Associations among Aspects of the Neonatal Intensive Care Unit Nursing Practice Environment, Individual Nurse Characteristics, and Self-Perceived Nurse Fatigue

Dissertation

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By

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Abstract

Patient safety continues to be an area of concern, and attention to this topic is evident from a variety of perspectives and disciplines within current literature. Little literature, however, exists regarding aspects of the nursing practice environment, including the psychosocial elements, and their relationship to self-perceived nurse fatigue, as they relate to patient safety. The purpose of this dissertation is to describe and discuss a research study related to patient safety, aspects of the nursing practice environment, individual nurse characteristics, and self-perceived nurse fatigue, within the specific setting of the neonatal intensive care unit (NICU). This dissertation research study utilized a cross-sectional, correlational study design with a convenience sample of registered nurses working as direct patient care providers within one of five NICUs in the Midwestern United States. Using a secure, anonymous, web-based survey technique with a common survey link, demographic data, as well as data regarding the nursing practice environment and self-perceived nurse fatigue were gathered. The Practice Environment Scale of the Nurse Workload Index (PES-NWI) was used to collect data related to the nursing practice environment, while the Checklist Individual Strength (CIS) Questionnaire was employed to solicit information regarding self-perceived nurse fatigue. A hierarchical regression analysis was performed to examine the relationships among the variables. Results of the study indicated a 43% response rate (175/406 completed
surveys) and confirmed prior nurse fatigue-related research by demonstrating statistically significant relationships between hours worked each shift in the past two weeks and self-perceived nurse fatigue ($t = 2.30; p < .05$) and hours of sleep each 24-hour period prior to shift and self-perceived nurse fatigue ($t = -2.10; p < .05$). Correlations between a physical or mental contributor to fatigue and self-perceived nurse fatigue ($t = 3.61; p < .001$) and a distressing patient event and self-perceived nurse fatigue ($t = 2.13; p < .05$) were also discovered to be statistically significant within this study. Additionally, a novel finding from this analysis included the significant relationship between nurse manager leadership, ability, and support and self-perceived nurse fatigue ($t = -2.02; p < .05$). Based on the study results, suggested implications for practice include the incorporation of organizational and individual strategies focused on alleviating nurse fatigue as well as tactics for the nurse manager when dealing with staff members who have a physical or mental health contributor to fatigue, as well as supporting staff members through a distressing patient situation. Ideas for future research include replication of this study within other nursing practice environments to compare results from varying environments and to improve generalizability, concentration on specific individual and system-level interventions designed to alleviate self-perceived nurse fatigue, incorporation of additional concepts into studies focused on understanding and alleviating nurse fatigue, and examination of optimal strategies for nurse managers to recognize and support staff members through difficult situations, both personal and patient-related.
Dedication

I dedicate this to my three favorite boys, Jeff, Austin, and Keegan, who continue to show me endless love and support.

I also dedicate this to my brother-in-law, Tim, who passed away two days before I started my doctoral journey. I know he has been watching over me, and for that, I thank him.
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Publications


Knupp, A. & Firestone, K. Using consistent education strategies to implement a process change for clinically significant cardiopulmonary events (2008). Newborn & Infant Nursing Reviews 8, (2), 83-86.


Fields of Study

Major Field: Nursing
Table of Contents

Abstract ......................................................................................................................... ii
Dedication .................................................................................................................... iv
Acknowledgements ................................................................................................... v
Vita .............................................................................................................................. vii
List of Tables ........................................................................................................... xii
List of Figures .......................................................................................................... xiii

Chapter 1: Introduction .......................................................................................... 1
  Background and Importance ................................................................................ 1
  Overall Purpose ..................................................................................................... 3
  Theoretical Support ............................................................................................... 4

