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The work environment of nurses places them at high risk of fatigue. The literature suggests a high prevalence of fatigue exists among nurses. Fatigue leads to reduced cognitive and physical abilities increasing the risk for personal injury and patient care errors. Nurse fatigue should be mitigated in an effort to improve safety and quality in healthcare organizations. The purpose of this study was to describe nurses' self-perceptions of fatigue and to examine nurses' willingness to engage in specific fatigue countermeasures within the workplace. Data were collected through an anonymous Qualtrics survey. A sample of 279 nurses completed the survey. The Fatigue Assessment Scale (FAS) was used to measure fatigue. The instrument suggested a high level of fatigue within the sample. Findings revealed that 54% of the sample's self-assessment of fatigue agreed with the established fatigue instrument. Exploring FAS scores for each self-rated fatigue category revealed that the remainder of the sample (46%) either over or under estimated their level of fatigue. This study revealed that many nurses are willing to work 9-hour shifts, limit consecutive 12-hour shifts to two, hand over patient care for a duty-free break, avoid working beyond their scheduled shift and avoid adding additional work days to their regular scheduled days. Nurse leaders are well positioned to implement these fatigue reduction strategies and to make changes to the work environment in an effort to alleviate fatigue among nurses. Further research is recommended to examine the impact of these changes on the occurrence of nurse fatigue.

A QUANTITATIVE EXPLORATION OF STRATEGIES

TO REDUCE FATIGUE AMONG NURSES

by

Karen R. Cochran

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Approved by

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Committee Chair

This dissertation is dedicated to my husband David. Thank you for your unwavering patience, love and support of my educational endeavors. Your constant encouragement during the challenges of my doctoral program was very much appreciated.

APPROVAL PAGE

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CHAPTER I

INTRODUCTION

Fatigue is a global concern that has been researched extensively. It has been explored in terms of its relation to illness and relation to work. As early as the 19th century, occupational fatigue has been a topic of research. Britain in 1893, Germany in 1901 and Belgium in 1905 researched the association between working long hours, productivity, absenteeism and wear and tear on machinery (Fletcher, 2018). The work efforts related to the production of munitions for World War I resulted in an escalation of worker fatigue and sparked an interest in the psychological effects of work. The British Health of Munition Workers Committee, formed in 1915, recognized a reduction in performance when workers were fatigued. During World War II, the impact of fatigue on the performance of pilots became of interest. Workplace fatigue continues to be a topic of interest today, evidenced by the abundance of research found in current literature.

Fatigue remains prevalent among workers worldwide and plays a role in numerous negative outcomes. The prevalence of fatigue in the working population of Europe is estimated at 22% (Ali et al., 2014; Parent-Thirion et al., 2012). The Health and Safety Executive, of the United Kingdom, reports that fatigue has been linked to 20% of vehicular accidents and is related to £115 - £240 million per year in workplace accidents (*Human Factors: Fatigue*, 2019). The Challenger space shuttle crash, Chernobyl, Three-Mile Island and the Exxon Valdez oil spill accidents were all found to have fatigue as a

contributing factor in the human errors that led to those events (Fletcher, 2018; Techera et al., 2016). A 2016 meta-analysis of fatigue literature revealed that 20% of the workforce in the United States (U.S.) experienced work-related fatigue, resulting in $136.4 billion in health care expenses and lost productivity (Techera et al., 2016). More recently, a 2018 survey conducted by the National Safety Council indicated that two-thirds of workers in the U.S. experience workplace fatigue (National Safety Council, 2019). According to the National Safety Council (2019), 97% of workers have at least one risk factor for work-related fatigue and more than 80% have two or more risk factors. The potential for occupational injuries increases as the number of fatigue risk factors increase (National Safety Council, 2019; Techera et al., 2016).

Safety sensitive industries such as aviation, transportation, maritime, and nuclear power recognize the danger of worker fatigue and have implemented policies and regulations in efforts to improve both worker and public safety. The Federal Aviation Administration, Federal Railroad Administration, Federal Motor Carrier Safety Administration, U.S. Nuclear Regulatory Commission and the U.S. Department of Transportation place limits on workers' hours on-duty and specify requirements for rest periods. No such federal regulations exist for nurses. Fatigue among nurses is particularly important because of its' negative impact on patient safety (Barker & Nussbaum, 2011; Gardner & Dubeck, 2016). Medical errors are the third leading cause of death in the U.S.; however because fatigue is not assessed when errors occur, it is unknown how many errors leading to death had fatigue as a contributing factor (Makary & Daniel, 2016). The nursing profession has been slow to respond to the evidence

regarding worker fatigue. Fatigue countermeasure programs for nursing are needed to improve safety and performance. The purpose of this study was to advance the science in fatigue reduction among nurses.

Definition of Fatigue

Fatigue is a common term that is used. Fatigue is defined by NIOSH (2018) as an overall deficiency of alertness and a degradation in mental and physical performance that affects an individuals' judgment. Fatigue is further described by NIOSH as "naturally occurring" in response to excessive work, insufficient breaks from work, inadequate sleep, a low level of autonomy, and a lack of fatigue management initiatives or lack of participation in the initiatives (Fletcher, 2018). A concept analysis by Ream and Richardson (1996) described fatigue as a subjective experience that is complex, universally experienced, and dependent upon an individual's perceptions. Fatigue is a total body feeling and experience, that is multi-dimensional including physical, cognitive and emotional dimensions which cause distress (Ream & Richardson, 1996).

Various forms of fatigue exist. For example, fatigue may be classified as acute, chronic, work-related, illness-related, physical, mental or compassion fatigue. Techera et al. (2016) distinguish acute from chronic fatigue by describing acute fatigue as a normal response to adverse situations which can be easily resolved with rest, sleep, diet or exercise. In contrast, chronic fatigue is described as lasting for long periods of time, which is not easily resolved with the actions that can improve the symptoms of acute fatigue (Techera et al., 2016). Additionally, chronic fatigue is defined as severe, prolonged, debilitating, and drastically impacting quality of life (Jason et al., 2010).

Chronic fatigue often occurs with chronic illness but may occur in the absence of chronic illness. Compassion fatigue is described as a vicarious trauma or secondary trauma which can result from continuous and intense care giving activities, a post-traumatic stress syndrome, or from the inability to meet self-expectations of providing care for others (Coetzee & Klopper, 2010; Ledoux, 2015). This study focused on fatigue among nurses attributed to work factors.

Background and Significance

Fatigue among nurses is increasingly gaining attention. The National Academies of Medicine acknowledges that nurse well-being is strongly linked to the quality of patient care (National Academy of Medicine, 2019). Nurses play a crucial role in patient care because they are the primary care givers in the hospital setting. Nurses must remain alert, maintain cognitive flexibility in intense situations, and apply highly cognitive problem-solving skills during complex decision making, in order to provide safe patient care (Drake et al., 2012). Patient safety hinges on nurse wellbeing. Today's healthcare environment presents patients of higher acuity than in the past with complex care giving needs. A 2014 literature review of original research on nurse fatigue revealed that the prevalence of fatigue among hospital nurses ranged between 71% and 92% (Smith-Miller et al., 2014). As discussed, 20% of the general working population in 2016 and approximately 66% in 2018 reported experiencing fatigue (National Safety Council, 2019; Techera et al., 2016). Thus, evidence suggests nurses experience higher rates of fatigue than does the general working population.

Antecedents of Workplace Fatigue

Evidence suggests sleep deprivation is the most significant cause of fatigue and that those working early morning and night shifts are at highest risk (Shen et al., 2006; Techera et al., 2016). Workers who frequently work during the night experience fatigue at a severity level almost as high as patients with fatigue-causing diseases such as multiple sclerosis and lupus (Shen et al., 2006). A national survey revealed that the duration and frequency of call requirements among certified registered nurse anesthetists (CRNAs) is a predictor of fatigue. Working the next day after being on call, without adequate time off between work periods contributes to fatigue and the commission of errors among CRNAs (Domen et al., 2015).

Through a meta-analysis of original research on fatigue, Techera et al. (2016) also identified poor lighting, noise, and harassment or lateral violence as contributors to fatigue. Additionally, poorly performing technology, lack of teamwork, poor layout of the unit which leads to excessive walking, poor staffing, turnover of staff, precepting responsibilities, and repetitive charting contribute to nurse fatigue (Steege & Dykstra, 2016). Nurses are at exceedingly high risk of fatigue because these are common characteristics of their work settings. These conditions pose serious threats to nurses' health and well-being.

Negative Outcomes of Workplace Fatigue

Healthcare is a 24-hour operation, thus the disruption of sleep places many nurses at a high risk for fatigue and injury. Those who work during the night were three times more likely to experience an injury while at work compared to those who work during the

day (Swaen et al., 2003). The National Safety Council (2019) reports that worker fatigue is attributed to 13% of all workplace injuries. A survey of 1200 registered nurses across 35 states and the District of Columbia revealed that within the previous year 66% of the respondents worked 12-hour shifts, 64% worked overtime, 25% reported a needle-stick injury, 39% reported a sprain, 21% reported having a cut, 46% reported a bruise and 62% reported experiencing verbal abuse (Kovner et al., 2007). In 2011 the Occupational Safety and Health Administration (OSHA) reported that 58,860 injuries occurred among healthcare workers. This figure represents twice the rate seen in other industry sectors (OSHA, 2019). In 2016, 19,790 registered nurses experienced injuries and illnesses for an incidence rate of 104.2 cases per 10,000 full-time workers (Dressner & Kissinger, 2018). Because fatigue is not typically explored as a causative factor when injuries occur within the healthcare field, the extent to which fatigue plays a part in injuries among nurses is not known.

Overtime and Long Work Hours in Nursing

Working overtime is not uncommon for nurses. Even when state law restricts mandatory overtime or healthcare organizations have policies against mandatory overtime, nurses can circumvent policies by voluntarily working overtime and working on-call hours resulting in overtime (Bae & Yoon, 2014). Additionally, the 12-hour shift has become a widely used scheduling pattern in hospitals. Working more than eight hours, i.e. a 12-hour shift, is considered long working hours by OSHA. A normal work schedule is defined by OHSA as an eight hour work day, occurring during the day, for five days each week (Caldwell et al., 2019). Evidence suggest that working longer than

eight hours, working overtime, rotating shifts, lack of breaks while at work, inadequate time to recover between shifts and stress in the work environment are associated with nurse fatigue (Barker & Nussbaum, 2011; Garrett, 2008; Knupp et al., 2018; Rogers, 2008; Witkoski & Dickson, 2010; Yuan et al., 2011).

Working long hours is also associated with the commission of errors, burnout and absenteeism (Garrett, 2008; MacKusick & Minick, 2010; Rogers, 2008; Smith-Miller et al., 2014). Specifically, working more than 40 hours in a week is associated with an increase in medication errors (wrong medication or dose) and needlestick injury (Olds & Clarke, 2010). Fatigue is a factor in job dissatisfaction and in nurses' decisions to leave the profession (Barker & Nussbaum, 2011; Kovner et al., 2007; MacKusick & Minick, 2010; Stimpfel et al., 2012). A survey of 633 nurses in Illinois and North Carolina revealed that 45% of nurses who chose to work outside of nursing cited burnout or stressful work as the reason, followed by 41% citing scheduling or long working hours as their main reasons for leaving the nursing profession (Trinkoff et al., 2011). The percentages of nurses reporting burnout and an intention to leave their job increases as shift length increases (Stimpfel et al., 2012; Trinkoff et al., 2011). The turnover rate for nurses in the U.S. is approximately 27% with an estimated to cost hospitals between $5.13 to $7.86 million per year (Wei et al., 2018).

Working long hours without adequate time off to recover between work days is associated with higher patient mortality. Trinkoff et al. (2011) found that deaths from pneumonia were significantly more likely to occur in hospitals where nurses work long hours; deaths from abdominal aortic aneurysm were significantly associated with

inadequate time to recover between shifts and that as the nurses shift length increased, patients' dissatisfaction with care increased.

Work Schedules in Other Safety Sensitive Industries

Contrary to nursing, work schedules, including rest periods, in many safety sensitive industries are heavily regulated in effort to reduce the occurrence of fatigue among workers. The Federal Aviation Administration (FAA) tightly regulates hours on duty and rest periods for flight crews and air traffic controllers. Pilots are required to have a 10 hour rest period between flights, daytime flights are limited to nine hours and nighttime flights are limited to eight hours (*FAA Regulations*, 2019). Longer flights require more pilots, to allow for breaks and periods of sleep to reduce the occurrence of fatigue (Lamp, 2019). Additionally, pilots must sign a statement that they are fit for duty and if the pilot reports feeling fatigued, they are replaced for the assigned flight. Air traffic controllers cannot be on duty for more than 10 consecutive hours, and cannot work more than 10 hours within a 24 hour period unless there has been an eight hour break between the worked shifts (*FAA Regulations*, 2019).

With regards to the rail industry, the U.S. Federal Railroad Administration (FRA) limits the work period to 12 consecutive hours and requires a minimum of 10 consecutive hours of rest for each 24 hour period (*Rail Safety Improvement Act of 2008 (RSIA) | FRA*, 2019). Under this regulation, no more than 6 consecutive days of work are allowed. Statistical modeling is used to plan schedules in an effort to reduce the occurrence of fatigue (*Rail Safety Improvement Act of 2008 (RSIA) | FRA*, 2019). If schedules are

deemed to present a risk of fatigue, they must be approved by the Federal Railroad Administration.

The Federal Motor Carrier Safety Administration (FMCSA) regulates truck drivers in the U.S. The maximum average work week is limited to 70 hours (*Regulations | FMCSA*, 2019). Drivers are required to take a 30-minute rest break during the first eight hours of driving and the daily limit is 11 hours. Companies may be fined up to $11,000 and drivers up to $2,750 for violating regulations (*Regulations | FMCSA*, 2019).

The U.S. Nuclear Regulatory Commission (NRC) limits workers to 16 hours per 24 hour period and a total of 72 hours per week (*NRC: Regulations Title 10, Code of Federal Regulations*, 2019). The NRC requires workers to have a minimum of 10 hours off between consecutive work periods and a minimum of 34 hours off in any 9-day period.

The Accreditation Council for Graduate Medical Education (ACGME) regulates on duty hours for medical residents (Philibert & Amis, 2011). In 2011 the regulation established a limit of 80 hours per week for medical residents and in 2017 the regulation was updated to prevent shift extensions in excess of 16 hours for first year residents (*ACGME Duty-Hour Requirements per Specialty*, 2017). There are no regulations at the federal level for the nursing profession.

