**Faculty Advisor:** Dominick Sturz

**College/Department:** OPS

**IRB Determination:** Expedited Application Approved – Student research using confidential interviews; no minor participants; no more than minimal risk/risk appropriately mitigated; no deception utilized; acceptable consent procedures and documentation; acceptable data protection procedures. Data collection may begin, in accordance with the final submitted documents and approved protocol.

**Waiver of Documentation of Consent:** Per 45 CFR 46.117, the IRB has approved the request to waive the documentation of informed consent (e.g., no participant signatures will be collected, though participants do receive a copy of the consent information) because the signature of the participant would be the only linking record to the data that may harm the participant if released.

**Future Correspondence:** All future correspondence about this project must include all PIs, Co-PIs, and Faculty Advisors (as relevant) and reference the assigned IRB number.

**Approval Information:** Approval is granted for one year from date below. If you would like to continue research activities beyond that date, you are responsible for submitting a Research Renewal Request with enough time for that request to be reviewed and approved *prior* to the expiration of the project. In the case of an unforeseen risk/adverse experience, please report this to the IRB immediately using the appropriate forms. Requests for a change to protocol must be submitted for IRB review and approved prior to implementation. At the completion of the project, you are to submit a Research Closure Form.

**Researcher Responsibilities:** The researcher is responsible for ensuring that the research is conducted in the manner outlined in the IRB application and that all reporting requirements are met. Please refer to this approval and to the IRB handbook for more information.

**Date:** December 14, 2018