Chapter 2: Literature Review ............................................................................... 7
  Description of Nurse Fatigue ............................................................................... 7
  Complexities of Measuring Nurse Fatigue ......................................................... 8
  Other Concepts Related to Nurse Fatigue ......................................................... 9
  Potential Effects of Nurse Fatigue ....................................................................... 10
  Potential Factors Influencing Nurse Fatigue and/or Patient Safety .................. 12
  Exploration of Nurse Fatigue Specific to the NICU Work Environment ............ 19
  Current Study ....................................................................................................... 20
Chapter 3: Methodology .................................................................25
  Design .....................................................................................25
  Sample and Setting ....................................................................25
  Measures ..................................................................................27
  Procedure ..................................................................................35
  Data Analysis ............................................................................37
Chapter 4: Results ........................................................................40
Chapter 5: Discussion ....................................................................50
  Relation to Study Aims ...............................................................50
  Implications for Practice ............................................................52
  Study Strengths and Limitations .................................................54
  Suggestions for Future Research ...............................................66
  Conclusion ..................................................................................69
References ....................................................................................71
Appendix A: Checklist Individual Strength (CIS) Questionnaire ........86
Appendix B: Practice Environment Scale of the Nursing Work Index (PES-NWI) ....88
Appendix C: Permission to Use the PES-NWI .................................90
Appendix D: Study Approval Letters ...............................................92
Appendix E: Study Introduction Email ..........................................95
Appendix F: Study Notice Email with Survey Link .........................98
Appendix G: NICU Nursing Practice Environment and Nurse Fatigue Survey ....100
Appendix H: Study Reminder Email ..............................................107
List of Tables

Table 1: Study Variable and Sources of Information ..............................................29
Table 2: Characteristics of Study Participants ........................................................43
Table 3: Descriptive Statistics for Primary Independent Variables and Dependent Variable......................................................................................................................45
Table 4: Coefficients Table ....................................................................................47
Table 5: Model Summary Table ............................................................................49
List of Figures

Figure 1: The SEIPS Model of Work System and Patient Safety.................................5
Chapter 1: Introduction

Patient safety is a reason for widespread awareness and concern, with recent data indicating that preventable healthcare errors are now the third leading cause of death, behind only heart disease and cancer, in the United States (James, 2013; Makary & Daniel, 2016). Patient safety is often referred to as a specialty that applies safety science methodology to achieve the goal of a trustworthy healthcare system by minimizing the occurrence of adverse events and maximizing recovery, if such an event would occur (Emanuel et al., 2008). The Institute of Medicine (IOM) suggests that safety is a critical component in the delivery of high-quality patient care (Kohn, Corrigan, & Donaldson, 2000). Thus, patient safety continues to be considered from a variety of perspectives.

Background and Importance

Related to patient safety, human error is a phenomenon that continues to attract attention. The earliest attempts at examining human error in relation to safety within the healthcare arena can be traced back to 1955, when patient safety efforts were focused more on outcomes, complications, and monitoring strategies, and less on error reduction and patient safety initiatives (Byers & White, 2004). In the mid-to-late 1990’s, an increased interest in patient safety and human error became apparent with the establishment of the National Patient Safety Foundation (NPSF), which is an organization
that “partners with patients and families, the health care community, and key stakeholders to advance patient safety and health care workforce safety and disseminate strategies to prevent harm” (NPSF, 2015). Thus far though, the most influential push for patient safety and error reduction has been fueled by the IOM’s breakthrough report, *To Err is Human: Building a Safer Health System* (Kohn et al., 2000). As a result of this landmark report, national attention consequently became focused on errors that occurred in an inadequate system, which reportedly allowed almost 100,000 preventable patient deaths every year as a result of medical error (Kohn et al., 2000). Sadly, a more recent report has indicated that the number of lives claimed as a result of a healthcare error may actually be closer to 400,000 patients each year (James, 2013). A subsequent IOM report, *Crossing the Quality Chasm: A New Health System for the 21st Century*, focused on ways for the healthcare system to foster innovation and improve care delivery by stressing the six aims of healthcare as care that is safe, effective, patient-centered, timely, efficient, and equitable (Corrigan, 2001; Institute of Medicine [US] & National Academies Press, 2003). By the year 2000, the Agency for Healthcare Research and Quality (AHRQ) became a funding agency for research focused on patient safety, error reduction, and strategic planning efforts related to patient safety and the utilization of technology for enhancing and optimizing the quality and safety of patient care (AHRQ, 2015).