Nursing Professional Culture

Nursing professional culture has been found to be a barrier to implementation of fatigue countermeasures among nurses. Fatigue is viewed as a normal part of the job (Steege et al., 2017a; Steege & Rainbow, 2017). Self-expectations as well as peer and

management expectations not to take a break, and the opinion that fatigue is a sign of weakness present barriers to implementation of fatigue countermeasures (Steege & Rainbow, 2017). Nurses have demonstrated reluctance to participate in fatigue countermeasures during intervention studies and expressed guilt for participation in countermeasures during interviews (Scott et al., 2010; Smith-Miller et al., 2016). For this reason, nurses must be part of the solution and decision making process from the beginning. Their buy in is paramount to the success of any intervention. Beginning with an assessment of what nurses are willing to do to address work-related fatigue is needed to devise interventions that nurses will deem acceptable.

Study Purpose

This study focused on workplace strategies to reduce fatigue among nurses. The overall purpose of this study was to describe nurses' self- perceptions of fatigue and to examine nurses' willingness to engage in specific fatigue countermeasures. Relationships between the perceived threat of fatigue and the nurses' age, years of experience and education level were explored. Also, the effect of the perceived threat of fatigue on the nurses' willingness to engage in fatigue reduction strategies were examined.

The research questions for this study were:

1. What workplace fatigue reduction strategies are nurses willing to engage in to reduce their risk of experiencing work-related fatigue?
2. What are nurses' self-perceptions of fatigue?

3. What is the relationship between nurses perceived threat of fatigue and nurse age, years as a nurse, and education level?
4. What is the effect of nurses' perceived threat of fatigue on willingness to engage in fatigue reduction strategies?

Theoretical Framework

Theory can aid in the understanding of phenomena by providing a broad view of the topic, taking into consideration its related concepts and influencing factors. Theoretical frameworks can help to organize thoughts about, as well as describe and explain phenomena. Theory can also provide a framework for data collection and analysis in research.

The Health Belief Model (HBM) provided the guide for this study. The HBM is an expectancy value model that focuses on the likelihood of an individual engaging in preventive health behavior (Simons-Morton et al., 2012). The model attempts to explain the effects of an individuals' beliefs about a perceived threat on the likelihood of taking preventive action. According to HBM, in order for an individual to take action, they must believe that they are susceptible to a threat, the threat has potential to negatively impact them and that taking action will be beneficial by reducing their susceptibility to the threat (Rosenstock, 1974; Simons-Morton et al., 2012). Socioeconomic status, geographic location, age, knowledge, gender and race may modify the individual's perception of a threat (Rosenstock, 1974; Simons-Morton et al., 2012). In the presence of a perceived threat, an individual is likely to engage in a preventive behavior if there is the ability to engage in the behavior and consequences of not taking action are perceived to

be severe (Simons-Morton et al., 2012). The HBM comprises these key constructs: perceived threat, modifying factors, cues to action, expected benefit, self-efficacy and the likelihood of taking action (see Figure 1) (Simons-Morton et al., 2012). The full model is provided below, followed by an adapted model depicting the constructs used to guide this study.

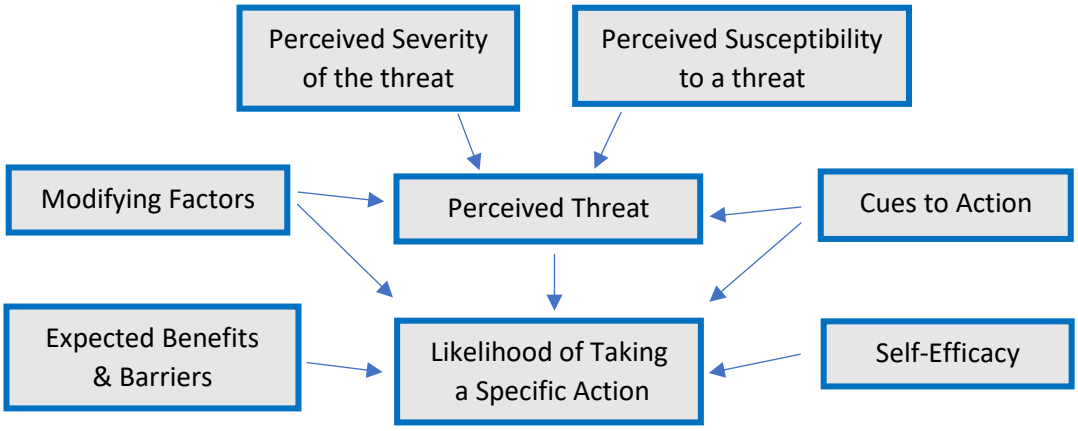

Figure 1. The Health Belief Model

Understanding nurses' perception of the threat of fatigue and their likelihood of taking actions to reduce their risk of fatigue aligns with the HBM. Although nurse fatigue is a well-researched topic, the literature is lacking in descriptions of interventions to reduce fatigue among nurses. What is needed to address work-related fatigue among nurses is the discovery of fatigue countermeasures in which nurses are willing to participate. This study uses the HBM to explain acceptance of specific fatigue reductions strategies among nurses.

Operationalizing the Health Belief Model in a Study of Nurse Fatigue

Because this study focused on perceptions of fatigue and willingness to engage in specific fatigue countermeasures, the HBM was adapted to focus on these constructs in the model: perceived susceptibility, perceived severity, modifying factors and the likelihood of taking specific actions (see Figure 2). Fatigue represents the threat in HBM. Perceived susceptibility was operationalized by exploring nurses' perceived risk of experiencing work-related fatigue. Perceived severity was operationalized by exploring nurses' concerns about performance outcomes related to working while fatigued. These two constructs combined create the nurses overall perception of the threat of fatigue, which represents the latent variable *perceived threat* (Simons-Morton et al., 2012). Modifying factors was operationalized by exploring relationships between nurse age, years as a nurse and education level, and the perceived threat of fatigue. Likelihood of taking action was operationalized by asking the nurse about their likelihood to engage in specific preventive actions related to fatigue.

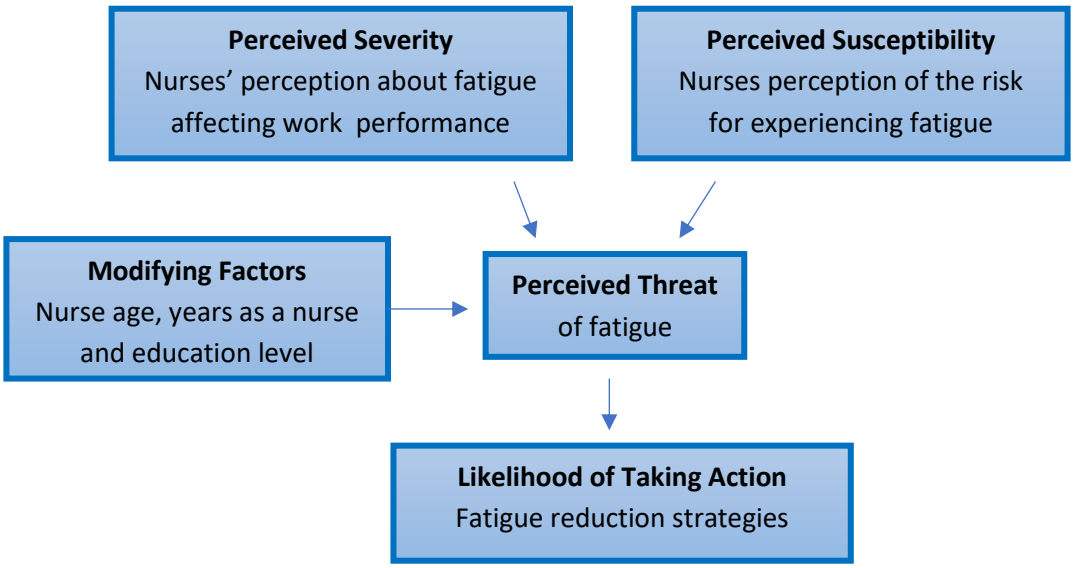

Figure 2. Operationalization of the Health Belief Model in a Study of Nurse Fatigue

Conceptual Definitions

Perceived susceptibility. Perceived susceptibility is defined as an individual's acknowledgement of susceptibility to a threat (Simons-Morton et al., 2012). It is the individuals' consideration of their chances of experiencing the threat.

Perceived severity. Perceived severity is defined as an individuals' beliefs about the seriousness of the threat (Simons-Morton et al., 2012). With severity, the individual considers how great the impact could be and the difficulties the threat would cause.

Perceived threat. Perceived threat is a latent variable made up of an individuals' beliefs about their susceptibility to and the severity of a threat (Simons-Morton et al., 2012). This combination results in the overall perception of the threat.

Modifying factors. Individual characteristics can serve as modifying factors to influence the perceived threat (Rosenstock, 1974). Modifying factors included in this study are nurse age, years as a nurse and level of education.

Summary

It is widely accepted that fatigue degrades a workers' performance and negatively affects quality of life. Other safety sensitive industries have established limits for work hours and requirements for rest periods in the interest of public safety. There is a need to address worker fatigue in the healthcare industry. Healthcare and nursing specifically have been slow to respond to the evidence connecting worker fatigue and worker performance.

As discussed, numerous studies suggest that working long hours and overtime contributes to fatigue. Many nurses work long hours because the 12-hour shift is a common staffing pattern for hospital nurses. The evidence supports that those working long hours, such as a 12-hour shift, report higher fatigue when compared to those working eight-hour shifts. Nurse fatigue is a widespread issue and the cost is high. Working while fatigued results in poorer patient and nurse outcomes. However, the context in which fatigue occurs in nursing is complex, making it challenging to address. Far fewer studies can be found on fatigue countermeasures than the existence, antecedents and consequences of the phenomenon. The gap in the literature, and in the science, is in fatigue countermeasures among nurses.

Addressing nurse fatigue is an important task that must be undertaken. The need to reduce fatigue among nurses has been discussed by the National Academy of Medicine

(formerly the Institute of Medicine), the Joint Commission, OSHA, National Institute for Occupational Safety and Health (NIOSH), Healthy People 2020 and many nursing professional organizations such as the American Nurses Association (ANA). National goals for Healthy People 2020 are to reduce preventable injuries and deaths and to promote health. Specific focus is placed on promoting workplace health and safety through prevention of work-related illness, injuries and deaths (Office of Disease Prevention and Health Promotion, 2019). Objectives are addressed through research activities supported by the Center for Disease Control and Prevention (CDC) and the National Occupational Research Agenda.

A training course is available from NIOSH to educate nurses and their managers about the association between working long hours and/or working during the night and workplace fatigue, and the associated health and safety risks. The training recommends strategies to minimize fatigue such as good sleep hygiene, use of caffeine and naps at work, fatigue assessment in the workplace, management of work schedules, exercise and techniques for relaxation and coping (Caruso et al., 2015). The Joint Commission issued a Sentinel Event Alert regarding healthcare worker fatigue with recommendations that also included use of caffeine, naps and exercise, to assess for fatigue, sleep hygiene, education of staff on fatigue, and to consider fatigue as a potential factor when errors occur (The Joint Commission, 2011).

The ANA urges employers to design staffing schedules to minimize fatigue and stresses that the Code of Ethics for Nurses acknowledges the self-accountability of nurses in the management of fatigue (Brown et al., 2020). The ANA recommends that nurses

obtain seven to nine hours of sleep in each 24-hour period, nap at work if allowed, take breaks, to eat healthy and exercise, avoid use of caffeine, and to self-assess for fatigue, alertness and safety (Brown et al., 2020). The American Academy of Nursing recommends that organizations implement policies that promote healthy sleep, maintain a backup staffing plan and take a non-punitive approach for nurses too fatigued to work, design schedules that reduce fatigue, limit night shifts to eight hours, assess for fatigue during incident investigations, address sleep disorders, the use of naps and breaks while at work, and education of managers and staff nurses about the risks of fatigue (Caruso et al., 2019).

Collectively, these recommendations suggest implementation of several actions to reduce fatigue among nurses. It is time for the nursing profession to respond to the evidence and take tangible action to reduce fatigue. However, prior to devising interventions, an assessment of what nurses are willing to do to reduce fatigue is needed. Interventions must be deemed acceptable to nurses. This study described nurses' self-perceptions of fatigue and explored nurses' willingness to engage in specific fatigue countermeasures. Relationships between the perceived threat of fatigue and the nurses' age, years of experience and education level were explored. Also, the effect of perceived threat of fatigue on the nurses' willingness to engage in fatigue reduction strategies were examined.

CHAPTER II

LITERATURE REVIEW

An extensive review of the literature related to nurse fatigue and interventions used in safety sensitive industries to reduce workplace fatigue was conducted in preparation for this research study. The reduction of nurse fatigue is important to the health and safety of nurses as well as the quality of patient care. Understanding the current state of the science can inform next steps to be taken in efforts to reduce nurse fatigue. Other concepts closely related to, but distinct from fatigue, and not focused on in this literature review include stress, burnout, compassion fatigue and sleepiness. The purpose of this literature review was to describe what is currently known about nurse fatigue and interventions that may aid in reducing nurse fatigue.

Literature Search Method

In an effort to explore the literature on nurse fatigue, searches were conducted using the University of North Carolina at Greensboro (UNCG) library, Western Carolina University (WCU) library and Google Scholar. Databases searched included the Cumulative Index for Nursing and Allied Health Literature (CINAHL), Medline, PubMed, Elton B. Stephens Co (EBSCO*host*), PsycINFO, and the Offshore Vessel Inspection Database (OVID). The list of keywords used in the search was developed with the assistance of a UNCG librarian. Keywords used in the literature search included nurse fatigue, occupational fatigue, fatigue management, fatigue countermeasure, fatigue

intervention, fatigue and nurse performance, fatigue and errors, fatigue and shift length, and nurse health. The search was limited by using a Boolean search that included combinations of keywords and NOT compassion fatigue, cancer, multiple sclerosis, chronic fatigue syndrome, disease, patient fatigue or burnout. The search was additionally limited to articles published in peer reviewed journals, in English, between 2010 and 2020 to reflect the current state of the science. Abstracts were reviewed to assess appropriateness for inclusion in this review. References provided in articles of interest were also reviewed for potential inclusion in this review. Focus was placed on literature addressing work-related fatigue among nurses. Literature focused on compassion fatigue, stress, burnout, chronic fatigue syndrome, fatigue related to medical conditions, or patient fatigue were excluded from this review. Literature reviews, policy briefs, commentaries, and letters to the editor were also excluded. This resulted in the inclusion of 28 articles meeting the selection criteria for this review. See Figure 3.

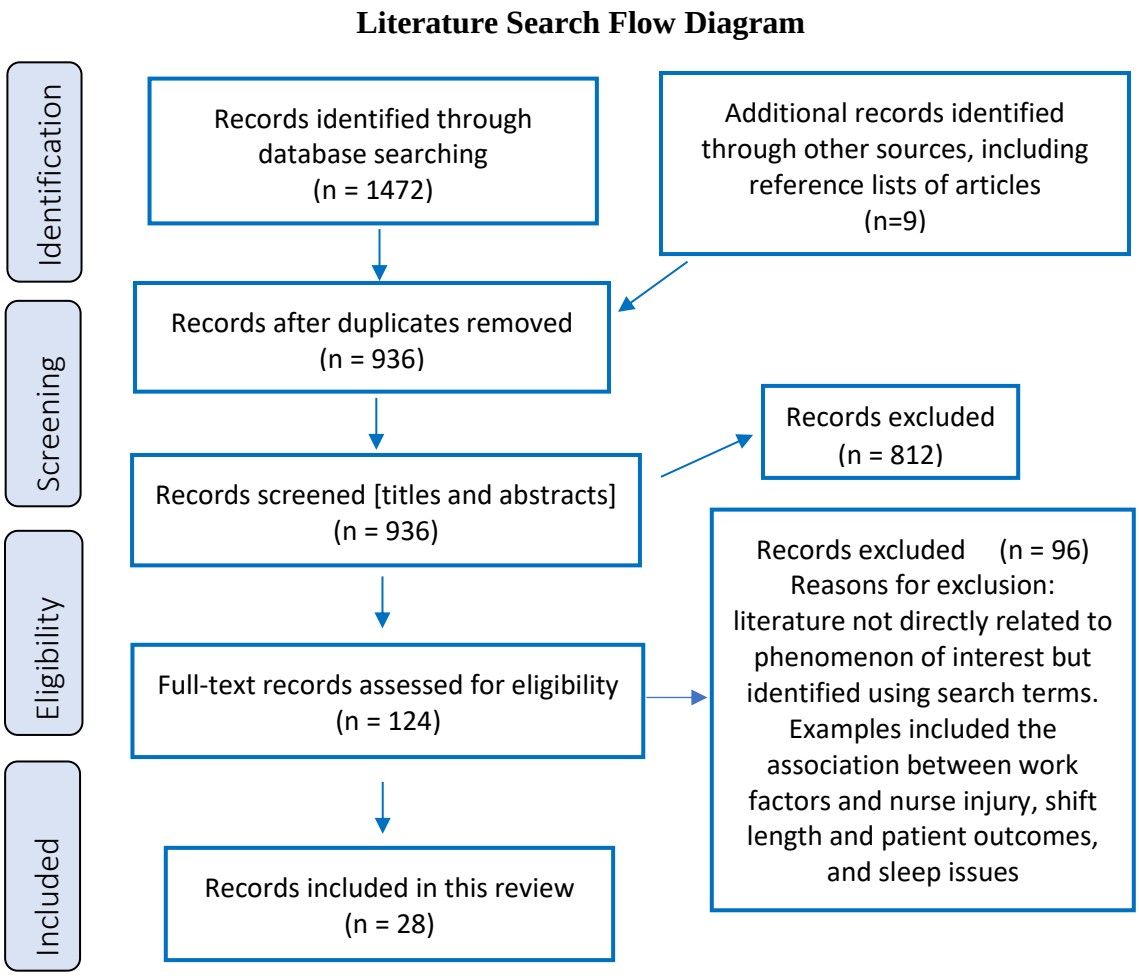

Figure 3. PRISMA Diagram (Nursing)

Publications in this review included 11 quantitative, three qualitative, six intervention, two mixed methods, one observational, and five secondary data analysis studies that presented original research. Among these, four were national surveys. Also included is a newly proposed theory explaining the occurrence of nurse fatigue and data mining of an error reporting system. Most studies were conducted in the United States; two were in New Zealand and one each was conducted in Canada, Austria, Indonesia, Iran, and Taiwan. Sample sizes ranged from 10 – 3,133 nurses. Much more descriptive

research (22) was found in the literature than intervention (six) studies. The gap in the science is clearly in interventions to mitigate nurse fatigue.

Literature Review with Focus on Nurse Fatigue

Evidence suggests that numerous factors contribute to the occurrence of nurse fatigue. Work-related fatigue among nurses can result from various characteristics of the work environment, disrupted sleep, individual factors and the culture of professional nursing. It appears that nursing is in the early stages of addressing the occurrence of work-related fatigue.

Influence of Work Characteristics on Nurse Fatigue

Research suggests that nurse fatigue is associated with numerous work factors. Working long hours, i.e. greater than eight hours, working overtime, rotating shifts, lack of breaks while at work, inadequate time to recover between shifts and stress in the work environment are associated with nurse fatigue (Barker & Nussbaum, 2011; Han et al., 2014; Knupp et al., 2018; Neville et al., 2017; Yuan et al., 2011). Gander et al. (2019) reported fatigue increases when nurses work greater than 30 minutes beyond the scheduled shift. Knupp (2018) and MacKusick (2010) both found distress related to patient care to be associated with fatigue among nurses. Additionally, poorly performing technology, poor layout of the unit which leads to excessive walking, lack of private break areas, poor staffing, turnover of staff, precepting responsibilities, and repetitive charting contribute to nurse fatigue (Steege & Dykstra, 2016; Wingler & Keys, 2019).

A national survey revealed that the duration and frequency of call requirements among certified registered nurse anesthetists (CRNAs) is a predictor of fatigue. Working

the next day after being on call, without adequate time off contributes to fatigue and the commission of errors among CRNAs (Domen et al., 2015). Nurses are at exceedingly high risk of fatigue because these are common characteristics of the work of nurses.

During interviews nurses stated that physically demanding patient care activities contribute to physical fatigue while activities of high cognitive demand such as multi-tasking, time management, organization/planning, and interruptions contribute to mental fatigue (Steege et al., 2015). High physical demands also reduces the ability to recovery between worked shifts (Steege et al., 2018). A study among emergency room triage nurses revealed that fatigue increased as the time they performed triage increased, with the biggest percent increase in fatigue being between hours four and eight (McMahon et al., 2017). Furthermore, fatigue increases over consecutive worked days and evidence suggests that it takes three days off of work to recover from two consecutive 12-hour shifts (Blasche et al., 2017).

Influence of the Social Environment of Nurses' Work Settings

Evidence suggests that the social environment in the work setting greatly influences the occurrence of fatigue among nurses. Two qualitative studies by Steege et al., (2015) and Steege and Dykstra (2016), revealed that lack of team support and social support contribute to both mental and physical fatigue. Similarly, MacKusick and Minick (2010) found that lateral violence from co-workers, lack of a supportive manager and emotionally distressing patient care contributed to extreme fatigue and exhaustion. Conversely, social support from coworkers and supervisors is associated with lower fatigue and higher recovery between shifts (Han et al., 2014). Nurses have reported that a

caring manager, satisfaction with the work schedule, supportive co-workers and a sense of teamwork, promote coping and prevents fatigue (Steege & Dykstra, 2016). Increased autonomy is associated with lower levels of fatigue (Gander et al., 2019; Steege et al., 2015, 2018). Knupp (2018) reported that the nurse manager's abilities to lead and offers of support are significantly associated with nurse fatigue, higher abilities to lead support lower fatigue. Access to managers and time to communicate with managers has been associated with reduced fatigue among nurses (Steege et al., 2018). Managers set the tone of the work environment, have potential to influence the occurrence of fatigue, and are key in creating a healthy work environment.

A study involving 20 recovery room nurses revealed no association between workload and fatigue (Hazzard et al., 2013). Although the nurses in the study had high levels of acute fatigue, the ability to recover between shifts was also high. Nurses reported that they had sufficient time between patient admissions, were able to help other nurses when needed, were able to take breaks, did not work beyond the scheduled 12-hour shift and were able to avoid three consecutive shifts (Hazzard et al., 2013). Autonomy in scheduling, the presence of teamwork and staggering of shift start/end times contributed to the participants ability to engage in these fatigue countermeasures. Hazzard and colleagues' study provided strong evidence of the influence of the work environment on fatigue.

Drake et al., (2012) proposed a new theory explaining that the work environment can either support the work of nurses, thereby increasing nurse wellness and safety, or impede the work of nurses, thereby promoting fatigue and increasing the risk of

occupational injury and patient care errors. Evidence from this literature review lends support for the proposed theory.

Influence of Individual Characteristics on Nurse Fatigue

The influence of age and caregiving responsibilities outside of work on fatigue is not clear. Younger age has been associated with higher fatigue by Drake and Steege (2016), Neville et al. (2017), Widyanto et al., (2018), Yu et al., (2019) and Steege et al. (2018). Conversely, Chen (2014) found older age to be associated with higher fatigue. Chen (2014) and Han et al. (2014) found no association between fatigue and caregiving responsibilities outside of work. Yu et al., (2019) found caregiving responsibilities outside of work to be associated with lower levels of fatigue (Yu et al., 2019). However, Widyanto et al., (2018) found caregiving responsibilities to be associated with higher fatigue and Neville et al. (2017) found caregiving responsibilities outside of work to be a predictor of higher fatigue. The conflict in outcomes found in the literature may point to other factors being more prominent in influencing the occurrence of fatigue than age and caregiving responsibilities outside of work.

Researchers have found engaging in exercise to be associated with lower levels of fatigue (Afrasiabifar et al., 2018; Chen et al., 2014; Yu et al., 2019). Chen (2014) reported that percent of body fat and type of unit on which the nurse worked was not associated with fatigue. Additionally, Steege et al. (2018) reported an association between increased years of experience and decreased reported fatigue. It is possible that years of experience leads to positions that result in less fatigue. Neville et al. (2017) found having a second job to be a predictor of fatigue. A study among 39 nurses working

in an emergency department in Indonesia revealed severe fatigue is associated with malnutrition of the nurse (Widyanto et al., 2018).

Sleep appears to have a clear influence on fatigue. Barker and Nussbaum (2011) reported that nurses who obtained less than six hours of sleep had higher fatigue. Lower amounts of sleep were associated with higher levels of fatigue among nurses in numerous studies (Blasche et al., 2017; Gander et al., 2019; Knupp et al., 2018; Scott et al., 2010).

Influence of Nursing Culture on Fatigue

Nursing professional culture has been found to be a barrier to implementation of fatigue countermeasures among nurses. Nurse fatigue is viewed as a normal part of the job (Steege et al., 2017b; Steege & Rainbow, 2017). Self-expectations as well as peer and management expectations not to take a break, and the opinion that fatigue is a sign of weakness present barriers to use of countermeasures (Steege & Rainbow, 2017). Nurses have demonstrated reluctance to participate in fatigue countermeasures during intervention studies and expressed guilt for participation in countermeasures (Scott et al., 2010; Smith-Miller et al., 2016).

Although many nurses are in favor of the 12-hour shift, study results offer evidence of chronic fatigue and an inability to adequately recover from such long work hours (Chen et al., 2014). Chen et al. (2014) found that despite the negative nurse outcomes associated with longer shift lengths, nurses are satisfied with working a 12-hour shift. Whether or not nurses recognize when they are fatigued and its impact on their performance is unclear. In a national survey, nurses acknowledged that working while fatigued negatively affected their performance (Pasupathy & Barker, 2012).

However, other researchers found that nurses often do not recognize that fatigue negatively impacts their performance (Smith-Miller et al., 2016). The question remains whether health care workers who are fatigued have the capacity to determine if they are able to work safely (Gardner & Dubeck, 2016). The extent to which nurses are capable of accurately assessing personal fatigue is also unknown.

Impact of Nurse Fatigue

Research indicates that fatigue degrades performance leading to a decrease in safety for nurses and poorer patient outcomes. Fatigue is associated with poorer perceived performance, a decrease in work satisfaction, reduced motivation, negative mood, cognitive degradation (i.e. reduced concentration, lapses of attention to detail and compromised problem solving), physical degradation (i.e. increased risk of illness, reduced reaction time, inability to maintain balance and reduced energy), decisions to take shortcuts, occupational injury, increased risk of error, an increase in perceived stress and a decreased quality of life (Barker & Nussbaum, 2011; Gardner & Dubeck, 2016; Han et al., 2014; MacKusick & Minick, 2010; Steege et al., 2015; Yuan et al., 2011).

Fatigue reduces situational awareness, vigilance, empathy and the desire to care for patients (Wingler & Keys, 2019). The nurses' ability to remain vigilant impacts patient monitoring, medication administration, and documentation (Barker & Nussbaum, 2011). The ability to plan, assess risk and make timely decisions are at the foundation of safe nursing practice. A national survey in New Zealand asked nurses to recall errors where fatigue was considered to be a contributing factor during the previous six months. Study participants totaled 3,133 nurses. The study revealed that the occurrence of

fatigue-related errors were recalled by 31% of the nurses (Gander et al., 2019). Barker and Nussbaum (2011) found that nurses working during the night are three times more likely to commit errors compared to those working during the day.

The 12-hour shift has become a widely used scheduling pattern in hospitals. Working long hours is associated with fatigue, errors, burnout, absenteeism and nurses decisions to leave the profession (MacKusick & Minick, 2010). Fatigue has an inverse relationship with nurse wellness, and nurse and patient safety (Drake & Steege, 2016; Wingler & Keys, 2019). Conversely, fatigue has demonstrated a positive relationship with depression, sleepiness and stress (Drake & Steege, 2016). Nurses demonstrating a high level of chronic fatigue reported a reduced sense of meaning in their work (Han et al., 2014). Fatigue contributes to nurses losing the desire to be a nurse (Wingler & Keys, 2019).