As a follow up to the two reports released by the IOM, the AHRQ subsequently urged the IOM to conduct a further investigation specific to the work environment for nurses. The key areas of focus for this analysis were: (1) to examine the aspects of the
nursing practice environment that have the potential to affect the safety of patients and
(2) to identify opportunities for improvement within the nursing practice environment
that could contribute to improved patient safety (Page, 2004). Results of this
investigation both complemented and supplemented the previous IOM reports by
reinforcing the need for healthcare organizations to incorporate the suggestions
highlighted in the previous two IOM reports into their existing workplace structures and
addressing elements of the practice environment specific to nurses, including nurse
staffing, nurse work hours, nurse workload, and workplace processes (Levy, 2004; Page,
2004).

Additionally, in 2005, the American Association of Critical Care Nurses (AACN)
developed a set of standards focused on the nursing work environment. These Standards
for Establishing and Sustaining Healthy Work Environments: A Journey to Excellence
highlighted the importance of skilled communication, true collaboration, effective
decision making, appropriate staffing, meaningful recognition, and authentic leadership
as key drivers in maintaining a healthy work environment (AACN, 2005).

Together, these recommendations continue to support a nursing-specific focus on
patient safety to examine factors such as the length of a nursing shift or number of hours
worked, nurse fatigue, and elements within the nursing practice environment.

**Overall Purpose**

This dissertation expands on the idea to focus on patient safety by examining
factors related to the nursing practice environment. Specifically, the overall purpose of
this dissertation is to describe and discuss a research study that was conducted related to
patient safety, nursing practice environment characteristics, individual nurse
characteristics, and self-perceived nurse fatigue, initially within the specific setting of the neonatal intensive care unit (NICU).

**Theoretical Support**

The inclusion of a theoretical framework into a research study design “offers structure and organization to nursing knowledge and provides a systematic means of collecting data to describe, explain, and predict nursing practice” (McEwen & Willis, 2011, p. 23). This research study was informed by the Systems Engineering Initiative for Patient Safety (SEIPS) Model of Work System and Patient Safety (Figure 1), which demonstrates that varying components within the work structure/system influence one another and create processes that result in outcomes pertaining to work performance, quality and safety, and satisfaction (Carayon, et al., 2006). The elements within a work system include the organization, the environment, the person, the technology and tools, and the tasks. Together, these elements have the potential to impact both work and clinical processes, and subsequently, can influence outcomes at the patient, employee, practice environment, and organizational levels. For this study, self-perceived nurse fatigue was considered the performance shaping factor (Sneddon, Mearns, & Flin, 2013) capable of impacting patient safety within the nursing practice environment as a result of varying influences. As an employee outcome, self-perceived nurse fatigue may be influenced by personal (i.e. age) or situational and environmental factors (i.e. leadership and support of the nurse manager) within the work system and may have the potential to contribute to processes that increase the perception of nurse fatigue, thereby, impacting patient safety and quality of patient care. Consequently, an increased self-perception of nurse fatigue has the ability to impact elements within the work system, that then have
the potential to create further care process that can negatively impact patient safety and the quality of patient care that is provided. As a theory based outside of the profession of nursing, the SEIPS Model of Work System and Patient Safety assists with collaboration between the profession of nursing and other disciplines to target a common goal of optimizing patient safety.

*Figure 1.* The SEIPS Model of Work System and Patient Safety. Adapted from Carayon, et al. (2006). This figure illustrates components of the SEIPS Model of Work System and Patient Safety.

In addition to the SEIPS Model of Work System and Patient Safety, principles related to social support theory were utilized in this study as a framework for understanding the importance of nurse manager support and nurse-physician teamwork and communication, both of which are elements within the nursing practice environment.
According to Kahn and Antonucci (1980), who have studied individuals’ well-being throughout the life course, strong and supportive relationships enhance the capability of an individual to cope within his/her environment. In describing an individual’s personal network, or convoy, they suggest that social support is reciprocal in nature and can help to moderate the effects of stress that one may experience. The social support within the NICU nursing practice environment can be considered the collaboration among the various healthcare team members, while nurse fatigue can be considered the stress that an individual nurse may encounter.
Chapter 2: Literature Review

This review of the literature begins by describing the concept of nurse fatigue and then highlights some of the complexities that have been suggested in terms of measuring fatigue/nurse fatigue. Next, other concepts related to nurse fatigue are discussed, and potential effects of nurse fatigue, as well as factors that have been suggested to influence nurse fatigue are explained. Then, the exploration of nurse fatigue specific to the NICU setting is justified. Finally, gaps in the existing literature are highlighted related to nurse fatigue, thereby, warranting the dissertation research study purpose, specific aims and hypotheses, research questions, and expected findings.