The Pennsylvania Patient Safety Authority's Pennsylvania Patient Safety Reporting System (PA-PSRS) captures fatigue as a contributing factor when errors have occurred. Data mining of the errors reported revealed that between 2004 and 2013 the most frequently reported error associated with fatigue was related to medication administration (n =995); other errors were related to lab tests and procedures (Gardner & Dubeck, 2016). Pennsylvania is unique in that fatigue is assessed when errors occur. A national survey of nurse leaders revealed that few organizations monitor fatigue among nurses, 90% of respondents had no resources to support decisions about nurse fatigue, approximately half did not feel their organization was aware of sources of nurse fatigue, and only one quarter of the survey respondents indicated that their organization has a

fatigue management policy (Steege et al., 2017b). Nurse leaders stated that there is a deficit in recognizing the importance of fatigue and that the social norms of fatigue impede the advancement of the issue to prompt changes (Steege et al., 2017b). Again, this harkens back to the suggestion that attitudes about fatigue are a barrier to addressing the phenomena. Additionally, Steege (2017) reported that only 19% of nurse leaders had a policy that limits nurse work hours to less than 60 hours in a 7-day period; 26% had a policy that limits shift length to 12 hours in a 24-hour period; only 33% had a policy that limits the number of consecutive shifts (Steege et al., 2017b).

Interventions to Reduce the Occurrence of Fatigue Among Nurses

Few interventions aimed at reducing nurse fatigue were found in the literature. This is where the gap in the science lies. Knowledge about effective interventions to reduce nurse fatigue is needed. A description of interventions found in the literature follows.

Scott et al. (2010) studied napping as an intervention aimed at reducing fatigue and patient care errors. Researchers state that there were 47 nurses in the study, however in the demographics they report 17 worked day shift, two worked evening and 25 worked night shift (Scott et al., 2010). The discrepancy is not explained. Although napping was the main focus of the intervention, the researchers also included a 60-minute education activity about how to minimize fatigue, sleep and circadian rhythms, use of caffeine, and how the work schedule could be managed to avoid fatigue and sleep deprivation. The units where participants worked were required to provide adequate staffing so that nurses could take duty free breaks, i.e. breaks free of patient care responsibility, and provide

space for nurses to nap. Results revealed that participants developed better sleep habits, averaged an increase in their sleep time, had a decrease in drowsiness at work, thus increased alertness at work, and a reduction in errors (Scott et al., 2010). Nurses reported feeling guilty for taking breaks and napping, while at the same time were more aware of feeling fatigued and of the need to sleep. Results indicate that this intervention was successful overall, but fatigue was not directly measured. Thus, napping improved measurements of sleep and reduced errors, but it remains unclear if fatigue was reduced in this study.

Napping was also explored through an observational study. The aim of the study was to explore the relationship of night-shift napping on fatigue (Neville et al., 2017). This study included 65 nurses who work night shift. The study involved a comparison of fatigue between nurses who engage in napping during night shift and those who do not nap during the shift. The Brief Fatigue Inventory scale was used to measure fatigue. The study revealed no statistically significant differences in fatigue between nurses who nap and those who do not nap during the night shift (Neville et al., 2017).

Another study focused on the effect of duty-free breaks as part of a larger fatigue management plan. The aims of the study were to identify the barriers and facilitators in implementing a fatigue management plan and to evaluate the effects of a taking duty-free breaks on nurses (Smith-Miller et al., 2016). The sample included 614 nurses, including day, night and rotating shifts, on four nursing units. The units included a medical-surgical unit, a surgical unit, a medical unit and a women's health unit. The three-month intervention included a duty-free break, limiting the shift length to 12.5 hours, requiring

48 hours off between a rotation of shifts from day to night or night to day, and limiting consecutive shifts to no more than 60 hours in a seven day period. Both quantitative and qualitative data were collected. During the intervention, the number of nurses taking breaks increased (Smith-Miller et al., 2016). Nurses reported feeling guilty for taking breaks, but also acknowledged the benefits of taking the break. The ability to recover between shifts improved and fatigue decreased with the intervention (Smith-Miller et al., 2016). The instrument used to measure fatigue and the ability to recover was the Occupational Fatigue Exhaustion Recovery survey. Over the course of the intervention, nurses' attitudes about taking breaks gradually changed with the expectations and encouragement of managers to take a break. The study revealed that the nurses themselves and the culture of the work environment presented a barrier to the intervention.

A study in Iran aimed to examine the impact of core stability exercises on nurse fatigue. The study included 46 nurses in a core stability exercise intervention (Afrasiabifar et al., 2018). An experimental design was used, including a control group and an intervention group. Nurses in the intervention group did core stability exercises for approximately 45 minutes, three times a week, for six weeks. Fatigue was measured pre and post intervention using the Multidimensional Fatigue Inventory (MFI) in this study. Results revealed that core stability exercises were able to reduce nurses' physical and mental fatigue scores (Afrasiabifar et al., 2018).

A study in Indonesia explored the effect of deep relax inspiration–pursed lip breathing on fatigue among nurses in the emergency department. The interventional

study included 39 nurses (Widyanto et al., 2018). The intervention involved engaging in deep relax inspiration–pursed lip breathing for 10 minutes, four hours into the shift, for six consecutive days. Fatigue was measured pre and post-intervention using the Fatigue Feelings Questionnaire (KAUPK2), the Visual Analogue Fatigue Scale (VAFS) and an interview (Widyanto et al., 2018). Study results revealed significant decreases in fatigue post-intervention.

An intervention of light exposure was studied among 33 Canadian nurses working night shift (Olson et al., 2019). The intervention included 40 minutes of bright light exposure prior to the start of the shift and use of sunglasses after the shift. Participants also used a sleep mask once they retired for sleep. The MFI was used to measure fatigue. The results suggest that strategic manipulation of light exposure is effective at reducing fatigue among the night shift nurses (Olson et al., 2019) .

Literature Review Focused on Fatigue Reduction in Other Industries

Addressing worker fatigue is one of the goals of the National Institute for Occupation Safety and Health (NIOSH). Experts in the field of fatigue management who are associated with NIOSH identified the following as *safety critical industries:* healthcare, aviation, rail and road transportation, mining, oil and gas, nuclear and maritime (Caldwell et al., 2019; Fletcher et al., 2015). These industries have been identified as *safety critical* because the performance of workers has the potential to impact public safety.

An additional literature search was conducted to explore efforts to reduce work-related fatigue in industries where safety is a high priority, outside of nursing. A

literature search was conducted using the University of North Carolina at Greensboro (UNCG) WorldCat library to explore the interventions used to reduce fatigue in other safety sensitive industries. In order to keep the search manageable, the search was limited to the following safety focused industries: aviation, transportation, and nuclear.

The list of keywords used in the search included fatigue reduction, intervention, prevention, countermeasures, safety sensitive industries, pilot, aviation, air traffic controller, nuclear, power plant, rail, railroad, worker, operator, and transportation. The search was limited by using a Boolean search that included combinations of keywords and NOT mechanical fatigue, metal, structural, compassion fatigue, cancer, chronic fatigue, disease, or patient fatigue. The search was additionally limited to articles published in peer reviewed journals, in English, between 2015 and 2020 to reflect current strategies in use to reduce fatigue. Abstracts were reviewed to assess appropriateness for inclusion in this review. References provided in articles of interest were also reviewed for potential inclusion in this review. Focus was placed on literature addressing the reduction of work-related fatigue. Literature focused on factors that contribute to fatigue, fatigue related accidents, fatigue related to medical conditions and stress fatigue on metal or structures were excluded from this review. This resulted in the inclusion of six articles meeting the selection criteria for this review. See Figure 4.

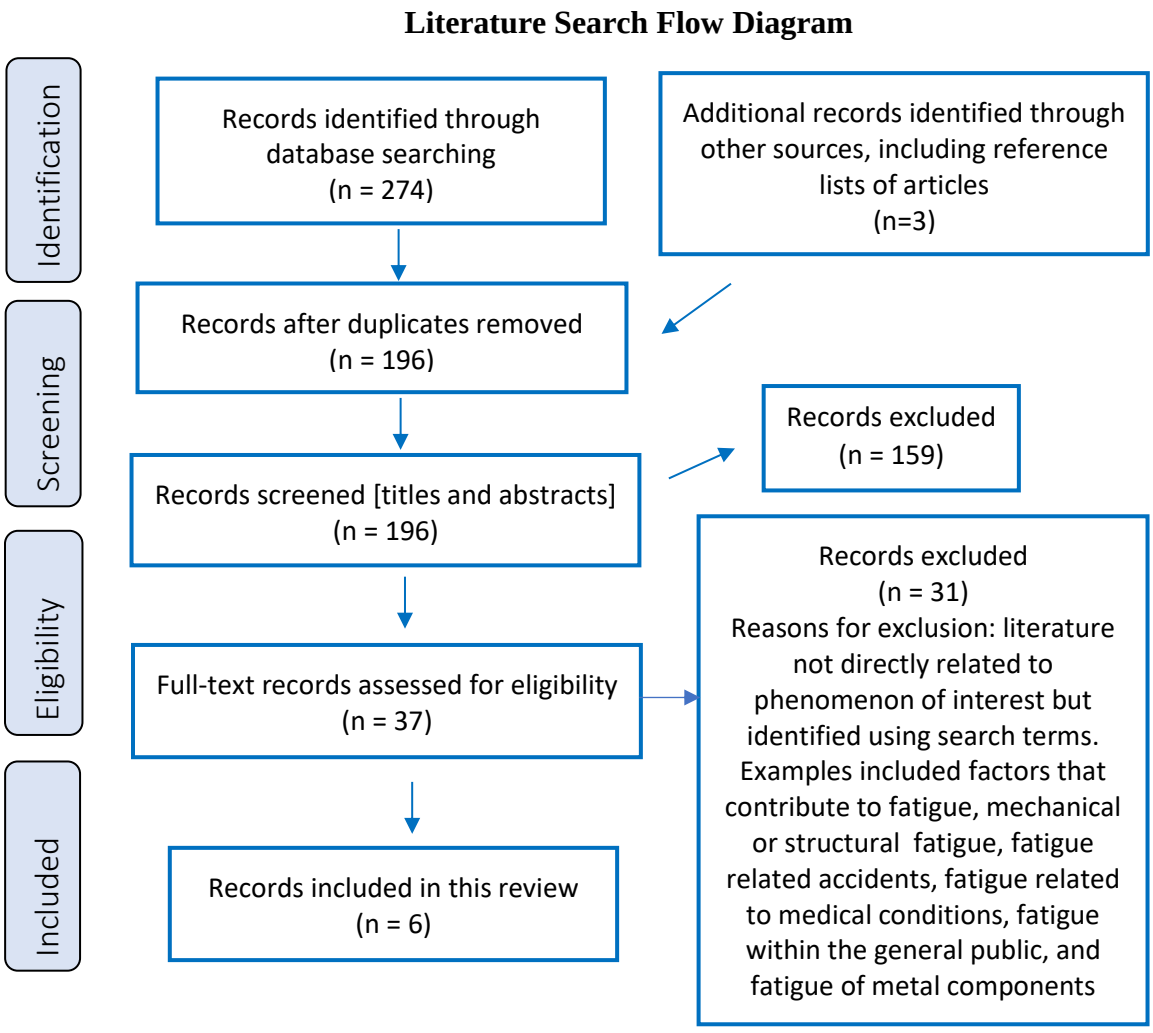

Figure 4. PRISMA Diagram (Industry)

Fatigue Countermeasures in Other Industries

Studies found were conducted in the U.S., New Zealand and Taiwan. Both qualitative and quantitative studies were found. Sample sizes ranged from 10 to 291. The focus of three publications was aviation, two focused on the rail industry, one focused on nuclear power plants and two were literature reviews conducted by individuals associated with NIOSH.

Pilots are allowed sleep breaks to reduce the occurrence of fatigue during flights. Sleeping during breaks has been found to reduce fatigue among pilots in both qualitative and quantitative studies (Lamp et al., 2019; Zaslona et al., 2018). Pilots take turns rotating off duty for breaks and have the opportunity to sleep from two to seven hours depending on the length of the flight and the time of the day of the flight (*FAA Regulations*, 2019; Lamp et al., 2019). In order to meet safety standards, a 16-hour flight would require four pilots so that each pilot has the opportunity to obtain the prescribed amount of sleep. This staffing model has demonstrated effective management of fatigue (Lamp et al., 2019). Pilots have reported that sleep is effective in reducing feelings of fatigue (Zaslona et al., 2018).

The use of peppermint to improve performance and reduce fatigue was examined among 16 air traffic controllers. Workers were divided into either a control or experimental group. Workers had a diffuser with peppermint essential oil placed in their confined work space as the intervention. Fatigue was measured by an electroencephalograph (EEG), a heart rate monitor (HRM), and psychomotor vigilance task (PVT) apparatus (Pujiartati & Yassierli, 2017). Exposure to the scent of peppermint significantly improved participant performance during simulations when compared to the control group and inhibited the development of fatigue (Pujiartati & Yassierli, 2017).

Feedback from 28 workers in the rail industry revealed that the regulations around scheduling were not perceived to be effective at alleviating fatigue (Filtness & Naweed, 2017). Workers reported that managers placed focus on covering shifts as opposed to driver fatigue, which led to working overtime offered by managers and that drivers

swapped shifts averting scheduling guidelines which led to a lack of recovery time between shifts. Workers felt that the mathematical modeling used to create schedules was ineffective and did not take into account individual opinion or experience with fatigue (Filtness & Naweed, 2017). Train drivers reported inviting others into the cab, drinking caffeine, smoking, making phone calls, moving around and standing up, slowing the train down in efforts to deal with feeling fatigued when working or calling in sick because of feeling too tired to report to work (Filtness & Naweed, 2017). The drivers acknowledged that distractions such as having others in the cab and making phone calls, as well as standing up when driving the train are against safety regulations. Conversely, Zaslona (2018) received positive feedback from 291 pilots regarding the design of schedules because their opinions had been considered during the design of schedules and fatigue reduction strategies.

Smith et al. (2018) found that education could potentially be effective at reducing fatigue among workers in the rail industry. After 200 rail workers participated in fatigue training as part of a fatigue management plan, workers reported an increased awareness of factors that contribute to fatigue, improved ability to identify personal fatigue, increased knowledge of ways to manage fatigue, and recognized the importance of sleep in relation to fatigue (Smith et al., 2018).

In an effort to identify a fatigued worker, 10 participants working night shift in a nuclear power plant wore a monitor that detected brain waves as a measure of mental fatigue. Lower alpha rhythm is associated with fatigue (Tsai, 2017). When the monitor detected lower alpha rhythms, an alarm was triggered to alert the worker as well as

nearby co-workers. The monitor successfully alerted the worker and co-workers upon detection of lowering alpha rhythms (Tsai, 2017). No other studies were found describing actions taken to address fatigue among power plant workers.