Description of Nurse Fatigue

Fatigue is a concept that has been studied within a variety of industries including aviation (Caldwell, 2005) and transportation (Jones, Dorrian, Rajaratnam, & Dawson, 2005), as well as healthcare. Within the healthcare arena, fatigue remains an ongoing factor that is examined in conjunction with patient safety. According to an early concept analysis, a proposed definition of fatigue for use within the nursing profession suggests that fatigue is “a subjective, unpleasant symptom which incorporates total body feelings ranging from tiredness to exhaustion creating an unrelenting overall condition which interferes with an individual’s ability to function in their normal capacity” (Ream & Richardson, 1996, p. 527). Fatigue has been subjectively linked to tiredness or
weariness, decreased energy, and feelings of exhaustion associated with impairments in both physical and cognitive functioning (Shen, Barbera, & Shapiro, 2006).

**Complexities of Measuring Nurse Fatigue**

Fatigue remains a difficult concept to measure consistently. Shen et al. (2006) suggest that one of the reasons for inconsistencies in measurement may relate to the varying dimensions associated with fatigue, including physical, mental, emotional, and total fatigue. Additionally, information about fatigue can be measured by capturing both subjective and objective data from study participants. Several instruments are available for measuring fatigue, which may also contribute to the complexity of accurately and consistently measuring the concept. For example, the Checklist Individual Strength (CIS) Questionnaire (Beurskens et al., 2000) examines fatigue by asking respondents about their experiences over the past two-week time frame, while the Karolinska Sleep Scale (KSS) (Shahid, Wilkinson, Marcu, & Shapiro, 2012) measures situational sleepiness and asks respondents to rate their current feeling of sleepiness on a scale ranging from “extremely alert” to “extremely-fighting sleep,” and the Occupational Fatigue Exhaustion/Recovery (OFER) Scale (Winwood, Lushington, & Winefield, 2006; Winwood, Winefield, Dawson, & Lushington, 2005) is designed to measure work-related fatigue by inquiring about chronic fatigue, acute fatigue, and intershift recovery.

Another potential contributor to the variations in measurement strategies for fatigue may be a result of inconsistent time scales for measurement. Some suggest that fatigue should be measured on a continuum, such as from acute to chronic or during various points within a timeframe (Shahid, et al., 2012; Winwood et al., 2006; Winwood
Others, however, recommend that fatigue is measured at a single moment in time to assess fatigue at that particular moment or even during a previously defined time period (Beurskens et al., 2000; Shahid et al., 2012). Differing time scales may add to the complexity of measuring self-perceived nurse fatigue as thoughts from organizational theory literature suggest that varying time scales have the potential to alter the meanings of and the theoretical relationships among the phenomena being investigated (Lemke, 2000; Mitchell & James, 2001; S. Zaheer, Albert, & A. Zaheer, 1999).

**Other Concepts Related to Nurse Fatigue**

In examining the literature pertinent to fatigue and nurse fatigue, the concepts of stress, burnout and compassion fatigue were also explored, as they are similar in nature to fatigue/nurse fatigue. To assist with differentiation and further understanding of the concepts, the following provides an explanation of stress, burnout and compassion fatigue.

**Stress**

The concept of stress, specifically psychological stress, has been described in terms of an individual’s reaction or response to specific events or experiences (Cohen, Kessler, & Gordon, 1997). Psychological stress is often been measured by self-perception to understand the degree to which an individual is able to cope with an unanticipated, uncontrollable, or straining situation (Cohen, Kamarck, & Mermelstein, 1983).
Burnout

In as early as the mid-1970’s, work-related burnout was described as a human response to chronic stress that results from the multiple interactions with the various individuals in the work environment (Freudenberger, 1974). Within the healthcare arena, these interactions can occur with patients, family members, and/or other staff members. Specific to the NICU environment, burnout continues to receive a great deal of attention because of the NICU’s specialized environment, continual interactions, high potential for both physical and psychosocial stress, and increased risks to patient safety (Braithwaite, 2008). The most widely used instrument for measuring work place burnout is the Maslach Burnout Inventory (MBI) (Maslach, Jackson, & Leiter, 1996), which consists of a 22-item questionnaire that examines professional burnout primarily within the social science fields.