Gap in the Literature

The research literature on nurse fatigue and fatigue in safety critical industries was reviewed. Many publications were found describing contributors to fatigue. Numerous studies link work characteristics such as working long hours without adequate time to recover between work periods, a lack of breaks while at work, a stressful work environment, lack of teamwork, and the disruption of sleep with higher fatigue among nurses. Far fewer studies are found on interventions to reduce fatigue. Literature describing interventions to reduce fatigue included taking duty-free breaks, napping when on breaks, exercise, deep breathing, exposure to light, exposure to the scent of peppermint, fatigue education as part of a fatigue management plan, and use of a monitor and alarm system to detect fatigue. This literature review has revealed a gap in the science regarding strategies to reduce the occurrence of work-related fatigue among nurses.

Summary

Fatigue among nurses has gained attention both in the U.S. and internationally. Nurses are at high risk of work-related fatigue and the literature suggests a high prevalence of fatigue exists. The negative impact of nurse fatigue on patient outcomes is well documented. A fatigued nurse with reduced cognitive and physical abilities is a risk to his or her own safety as well as patient safety. Furthermore, fatigue negatively affects

quality of life for nurses. The phenomenon of nurse fatigue is complex, with numerous contributing factors, thus the solutions will not be simple. There is no one magic answer. Complexity of the issue makes it challenging to address. Nurse fatigue should be mitigated in the interest of creating a safe working environment and ensuring the best environment for quality patient care.

Other industries have placed regulations on work schedules to reduce fatigue among their workers. Hours on duty are limited and time off between work periods are detailed. No federal work regulations exist in nursing. Although there are common factors that contribute to fatigue across industries, solutions must be industry specific because solutions found to be effective in one work setting do not necessarily work in another (Fletcher et al., 2015). One must consider the practicality of possible countermeasures for each work setting.

Successful efforts to mitigate nurse fatigue will require partnership between nurses, managers, healthcare administrators, and policy makers. Solutions must be designed by all stakeholders (Caldwell et al., 2019; Fletcher et al., 2015). Nursing professional culture presents a barrier to implementation of fatigue countermeasures (Scott et al., 2010; Smith-Miller et al., 2016). Thus, nurses must be part of the solution and decision making process from the beginning. Nurses opinions about fatigue reduction strategies must be explored because their buy in is paramount to the success of any fatigue management initiative. Because NIOSH, the American Nurses Association and the American Academy of Nursing recommend managing schedules to reduce

fatigue among nurses, an exploration of acceptable modifications to work schedules among nurses is needed.

A nurse less fatigued is more focused, can think more critically and make better decisions. Organizations benefit from reducing nurse fatigue because it reduces injuries, illnesses, burnout, missed workdays and turnover. The general public benefits because by reducing nurse fatigue, patient safety improves. Staff nurses benefit through improved personal safety and quality of life.

CHAPTER III

METHODOLOGY

There is an abundance of studies in the literature describing the factors that contribute to nurse fatigue and the negative outcomes of working while fatigued. A paucity of literature can be found describing strategies to reduce fatigue among nurses. Fatigue reduction among nurses is needed for the improvement of nurse well-being and in the interest of public safety. Nurses have demonstrated reluctance to participate in interventions to reduce fatigue (Scott et al., 2010; Smith-Miller et al., 2016). This research study addresses a gap in current knowledge about strategies in which nurses are willing to engage to mitigate fatigue. Results will inform interventions that can be implemented going forward in efforts to prevent and alleviate nurse fatigue. Focus was placed on workplace strategies, to offset known contributors of fatigue, in an effort to reduce fatigue among nurses. In this chapter, the methods to examine nurses' self-perception of fatigue and nurses' willingness to engage in specific fatigue reduction strategies are detailed.

Theory, research and evidence are inseparable (Fawcett et al., 2001). Further, evidence generated from non-theory guided studies, widen the theory-practice gap (Fawcett et al., 2001; Upton, 1999). Moreover, theory guided research, supports theory guided practice (Lor et al., 2017). The methodology for this study was guided by the Health Belief Model. Because theory guided the design of the study, the variables

selected for inclusion (age, education and years of experience), the research questions and analysis are consistent with concepts and their suggested relationships in the Health Belief Model. Relationships among variables proposed by the Health Belief Model were examined. The selection of fatigue reduction strategies included in the study was guided by other safety sensitive industries actions to reduce fatigue among workers and the recommendations from NIOSH, the American Nurses Association and the American Academy of Nursing to manage fatigue among nurses.

Study Purpose

The overall purpose of this study was to describe nurses' self-perception of fatigue and to examine nurses' willingness to engage in specific fatigue countermeasures. Relationships between the perceived threat of fatigue and the nurses' age, years of experience and education level were explored. Also, the effect of the perceived threat of fatigue on the nurses' willingness to engage in fatigue reduction strategies were examined.

Design

A descriptive, cross-sectional, correlational study was proposed. Using a cross-sectional design captures data from the sample at one specific moment in time. A cross-sectional design met the study goal of describing variables (Creswell & Creswell, 2018). A correlational study supported the study purpose, allowing for the exploration of relationships among variables (Creswell & Creswell, 2018; Tabachnick & Fidell, 2007). Measuring changes over time was not intended in this study, nor did it include

manipulation of any of the variables, thus a correlational, cross-sectional design was appropriate (Polit & Beck, 2017).

Setting and Sample

The study was conducted among nurses who provide direct patient care. The sampling frame included a large healthcare system in the southeast that employs approximately 7,000 nurses and social media platforms, Facebook and Instagram. Initial recruitment occurred within the healthcare system, and due to a low response rate, recruitment was extended to social media in an effort to augment participation. Inclusion criteria was that nurses be employed in a direct patient care role. All registered nurses (RNs) who provide direct patient care in the healthcare system and those reached through social media were eligible to participate in the study. Nurses who were not working in direct care roles and non-nurses were excluded. In the absence of providing an incentive, there was potential for a very low response rate, thus all eligible nurses were invited to participate in this study.

An a priori power analysis utilizing G* Power 3.1.9.4 was calculated for logistic regression. Power analysis indicated a sample size of 120 nurses was needed to meet statistical power for an alpha of 0.05, 80% power, a medium effect size (odd ratio = 2) and two-tailed test. The target sample was 150 participants to account for possible partially completed surveys. A minimum of 120 fully completed surveys was desired.

Data Collection

Data were collected using an anonymous Qualtrics survey. An online survey was well suited for this study because of the busy lifestyle of nurses. Recruitment occurred

through existing communication methods for research activities at the participating healthcare system and social media platforms, Facebook and Instagram. Participants completed the survey at their convenience, at any time during the study period. An adapted Tailored Design Method was used (Dillman et al., 2014). Lack of external funding prohibited offering incentives to survey participants as recommended by the Tailored Design Method. In an effort to maximize the response rate within the healthcare system, the survey link was sent to an identified contact person in the healthcare system to facilitate distribution (Dillman et al., 2014; Munn & Jones, 2020). A total of three emails, one per week for three consecutive weeks, was sent to each nurse (Munn & Jones, 2020). Each email included a direct link to the survey and a personal invitation from the researcher to participate in the study (Dillman et al., 2014; Munn & Jones, 2020). As discussed, due to a low response rate within the health system, data collection was extended by two weeks within the health system and was extended to social media for the same two week period.

Institutional Review Board (IRB) approval was sought from the University of North Carolina at Greensboro (UNCG) and the participating healthcare organization. There was no intended contact between the participants and the researcher. Contact between participants and the researcher would only occur if a participant initiated contact. The survey gathered no personally identifiable information and neither IP address nor email addresses were tracked. Responses to the online survey were downloaded into a statistical software database for analysis. Data are stored in UNCG Box, the university's cloud storage space.

Survey Instrument

The Fatigue Assessment Scale (FAS) was the instrument used to measure fatigue (Michielsen et al., 2003). The FAS is a general fatigue questionnaire developed to measure fatigue in the working population. The FAS has been used to measure fatigue in the general working population (Michielsen et al., 2003), among nurses (Barker & Nussbaum, 2011) and in a study targeting a variety of industry sectors, including healthcare (de Vries et al., 2017). The FAS is a 10-question instrument measuring total fatigue, with five questions measuring mental fatigue and five questions measuring physical fatigue. Respondents select options based on how they usually feel. Response options vary from never to always; 1 = never, 2 = sometimes; 3 = regularly; 4 = often; and 5 = always. Questions four and 10 require reversed scoring. Scores are then summed. The total score ranges from 10 to 50. Scores ranging from 10 – 21 represent a normal level of fatigue, scores from 22 – 34 represent high overall fatigue and scores from 35 – 50 represent extreme fatigue (Michielsen et al., 2003).

A comparison of five instruments has shown that the FAS has good convergent and divergent validity (de Vries et al., 2003; Michielsen et al., 2003). Factor analysis suggest the instrument is unidimensional, with item factor loadings ranging from 0.55 to 0.82 on a single factor (Hatcher, 1994). The underlying factorial structure was again suggested to have a single factor structure in another study (Völker et al., 2016). The FAS has demonstrated a high internal consistency, $\alpha = 0.90$ (Michielsen et al., 2003). The instrument is publicly available for use in research.

In addition to the FAS, demographic data were collected for the purpose of describing the sample and researcher developed questions, guided by the Health Belief Model (HBM) and evidence related to fatigue, were included on the survey instrument. Inclusion of the variables age, years as a nurse, and education level is supported by HBM and was included in examples in the literature where HBM guided studies about nurses (Chen et al., 2019; Quaranta & Spencer, 2015; Rosenstock, 1974; Simons-Morton et al., 2012).

Development of questions specific to the phenomenon of interest (perceived threat of nurse fatigue) follows examples found in the literature where other researchers developed questions to gauge the perceived threat of the specific subject studied (Chang et al., 2007; Chen et al., 2019; Quaranta & Spencer, 2015; Schulz et al., 2016). In examples found in the literature, researchers developed questions to explore participants perceived threat of tuberculosis, hearing loss, hepatitis B, influenza, measles, mumps, rubella, varicella, and asthma.

Sample questions to investigate the perceived threat of nurse fatigue include: "How likely are you to feel fatigued while at work?", "How susceptible are you to feeling fatigued due to the length of your shift?", " How worried are you about fatigue affecting your performance at work?", and "How worried are you about fatigue affecting your ability to concentrate while at work?". Response options ranged from "not at all" to "extremely". Recommendations to manage nurses work schedules by NIOSH, the American Nurses Association and the American Academy of Nursing and regulations in

other safety sensitive industries guided the fatigue reduction strategies explored in this study. The full survey is provided in Appendix A.

Data Analysis

The Statistical Package for the Social Sciences (SPSS) version 26 software (IBM Corp., Armonk, NY) and JASP (Version 0.13.1) [Computer software], which is freely available online, were used to conduct the statistical analyses. Descriptive statistics were used to summarize demographic characteristics of the participants, fatigue and related strategies. Univariate analysis was performed to calculate frequencies, percentages of categorical variables and examine the distribution/central tendency of continuous variables. A two-sided p value < 0.05 was considered to be statistically significant. Instrument reliability was estimated via internal consistency using Cronbach's alpha where $\alpha > 0.70$ is considered adequate (Nunnally & Bernstein, 1994). Data analysis methods by each research question were as follows:

RQ #1. What workplace fatigue reduction strategies are nurses willing to engage in to reduce their risk of experiencing work-related fatigue?

Analysis: Descriptive statistics were used to summarize the frequencies and percent of nurses willing to engage in each fatigue reduction strategy.

RQ #2. What are nurses' self-perceptions of fatigue?

Analysis: Nurses rated their perceived level of fatigue and also completed an established instrument that measures fatigue. Descriptive statistics were used to describe nurses' self-perceptions of fatigue. Spearman's rho was used to assess the correlation between the self-rated fatigue level and the FAS mean score. For additional congruency checking,

comparisons of means between the self-rating and instrument scores were explored using Analysis of Variance (ANOVA). Assumptions needed to run and interpret a parametric test are a minimum sample size of 40, independent data (non-paired), normal distribution of data within each group and equal variances between groups. Normality was checked through *Q-Q* Plots and the Shapiro-Wilk. Levene's test for equality of variances was used to assess group variances. If Levene's Test for Equality of Variances indicated unequal variances and normality could be assumed, Welch ANOVA is reported. However, if normality was violated, then the Kruskal-Wallis nonparametric ANOVA, which is robust to outliers and non-normality, is reported. If normality was assumed, post hoc tests were used to make pairwise comparisons either using Tukey's HSD if equal groups variances assumptions hold or Tamhane's procedure when there are unequal group variances. If normality was violated Mann Whitney U is reported for pairwise comparisons.

RQ #3. What is the relationship between nurses perceived threat of fatigue and nurse age, years as a nurse, and education level?

Analysis: Nurses responded to questions exploring their perceived susceptibility to fatigue and their perceived severity of fatigue. Nurses rated each item on a scale from one to five. Item responses were summed to create a score representing the nurses' perceived threat of fatigue. Higher sum scores indicate higher perceived threat. Count regression was performed to explore the relationship between the dependent variable (mean perceived threat sum score) and the independent variables (nurse age, years as a nurse and education level). The model does not require offset because all data were

collected within the same timeframe. Overdispersion was checked using the Lagrange Multiplier test and the Pearson Chi-square Goodness-of-fit statistic. Negative Binomial or Poisson regression is reported as appropriate.

RQ #4. What is the effect of perceived threat of fatigue on willingness to engage in fatigue reduction strategies?

Analysis: Logistic regression was used to examine the extent to which perceived threat sum scores are associated with the likelihood of engaging in fatigue reduction strategies. Assumptions to be met are independent data and no multicollinearity among independent variables (nurse age, years as a nurse and education level). Variance Inflation Factors (VIFs) were checked to determine if multicollinearity was present. Continuous variables were centered as appropriate to resolve multicollinearity. The effect of perceived fatigue on the odds of engaging in fatigue reduction strategies was quantified. Estimates of effect sizes were quantified by adjusted odds ratios (ORs) and their 95% confidence intervals (CIs). Goodness of fit of the model to the data was assessed through the Hosmer-Lemeshow test.

Summary

Contributors to fatigue as well as consequences of working while fatigued are well established. Numerous characteristics of the work environment, such as long work hours and lack of breaks, are associated with workplace fatigue. What this study adds is knowledge about nurses' abilities to self-assess fatigue and their willingness to engage in specific strategies to change the work characteristics that contribute to fatigue. Because

theory guided the design of the study, the methodology is consistent with concepts from the Health Belief Model.

The researcher aims to reveal fatigue reduction strategies that nurses would embrace in efforts to reduce the occurrence of fatigue, thereby improving the quality of life for nurses and the quality of patient care. Elements of the Tailored Design Method were included in the study design in an effort to increase response rates. The advice of a statistician for data analysis methods were sought to strengthen the study.

CHAPTER IV

RESULTS

The overall purpose of this study was to describe nurses' self- perceptions of fatigue and to examine nurses' willingness to engage in specific fatigue countermeasures. Relationships between the perceived threat of fatigue and the nurses' age, years of experience and education level were explored. Also, the effect of perceived threat of fatigue on the nurses' willingness to engage in fatigue reduction strategies was examined.

Data collection began after Institutional Review Board (IRB) approval from the University of North Carolina at Greensboro and the participating organization. A researcher developed survey was used to collect demographic data, fatigue perceptions and nurses' willingness to engage in fatigue reduction strategies. The Fatigue Assessment Scale (FAS) was used to measure nurse fatigue. The survey was distributed via email within the participating healthcare organization and by recruitment efforts through social media, Facebook and Instagram. The survey was anonymous, and data were de-identified. Data were analyzed using SPSS v26 (IBM Corp., Armonk, NY) and JASP (Version 0.13.1) [Computer software] based on the study's research questions and design. A two-sided p-value < 0.05 was considered to be statistically significant. The results of data analysis are presented here.

Management of the Data

Inclusion criteria was that nurses be employed in a direct patient care role. Nurses working in other roles and non-nurses were excluded from this study. There were 405 responses to the survey. A total of 115 surveys were excluded from data analysis because the participants failed to meet inclusion criteria. Although inclusion criteria was met, an additional 11surveys were excluded because participants accessed the survey but failed to respond to any of the survey questions. Final data analysis included $n = 279$ surveys.

Sample

Demographic data were collected to characterize study participants. Univariate analysis was performed with descriptive statistics. The sample demographics are displayed in Table 1. The mean age of the sample was 41 years ($SD = 12.55$, min = 20 , max = 70) and the mean years of experience as a nurse was 13.5 ($SD = 12.26$, min = 1, max = 48). Most nurses in the sample possess either an associate's (36.6%, $n = 102$) or bachelor's degree (56.4%, $n = 157$). The sample largely identified as non-Hispanic White/Caucasian (87.4%, $n = 244$) and female (91.4%, $n = 255$). The 12-hour shift was most common among the sample (75.6%, $n = 211$), as was working the day shift (62.7%, $n = 175$) compared to 42 (15%) indicating a shift of nine or less hours and 86 (30.8%) working night shift. Working at a Magnet status facility was split; 137 (49.2%) participants responded "yes", 95 (34.1%) responded "no" and 46 (16.5%) indicated that their facility was working towards Magnet status.

Table 1. Sample Demographics and Work Characteristics (*N* = 279)

Characteristic	*n* (%) or *Mean* ± (*-SD-*)
Nurse age	41 ± (-12.55-)
missing	3
Years of experience	13.5 ± (-12.26-)
missing	0
Highest nursing degree	
Associate	102 (36.6)
Bachelors	157 (56.4)
Masters	16 (5.8)
DNP	1 (0.4)
PhD	2 (0.7)
missing	1 (0.4)
Race/Ethnicity	
White/Caucasian/Non-Hispanic	244 (87.4)
Black/African American/Non-Hispanic	8 (2.8)
Native American/Alaska Native	0 (0)
Asian	7 (2.5)
Native Hawaiian/Pacific Islander	1 (0.36)
Hispanic/Latino	10 (3.5)
Multi-racial	5 (1.7)
Other	1 (0.36)
Prefer not to answer	3 (1.0)
missing	0
Gender	
Male	22 (7.8)
Female	255 (91.4)
Other	0 (0)
Prefer not to answer	2 (0.72)
missing	0
Shift length	
9 or less hours	42 (15)
10 or 11 hours	26 (9.3)
12 or greater hours	211 (75.6)
missing	0
Shift worked	
Day	175 (62.7)
	11 (3.9)

Evening	86	(30.8)
Night	7	(2.5)
Rotating		
missing	0	
Does the facility have Magnet status		
Yes	137	(49.2)
No	95	(34.1)
Working towards Magnet	46	(16.5)
missing	1	(0.4)

Note: SD = standard deviation

Findings

Results of statistical analysis of the data per research question are presented below.

RQ #1. What workplace fatigue reduction strategies are nurses willing to engage in to reduce their risk of experiencing work-related fatigue?

Univariate analysis was performed with descriptive statistics (see Table 2). When asked if given the opportunity to participate in the following activities to reduce their risk of fatigue, 209 (74.9%) participants responded "yes" to handing over patient care for a duty-free break, 78 (27.9%) responded "yes" to taking a nap during a break, 115 (41.5%) responded "yes" to working a 9-hour shift four days per week, and 59 (21.3%) responded "yes" to working five days per week. More than half of the participants, (65.7%, *n* = 182), are willing to limit consecutive 12-hour shifts to no more than two. The majority responded "yes" when asked if they would avoid working beyond their scheduled shift, (87.4%, *n* = 243), and would avoid adding additional shifts to their schedule (79.5%, *n* = 221).

Table 2. Willingness to Participate in Fatigue Reduction Strategies (*N*=279)

Fatigue Reduction Strategy	n (%)		
	Yes	No	Missing
Hand over patient care to a coworker for duty free breaks	209 (74.9)	70 (25.0)	0
Take a nap during break time	78 (27.9)	201 (72.0)	0
Work 9-hour shifts (4 days/week)	115 (41.5)	162 (58.4)	2 (0.7)
Work 8-hour shifts (5 days/week)	59 (21.3)	217 (78.6)	3 (1.0)
Work no more than 2 consecutive 12-hour shifts (not 3 in a row)	182 (65.7)	95 (34.3)	2 (0.7)
Avoid working beyond your regular scheduled shift (not staying over)	243 (87.4)	35 (12.5)	1 (0.4)
Avoid adding additional shifts/days to your regular schedule	221 (79.5)	57 (20.5)	1 (0.4)

RQ #2. What are nurses' self-perceptions of fatigue?

Participants were asked to rate their level of fatigue by choosing from the following categories: no fatigue, little fatigue, normal fatigue, high fatigue or extreme fatigue. Participants also completed the Fatigue Assessment Scale (FAS), an established instrument which measures fatigue. All participants completed both measures (n = 279).

Univariate analysis was performed with descriptive statistics. When asked to rate their current level of fatigue, 5 (1.7%) of participants indicated they have "no fatigue"; 17 (6.0%) indicated they have "little fatigue"; 85 (30.4%) indicated they have "normal fatigue"; 152 (54.4%) indicated they have "high fatigue" and 20 (7.2%) indicated that they have "extreme fatigue". Overall scale statistics for the FAS revealed a high level of fatigue on average (M = 26.26, SD = 7.3, min = 13, max = 48) within the sample. A

score on the FAS between 10 and 21 suggest a normal level of fatigue; scores between 22 and 34 suggest a high level of fatigue and scores from 35 to 50 suggest extreme fatigue (de Vries et al., 2003; Michielsen et al., 2003).

Instrument reliability was estimated via internal consistency using Cronbach's alpha; $\alpha = .89$, suggesting good internal consistency (Nunnally & Bernstein, 1994). Reliability was also checked through more contemporary methods which allow for differences in item discrimination using JASP (Version 0.13.1) [Computer Software]. These methods offer a better option for estimating reliability for cognitive and affective tools (see Table 3) (DeVellis, 2017; Dunn et al., 2014). Based on psychometric theory, the greatest lower bound is the best option (DeVellis, 2017) and here suggests high instrument reliability, 0.936.

Table 3. FAS Scale Reliability Statistics

Estimate	McDonald's ω	Cronbach's α	Guttman's λ6	Greatest lower bound
Scale	0.894	0.890	0.901	0.936

Spearman's rho correlation was used to assess the association between the self-rated fatigue levels and the FAS scores. There is a significant moderate positive relationship, $r_s = .519$, $p < .001$, between self-rated fatigue levels and FAS scores, as expected. A comparison of self-rated fatigue to FAS mean scores for each fatigue level revealed that: 152 (54.3%) participants self-assessment of fatigue matched the FAS measure of fatigue, which indicated a high level of fatigue (*M* 28.5 ± 6.6). The other self-assessments of fatigue did not align with the fatigue instrument results. There were

five (1.8%) participants who reported no fatigue and 17 (6.1%) reported little fatigue, however the FAS mean scores indicated a normal level of fatigue for both groups (*M* FAS 16.0 ± 2.5 and 19.3 ± 3.0 respectively). There were 85 (30.4%) participants who reported normal fatigue, however the FAS mean score suggests high fatigue (*M* FAS 22.5 ± 5.6). Also, 20 (7.1%) participants reported extreme fatigue where the FAS mean score suggests a high level of fatigue exists for the group (*M* FAS 32.0 ± 9.5). Figure 5 displays the mean score on the FAS for each self-rated fatigue level and shows congruence between the self-ratings and the FAS instrument. The FAS mean score increases with each self-rated fatigue level suggesting good convergent validity.

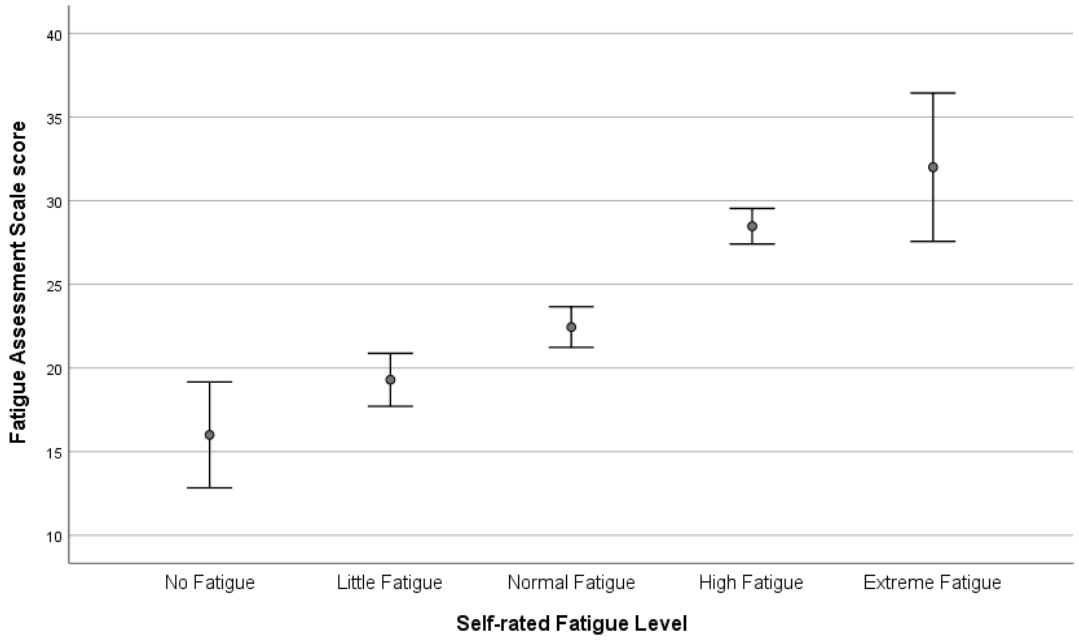

Figure 5. Self-Rated Fatigue and FAS Score Comparison

For congruency checking in addition to Spearman's rho correlation, comparisons of means between the self-rating of fatigue and instrument scores were explored using

Analysis of Variance (ANOVA). The following ANOVA assumptions were checked. The sample size of 279 was adequate for running ANOVA and the data are independent. Normality was checked through *Q*-*Q* Plots and Shapiro-Wilk testing. There are systematic departures from the reference line on the *Q*-*Q* Plots and the Shapiro-Wilk statistic is significant ($p < .001$). It was concluded that the assumption of normality has been violated, thus the Kruskal-Wallis is reported. Using Kruskal-Wallis of the FAS sum scores suggests there are statistically significant differences between the self-rated fatigue groups ($H = 78.2$, 4 *df*, $p < .001$). Because the assumption of normality was rejected, the Mann-Whitney U was used for group comparisons. With 10 group parings, resulting from a comparison of the five self-rated fatigue categories, the Bonferroni multiple comparisons correction is 0.05/10 = 0.005 (T. McCoy, personal communication, August 7, 2020). Therefore, the significance level for the Mann-Whitney U on each unique pair of self-rated fatigue categories is $p < 0.005$.

The group of participants that reported no fatigue is not significantly different in FAS scores from the group that reported little fatigue ($p = .048$) or from the group that reported normal fatigue ($p = .006$). However, the group reporting no fatigue is significantly different from the group reporting high fatigue ($p < .001$) and from the group reporting extreme fatigue ($p < .001$). The group that reported little fatigue is not significantly different in FAS scores from the group that reported normal fatigue ($p = .034$). There were significant differences between the group that reported little fatigue and the group that reported high fatigue ($p < .001$) and the group that reported extreme fatigue ($p < .001$). The group that reported normal fatigue is significantly different in

FAS scores from the group that reported high fatigue ($p < .001$) and from the group that reported extreme fatigue ($p < .001$). Groups reporting high fatigue and extreme fatigue were not significantly different from each other in their FAS sum scores ($p = .101$).

RQ #3. What is the relationship between nurses perceived threat of fatigue and nurse age, years as a nurse, and education level?

Nurses responded to questions exploring their perceived threat of fatigue. Each item was rated on a scale from one to five with five representing the highest perceived threat for that item. Items were summed to create a score representing the nurses perceived threat of fatigue. Higher sum scores indicate higher perceived threat.

Univariate analysis was performed with descriptive statistics. Perceived threat sum scores ranged from 10 to 50 with a mean score of 27.6 ($SD = 8.2$), n=275. Count regression was performed to explore the relationship between the dependent variable (perceived threat sum score) and the independent variables (nurse age, years as a nurse and education level). The Pearson Chi square Goodness-of-fit statistic = .083. There is evidence of substantial overdispersion (Lagrange Multiplier test $p < .001$), thus a negative binomial count regression model was used. The model did not suggest that a significant relationship exists between the independent variables and the nurses' perceived threat of fatigue (see Table 4). Nurse age did not have significant influence on perceived threat of fatigue (exp(b) = 1.000, 95% CI [.985, 1.016], $p = 0.966$). For every additional 1 year increase in years as a nurse, the predicted mean perceived threat of fatigue decreases by 0.6%, adjusting for age and education (exp(b) = .994, 95% CI [.978, 1.010], $p = 0.467$). Having a bachelor's degree is associated with a 6% decrease in the predicted mean

perceived threat of fatigue (exp(*b*) = 0.940, 95% CI [.723, 1,222], *p* = 0.644), adjusting for age and years as a nurse. Having a master's degree is associated with a 0.6% increase in the predicted mean perceived threat of fatigue (exp(*b*) = 1.006, 95% CI [.576, 1,757], *p* = 0.983), adjusting for age and years as a nurse. Having a DNP degree is associated with a 15% decrease (exp(*b*) = 0.848, 95% CI [.113, 6,341], *p* = 0.873), and having a PhD degree is associated with a 38% decrease in the predicted mean perceived threat of fatigue (exp(*b*) = 0.621, 95% CI [.146, 2,635], *p* = 0.518), adjusting for age and years as a nurse. These results are not statistically significant.

Table 4. Count Regression for Perceived Threat of Fatigue and Nurse Age, Years as a Nurse, and Education (*n* = 275)

Characteristic	Exp(b), (95% CI), *p*-value
Nurse age (years)	1.000, (.984, 1.016), 0.966
Years as a nurse	0.994, (.978, .1.010), 0.467
Education	
Associate degree[RC]	
Bachelor's degree	0.940, (.723, 1,222), 0.644
Master's degree	1.006, (.576, 1,757), 0.983
DNP	0.848, (.113, 6,341), 0.873
PhD	0.621, (.146, 2,635), 0.518

RC = Reference Category

RQ #4. What is the effect of perceived threat of fatigue on willingness to engage in fatigue reduction strategies?

Logistic regression was used to examine the extent to which perceived threat sum scores are associated with the likelihood of engaging in fatigue reduction strategies. The Hosmer and Lemeshow test to assess goodness of fit as well as multicollinearity was

checked. There was no evidence of lack of fit in the logistic regression models. The Hosmer and Lemeshow goodness-of-fit test p value is > .05 for each fatigue reduction strategy. Variance Inflation Factors (VIFs) suggest that there is no overlap of the independent variables age (VIF = 2.7), years as a nurse (VIF = 2.7), and education (VIF = 1.07). The odds of engaging in the fatigue reduction strategies limiting consecutive shifts to two and avoiding adding additional shifts are significantly associated with perceived threat sum scores, (p = .006 and p = .009 respectively). For every 1 point increase in the perceived threat sum scores, the odds of engaging in the fatigue reduction strategy of limiting consecutive shifts are 4.4% lower and the odds of engaging in avoiding adding additional shifts to their work schedule are 5% lower. The odds of engaging in all other fatigue reduction strategies were not significantly associated with the perceived threat of fatigue sum scores at the p = .05 level (see Table 5).

Table 5. Binary Logistic Regression for Perceived Threat Sum Scores and Likelihood of Engaging in Fatigue Reduction Strategies (N = 279)

Fatigue reduction strategy	AOR, (95% CI), *p*-value
Take duty free breaks	0.979, (0.947, 1.012), 0.217
Nap during break time	0.971, (0.941, 1.002), 0.069
Work 9 hour shifts (4 days/week)	0.995, (0.967,1.025), 0.744
Work 8 hour shifts (5 days/week)	1.014, (0.979, 1.050), 0.438
Work no more than 2 consecutive 12 hour shifts (not 3 in a row)	0.956, (0.926, 0.987), 0.006*

Avoid working beyond your regular scheduled shift (not staying over)	0.962, (0.919, 1.006), 0.092
Avoid adding additional shifts/days to your regular schedule	0.950, (0.915, 0.987), 0.009*

Note: * statistically significant, AOR = adjusted odds ratio.

Summary

The purpose of this study was to describe nurses' self- perceptions of fatigue and to examine nurses' willingness to engage in specific fatigue countermeasures. Data were collected through an anonymous electronic survey. The study sample included 279 nurses who work in direct patient care roles. If offered the opportunity, most nurses in the sample are willing to hand over patient care to a coworker for duty free breaks, work no more than two consecutive 12 hour shifts, avoid working beyond the regular scheduled shift and avoid adding additional shifts to their schedule. Almost half of study participants are willing to work 9-hour shifts four days per week if given the opportunity. When examining nurses' ability to self-assess fatigue, 54% of participants self-assessment were congruent with the established fatigue instrument and 46% of self-assessments differed from the measurement of the established fatigue instrument. Nurse characteristics did not influence the perceived threat of fatigue. Surprisingly, as the perception of the threat of fatigue increased, the odds of limiting consecutive 12-hour shifts and not adding additional shifts decreased.

CHAPTER V

DISCUSSION

The literature is replete with studies describing the factors that contribute to nurse fatigue as well as the deleterious consequences of working while fatigued. However, there is a gap in the literature describing successful interventions to alleviate nurse fatigue. In this study, nurses perceptions of fatigue and willingness to participate in fatigue reduction strategies were explored. A total of 279 participants completed an anonymous survey which included an established fatigue instrument. The purpose of this chapter is to discuss study findings. Specifically, this chapter presents an interpretation of findings for each research question, the application of the Health Belief Model, limitations of the study and recommendations for education, research, policy and practice.

Sample Characteristics

As previously discussed, recruitment was through social media and within a large healthcare system. There were 279 participants and it is assumed the sample includes nurses from various regions of the country because of the recruitment methods. The original recruitment post on Facebook was shared with nurses who live in six different states. Additionally, the survey link was shared by 14 nurses who viewed the original Facebook post. Recruitment through the participating healthcare organization included three additional states. Thus, it is assumed recruitment occurred in a total of nine states

which are located in different regions of the country. The state of residence was not recorded in this study. Although it is assumed participants are from different regions of the country, the sample demographics of this study differ from the national nurse workforce survey conducted by the National Council of State Boards of Nursing (NCSBN), which included approximately 48,000 nurses (Smiley et al., 2018). A comparison of participant demographics for this study and the national survey are displayed in Table 6.

Table 6. Participant Demographics (*N* = 279) Compared to National Sample (*N* = 48,704)

	n (%) or Mean ± (-*SD*-) or Median	
Characteristic	Current Study	National Sample
Nurse age	41 ± (-12.55-)	51
Years of experience	13.5 ± (-12.26-)	21
Highest nursing degree		
Associate	102 (36.6)	13,729 (28.5)
Bachelors	157 (56.4)	21,744 (45.2)
Masters	16 (5.76)	8,238 (17.1)
DNP	1 (0.36	551 (1.1)
PhD	2 (0.72)	284 (0.6)
Race/Ethnicity		
White/Caucasian/Non-Hispanic	244 (87.4)	38,766 (80.8)
Black/African American/Non-Hispanic	8 (2.8)	2,996 (6.2)
Native American/Alaska Native	0 (0)	176 (0.4)
Asian	7 (2.5)	3,605 (7.5)
Native Hawaiian/Pacific Islander	1 (0.36)	226 (0.5)
Hispanic/Latino	10 (3.5)	2,528 (5.3)
Multi-racial	5 (1.7)	828 (1.7)
Other	1 (0.36)	1,368 (2.9)
Prefer not to answer	3 (1.0)	

Gender		
Male	22 (7.8)	4,369 (9.1)
Female	255 (91.4)	43,715 (90.9)
Other	0 (0)	
Prefer not to answer	2 (0.72)	

Note: SD = standard deviation

Compared to the national sample, participants in this study on average are 10 years younger with a mean age of 41 years, have eight years less experience as a nurse with the mean of 13.5 years of experience, 8% more have an associate degree equaling 36.6%, 11% more have a bachelor's degree equaling 56.4%, and 11% fewer possess a master's degree equaling 5.8%. Additionally, 7% more of study participants identify as Caucasian equaling 87.4%, 3% fewer identify as Black/African American equaling 2.8%, and 1% fewer identify as male equaling 7.8% when compared to the national sample. It is unknown if participant characteristics influenced outcomes of this study. As discussed, previous studies have shown an association between fatigue and age, and fatigue and years of experience. Increased years of experience has shown to be associated with reduced fatigue (Steege et al., 2018). Chen (2014) found older age to be associated with higher fatigue, however other studies have revealed an association between younger age and fatigue (Drake & Steege, 2016; Neville et al., 2017; Steege et al., 2018; Widyanto et al., 2018; Yu et al., 2019). The influence of nurse characteristics on the presence of fatigue was not the focus of this study.

Interpretation of Findings

An interpretation of findings for each research question is provided here. Also included is a comparison of study findings to the literature.

RQ #1 Nurses' Acceptance of Fatigue Reduction Strategies

Results suggest that if given the opportunity, many of the participants are willing to engage in the fatigue reduction strategies offered in this study. The fatigue reduction strategies with the greatest acceptance included taking duty-free breaks, working 9-hour shifts, limiting consecutive 12-hour shifts to no more than two, not working beyond the scheduled shift and not adding additional shifts to their work schedule. These fatigue reduction strategies are in the purview of nurse leaders through ensuring adequate staffing, scheduling oversight and offering shorter shifts. Although it is commonly reported that nurses favor the 12-hour shift (Chen et al., 2014; Montgomery & Geiger-Brown, 2010; Stimpfel et al., 2012), almost half, 41.5%, of study participants indicated that they would work 9-hour shifts if given the opportunity. This finding contradicts the common assumption that nurses would resist changes to the 12-hour shift scheduling pattern, which is prolific in hospitals.

The current nursing culture is reported to be one of self-sacrifice which includes a sense of sole responsibility for patient care with reluctance to ask for help, reluctance to take breaks, feelings of guilt for refusing overtime and expectations of perfection (Steege & Dykstra, 2016; Steege & Rainbow, 2017). However, participants in this study reported acceptance of taking duty-free breaks, not working beyond the scheduled shift and not adding additional shifts to their work schedule. It is possible that nurses have always possessed these desires but give in to pressures from managers and peers, or work circumstances. In the face of the COVID-19 pandemic, nurses may have reached a level of fatigue where they no longer feel able to continue sacrificing themselves and are

willing to engage in these behaviors regardless of outside pressures. However, intent does not always translate into action.

The fatigue reduction strategies with the lowest acceptance are taking a nap during break time and working 8-hour shifts. Of note, most of the study participants work day shift, which may account for the lack of acceptance of the option to nap on breaks. Interestingly, 86 participants work night shift and 78 participants responded "yes" to taking a nap during breaks suggesting napping as a fatigue reduction strategy has the highest acceptance among those working night shift. In a previous intervention study, nurses acknowledged the benefits of taking a nap, but also expressed guilt for napping on breaks (Scott et al., 2010). Conversely, airline pilots have provided positive feedback regarding the use of napping when on breaks to reduce fatigue (Zaslona et al., 2018). A change to policies that prohibit napping on breaks as well as nursing culture may be required for napping during breaks to become the norm in nursing as it is in aviation.

RQ #2 Self-Perceptions of Fatigue

The American Nurses Associations' position is that nurses are responsible for self-assessing their fatigue level and rejecting work when deemed unsafe due to fatigue (American Nurses Association, 2014). Results from this study suggest that almost half of nurses (46%) are not able to accurately self-asses fatigue. Only 54.3% of participants rated themselves as having high fatigue matching the Fatigue Assessment Scale (FAS) measurement; 38.3% underestimated their level of fatigue and 7.1% overestimated their level of fatigue when compared to the established fatigue instrument. The FAS has been shown to be a reliable and valid instrument, however it is important to consider that

perhaps it did not accurately measure fatigue within this sample. Nonetheless, it may be unrealistic to expect individuals to self-assess fatigue levels and make decisions about their ability to safely provide patient care. This finding supports others who have questioned a nurses' ability to self-assess fatigue and make decisions about safety to practice (Montgomery & Geiger-Brown, 2010; Rogers, 2008).

Also, to comply with the American Nurses Association's position on fatigue, the culture of nursing requires a change that would include acceptance of a nurse to report a state of fatigue and reject work. This culture change is needed because fatigue is currently viewed as normal within the nursing profession (Steege et al., 2017b; Steege & Rainbow, 2017). Even with a change to nursing culture, results suggest that only half of nurses would correctly self-assess for fatigue. Another consideration is that nurses in right to work states have no protections from being discharged if they refuse to work. Thus, refusing work due to fatigue in right to work states may result in job loss.

RQ #3 Perceived Threat of Fatigue and Nurse Characteristics

Results suggest that study participants had a moderate level of perceived threat of fatigue with a mean score of 27.56 (*SD* = 8.2, min. 10, max. 50). None of the nurse characteristics (age, years as a nurse, education level) were significantly associated with the perceived threat of fatigue. This differs from other studies which found significant relationships between participant age, years as a nurse and education and perceptions of a health threat and willingness to engage in a health behavior (Chang et al., 2007; Chen et al., 2019; Quaranta & Spencer, 2015). Reasons for the difference in outcomes is unknown but may be attributed to other unique characteristics of the sample population

or to the uniqueness of the threat studied in each case. Because no validated instrument exists to measure perceptions of the threat of fatigue in nursing, it is possible that the questions asked did not fully or accurately query nurses perceptions of the threat of fatigue. This potentially impacted measurements of the relationship between variables.

RQ #4 Perceived Threat of Fatigue and Fatigue Reduction Strategies

Results suggest that there is a significant relationship between the perceived threat of fatigue and the likelihood of engaging in the fatigue reduction strategies limiting consecutive 12-hour shifts to two and avoiding adding additional shifts. Surprisingly, with an increase in perceptions about the susceptibility and potential severity of fatigue, the acceptance of limiting consecutive 12-hour shifts to two and avoiding adding additional shifts decreased. All other strategies were not significantly related to the perceived threat of fatigue. These are novel findings because no studies were found in the literature exploring the effect of the perceived threat of fatigue on nurses' willingness to engage in fatigue reduction strategies. However, in the absence of a validated instrument to measure nurses perceived threat of fatigue these results may not be reliable. A validated instrument is needed which measures nurses perceptions of the threat of fatigue. Future studies should explore factors that potentially influence the likelihood of nurses' engaging in fatigue reduction strategies. Reasons for acceptance of various fatigue reduction strategies should also be explored. Such information could be used to guide interventions aimed at reducing fatigue among nurses.

Theoretical Framework

The theoretical framework for this study was the Health Belief Model (HBM). The HBM was modified to focus on constructs being examined in this study. The HBM constructs focused on in this study were perceived threat of fatigue, modifying factors (nurse age, years of experience as a nurse and the education level), and the likelihood of taking action to avoid the threat of fatigue. The two research questions driven by the HBM were:

1. What is the relationship between nurses perceived threat of fatigue and nurse age, years as a nurse, and education level?
2. What is the effect of perceived threat of fatigue on willingness to engage in fatigue reduction strategies?

The HBM's proposed relationship between modifying factors and perceived threat were not found to be significant in this study. However, results suggest a significant relationship exists between perceived threat of fatigue and nurses' willingness to engage in two of the fatigue reduction strategies. The relationship was not as HBM proposes. According to HBM, in the presence of a perceived threat, an individual is likely to engage in a preventive behavior, however the opposite was found in this study. The lack of a validated instrument to measure the perceived threat of fatigue among nurses potentially impacted findings. Because of the correlational design of the study, causal relationships between variables are not able to be determined. Applications for the HBM should continue to be explored as other researchers have found significant relationships as proposed by the model (Chang et al., 2007, p.; Chen et al., 2019;

Quaranta & Spencer, 2015). As discussed, a valid instrument measuring the perceived threat of fatigue among nurses is needed.

Recommendations

It is well established that fatigue has an inverse relationship with safety. A nurse working while fatigued presents a hazard to the quality of patient care (Gardner & Dubeck, 2016; Olds & Clarke, 2010; Trinkoff et al., 2011). The reduction of fatigue and retention of experienced nurses should be a top priority for healthcare organizations considering the increased acuity of todays' patients, the desire for quality patient care and the growing nursing shortage. The need to reduce fatigue among nurses has been discussed by the National Academy of Medicine, the Joint Commission, OSHA, NIOSH, Healthy People 2020 as well as nursing professional organizations such as the American Nurses Association and the American Academy of Nursing.

Practice

Based on study results, recommendations for organizations to reduce fatigue among nurses include assessment of workplace fatigue using valid and reliable instruments and management of staffing levels to ensure nurses are able to take duty-free breaks, are not expected to work beyond the scheduled shift, nor expected to work extra shifts. Organizations should also design work schedules to minimize fatigue, e.g. avoid more than two consecutive 12-hour shifts and offer shorter shifts, such as a 9-hour shift scheduling pattern, where feasible. It is also recommended that night shift nurses be allowed to nap when on breaks and that policies are changed as needed to support this practice.

The recommendation for nurses is to take personal responsibility for the reduction of fatigue. Nurses must change their attitude toward fatigue, acknowledge that fatigue has potential to impact their performance and engage in strategies to alleviate fatigue. Nurses should advocate for shorter work shifts, take breaks when offered the opportunity and avoid self-scheduling more than two consecutive 12-hour shifts and/or volunteering for overtime.

It will take action from the level of the chief nursing officer (CNO) to the staff nurse to effectively mitigate work-related fatigue. Healthcare leaders must provide healthy work environments for nurses in order to provide patients with safe health care experiences. Nurses must participate in fatigue reduction strategies to manage fatigue and manage their schedules so that they are not setting themselves up to work while fatigued.

Implications for organizations. Leaders must acknowledge the relationship between fatigue and poorer performance. Organizations hold the responsibility for creating a work environment and culture that supports nurse well-being. Organizations position themselves for improved patient outcomes, increased nurse retention, and fewer employee injuries by reducing fatigue among nurses. It is reasonable to assume that these positive outcomes are desirable among many organizations.

Implications for nurses. Nurses can increase their quality of life by engaging in strategies to reduce fatigue. By reducing fatigue nurses improve the ability to concentrate and decrease the risk of committing errors. A nurse who is less fatigued is positioned to provide better patient care. Patient care errors potentially threaten ones' ability to

continue working as a nurse. Engaging in work-place fatigue reduction strategies coupled with a healthy lifestyle supports personal well-being.

Policy

Nurse leaders and nursing professional organizations must mobilize and advocate for policies that support worker health and well-being. Patient care settings and individual patients are dynamic; thus no one staffing model is perfect in every situation. Staffing and scheduling requires thoughtful consideration to ensure safe working conditions for the nurse and the delivery of quality care for the patient. Organizations need the flexibility to respond to changing circumstances, with minimum standards for safe practice to avoid abuses. Policies are needed to ensure safe staffing levels and scheduling patterns that do not promote fatigue in healthcare.

Staffing and/or scheduling should not be based on financial considerations alone. Schedules should allow for adequate recovery between shifts. Staffing must be such that adequate meal and rest breaks are achievable for nurses. Appropriate staffing supports safe practice and the delivery of quality care, thus hospitals are advised against staffing reductions in an effort to meet cost containment goals (American Nurses Association, 2019). Further, appropriate staffing garners higher patient satisfaction, lower mortality and readmissions, better patient outcomes, fewer complications, and less nurse fatigue (Aiken et al., 2017; American Nurses Association, 2019). The ANA (2019) defines appropriate nurse staffing as a match of the expertise of the nurse with the needs of the patient in the context of the setting.

Modifications are needed to the healthcare work environment to promote a healthy workplace and healthy workforce. Other safety sensitive industries have implemented such regulations and strategies in an effort to reduce the negative effects of fatigue among workers and in the interest of public safety. The healthcare industry must acknowledge the evidence connecting worker fatigue to negative outcomes and employ staffing and scheduling patterns that do not promote worker fatigue

Education

It is important for nurse educators to recognize the prevalence and negative impacts of fatigue. Educators should prepare student nurses for the work environment by providing information about the causes and consequences of workplace fatigue, the signs and symptoms of fatigue, and strategies to avoid and alleviate fatigue in the workplace. Raising awareness of the risk factors for fatigue and signs and symptoms of fatigue, can position new nurses to address the issue. Educators should prime student nurses to advocate for a safe working environment, including adequate staffing and schedules that supports personal well-being and reduces the chance of fatigue. Also, nursing students should be educated about the influence of lifestyle choices on personal wellness. Students need to be taught the importance of self-care and maintaining well-being.

Research

Future research is recommended to explore the effectiveness of various fatigue interventions aimed at mitigating fatigue. Specifically, the effect of taking duty-free breaks, implementation of a 9-hour shift scheduling pattern, and limiting consecutive 12-hour shifts to no more than two on nurse fatigue should be explored. Continued research

is also needed to discover other approaches to reducing nurse fatigue. Other interventions to reduce fatigue may include changes in the work environment to reduce various known contributors to fatigue as well as the impact of various self-care activities of the individual on fatigue. Also, studies with larger sample sizes are needed which explore nurses' abilities to self-assess for fatigue. Qualitative studies are needed to explore fatigue from the nurses' perspective. A valid instrument is needed to measure the perceived threat of fatigue among nurses.

Limitations

Limitations of the study included using a convenience sample, which may not be generalizable. Data were self-reported which relies on recall of the participant, thus potentially influencing accuracy. The results were not longitudinal and could not report fatigue overtime. Data were collected during the COVID 19 pandemic which potentially influenced levels of nurses' fatigue. There was a potential for over-exposure to surveys which could have impacted response rates. It was later discovered that the American Nurses Association distributed a series of surveys during the data collection period for this study. There was the chance that the survey appealed more to nurses with higher levels of fatigue who had a desire to express their state. Surveys carry the potential for response bias because participants may opt for what they think are socially desirable responses instead of answering items truthfully. Limitations of the Health Belief Model (HBM) include the lack of a temporal component to assess changes in mindsets over time, and necessity for researchers to develop questionnaires to measure the construct *perceived threat* in the model.

Conclusions

This study offers novel insights into nurses' abilities to self asses fatigue and nurses' acceptance of fatigue reduction strategies. These are topics not found in the literature. This study suggests that fatigue among nurses is high, confirming previous work found in the literature. Also, expecting nurses to self-assess for fatigue may not be an effective strategy to addressing fatigue. Fatigue among nurses is a complex multi-factorial phenomenon that will not be easily resolved; however, in the interest of public safety it must be addressed. Nurse fatigue must be considered within the context in which it occurs. Solutions will vary with the work setting.

Although the sample size was small, this study offers important information to consider. This study revealed that many nurses are willing to work 9-hour shifts, limit consecutive 12-hour shifts to two, hand over patient care for a duty-free break, and avoid working beyond their scheduled shift and adding additional work days to their regular scheduled days. Nurse leaders are in a position to make these changes. Implementation of these interventions have the potential to alleviate fatigue among nurses.

Addressing fatigue will require the partnership of health care leaders and nurses. Health care organizations have a vital role in creating healthy work environments that support the well-being of nurses and the reduction of the occurrence of fatigue. Healthcare leaders must provide healthy work environments for nurses in order to provide patients with safe health care experiences. Nurses must participate in self-care strategies to manage fatigue and manage their schedules so that they are not setting themselves up to work while fatigued. It will take action from policy makers, leaders of

healthcare organizations and staff nurses to effectively mitigate work-related fatigue. Interventions must target the factors that are known to contribute to fatigue. Nurses must be allowed to provide input into the intervention planning. Organizations can foster the delivery of quality patient care by addressing fatigue, thus its impact on safety, job satisfaction and the health and well-being of nurses.

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APPENDIX A

NURSE FATIGUE SURVEY

1. Are you a registered nurse working full time in a direct patient care role? Yes/No (if no the survey closes)
2. What shift do you typically work?
    a. Day shift
    b. Evening shift
    c. Night shift
    d. Rotating shifts
3. Typically, how long is your scheduled shift?
    a. 9 or less hours
    b. 10 or 11 hours
    c. 12 or greater hours
4. Does your facility have Magnet Status?
    a. Yes
    b. No
    c. Working towards Magnet

5. Which option best describes your work setting:
    a. Hospital-based inpatient care setting
    b. Community Health / outpatient care setting
    c. Cancer institute
    d. Skilled nursing / home health
    e. Behavioral health
    f. Sleep / Stroke care
    g. Orthopedics / sports medicine/rehab
    h. Women's children's health institute
    i. Other

6. What is your highest nursing degree?
    a. Associate degree
    b. Bachelor's degree
    c. Master's degree
    d. DNP
    e. PhD
7. How many years have you been a nurse?
8. What is your age?
9. Which race / ethnicity do you most identify with:
    a. White / Caucasian / Non-Hispanic
    b. Black / African American / Non-Hispanic
    c. Native American / Alaska Native

d. Asian

e. Native Hawaiian / Pacific Islander

f. Hispanic / Latino

g. Multi-racial

h. Other

i. Prefer not to answer

10. Gender identity

a. Male

b. Female

c. Other

d. Prefer not to answer

11. Please rate your current level of fatigue.

a. No Fatigue

b. Little Fatigue

c. Normal Fatigue

d. High Fatigue

e. Extreme Fatigue

12. Because of the COVID 19 pandemic, your level of fatigue is:

a. Much higher

b. Moderately higher

c. Slightly higher

d. About the same

e. Slightly lower

f. Moderately lower

g. Much lower

13. Optional comments regarding how COVID 19 has impacted your fatigue (i.e. were you furloughed, or did you work excessive hours, etc.)

14. How likely are you to feel fatigued while at work?

a. Not likely at all

b. Somewhat likely

c. Moderately likely

d. Highly likely

e. Extremely likely

15. How susceptible are you to feeling fatigued due to the length of your shift?

a. Not at all susceptible to feel fatigue

b. Somewhat susceptible to feel fatigue

c. Moderately susceptible to feel fatigue

d. Highly susceptible to feel fatigue

e. Extremely susceptible to feel fatigue

16. How susceptible are you to feeling fatigued due to the level of teamwork on your unit?

a. Not at all susceptible to feel fatigue

b. Somewhat susceptible to feel fatigue

c. Moderately susceptible to feel fatigue

d. Highly susceptible to feel fatigue

e. Extremely susceptible to feel fatigue

17. How susceptible are you to feeling fatigued due to the staffing level on your unit?

    a. Not at all susceptible to feel fatigue

    b. Somewhat susceptible to feel fatigue

    c. Moderately susceptible to feel fatigue

    d. Highly susceptible to feel fatigue

    e. Extremely susceptible to feel fatigue

18. How susceptible are you to feeling fatigued due to circumstances that cause you to work beyond your normal schedule.

    a. Not at all susceptible to feel fatigue

    b. Somewhat susceptible to feel fatigue

    c. Moderately susceptible to feel fatigue

    d. Highly susceptible to feel fatigue

    e. Extremely susceptible to feel fatigue

19. How worried are you about fatigue affecting your performance at work?

    a. Not at all worried

    b. Somewhat worried

    c. Moderately worried

    d. Highly worried

    e. Extremely worried

20. How worried are you about fatigue affecting your ability to concentrate while at work?

    a. Not at all worried

    b. Somewhat worried

    c. Moderately worried

    d. Highly worried

e. Extremely worried

21. How worried are you about experiencing an injury at work because of feeling fatigued?

    a. Not at all worried

    b. Somewhat worried

    c. Moderately worried

    d. Highly worried

    e. Extremely worried

22. How worried are you about fatigue affecting your ability to provide quality patient care?

    a. Not at all worried

    b. Somewhat worried

    c. Moderately worried

    d. Highly worried

    e. Extremely worried

23. How worried are you about making an error because of feeling fatigued?

    a. Not at all worried

    b. Somewhat worried

    c. Moderately worried

    d. Highly worried

    e. Extremely worried

24. If given the opportunity, are you likely to participate in the following strategies to reduce your risk of feeling fatigued while at work: (yes/no)

    a. Hand over patient care to a coworker for duty free breaks

    b. Take a nap during break time

c. Work 9 hour shifts (4 days/week)

d. Work 8 hour shifts (5 days/week)

e. Work no more than 2 consecutive 12 hour shifts (not 3 in a row)

f. Avoid working beyond your regular scheduled shift (not staying over)

g. Avoid adding additional shifts/days to your regular schedule

25. What suggestions do you have for reducing fatigue at work?

26. What do you currently do, if anything, to reduce or avoid feeling fatigued (work-related or personal)?

Fatigue Assessment Scale (FAS)

The following ten statements refer to how you usually feel. Per statement you can choose one out of five answer categories, varying from Never to Always.

1 = Never, 2 = Sometimes; 3 = Regularly; 4 = Often and 5 = Always.

	Never	Sometimes	Regularly	Often	Always
I am bothered by fatigue	1	2	3	4	5
I get tired very quickly	1	2	3	4	5
I don't do much during the day	1	2	3	4	5
I have enough energy for everyday life	1	2	3	4	5
Physically, I feel exhausted	1	2	3	4	5
I have problems starting things	1	2	3	4	5
I have problems thinking clearly	1	2	3	4	5
I feel no desire to do anything	1	2	3	4	5
Mentally, I feel exhausted	1	2	3	4	5
When I am doing something, I can concentrate quite well	1	2	3	4	5