Compassion Fatigue

Similar to nurse fatigue and burnout, is the concept of compassion fatigue. Researchers have described compassion fatigue in terms of the emotional effect sustained as a result of helping others who are experiencing trauma and/or distress (Figley, 2002; Yoder, 2010). More simply stated, compassion fatigue can be thought of as “the cost of caring” (Figley, 1995, p.1). For nurses, compassion fatigue may be exhibited as feelings of helplessness and even anger after being involved with patients and families during distressing illnesses and/or traumatic events (Joinson, 1992). Papadopoulos and Ali (2015) have recently suggested that further research is needed to develop and test
instruments for examining compassion fatigue for nurses in clinical practice as well as for nursing students.

**Potential Effects of Nurse Fatigue**

Within the healthcare field, particularly in focusing on healthcare professionals, fatigue has been examined in relation to cognition and mental alertness. Studies have indicated that fatigue suffered by healthcare providers may impact work-related performance. Specific to nursing, evidence suggests that fatigue has the ability to jeopardize a nurse’s ability to provide safe and effective care to patients.

Barker and Nussbaum (2011) studied the perceived levels of nurse fatigue in 745 registered nurses (RNs) utilizing an on-line survey technique. Findings from their cross-sectional on-line survey have suggested that the multiple dimensions of fatigue, including mental, physical, and total (mental and physical) fatigue, may impact the nature of a nurse’s work performance, thereby affecting patient safety. Lockley and colleagues (2007) have indicated that fatigue may be capable of decreasing nurse vigilance and/or attentiveness, thereby leading to a healthcare error to the patient or an occupational injury to the nurse. In a longitudinal study by Trinkoff, Le, Geiger-Brown, & Lipscomb (2007), almost 2,300 RNs were surveyed and 16.3% reported having experienced a needlestick injury. Additionally, the number of hours worked each day and working 13 or more hours per day at least one time per week were both significantly associated with a needlestick injury to the nurse.
The recent American Nurses Association (ANA) position statement that addresses nurse fatigue (ANA, 2014) suggests that fatigue can impact the nurse’s ability to provide safe care to patients, thereby increasing their vulnerability to errors. These deficits in the nurse’s performance have been linked to: (1) issues with short-term and working memory; (2) increases in risk-taking behaviors by the nurse; (3) reductions in the capacity to critically think and provide meaningful insight; and (4) decreases in the use of appropriate communication techniques (ANA, 2014; Durmer & Dinges, 2005; Goel, Rao, Durmer, & Dinges, 2009; Pilcher et al., 2007; Venkatraman, Chuah, Huettel, & Chee, 2007). As a result, the ANA (2014) has stressed the importance of implementing evidence-based strategies, targeted at both the individual and the system levels, focused on proactively addressing nurse fatigue, thereby promoting safe care, optimal patient outcomes, and nurse well-being, all within a healthy work environment supported by a culture of safety.

**Potential Factors Influencing Nurse Fatigue and/or Patient Safety**

Current literature reveals several factors that may influence nurse fatigue and/or patient safety. These include both environmental and situational factors within the work environment, as well as characteristics specific to the individual nurse.

**Situational and Environmental Factors**

Researchers have suggested a relationship between fatigue and the environment, indicating that certain situations and surroundings may have the potential to influence the perception of fatigue (Lan, Ji, & Looney, 2003; Zhu & Ji, 2004) and demands within the
work environment have the potential to contribute to increased fatigue levels (Smith-Miller, Shaw-Kokot, Curro, & Jones 2014). Specific factors including shift length and social support, specifically nurse manager support, and nurse-physician teamwork and collaboration, were explored as they relate to fatigue and/or other concepts associated with patient safety.

**Shift length.** Literature has linked a nurse’s working hours and shift length to patient safety and outcomes. In one of the initial studies that focused on nurse work hours, Rogers, Hwang, Scott, Aiken, & Dinges (2004) surveyed almost 400 hospital-based bedside nurses and found that about 40% of the total shifts worked among these nurses were greater than 12 hours in length. Consequently, the researchers also determined that the risk of committing an error increased significantly when a nurse worked longer than 12 hours at a time. In addition, researchers have suggested that the number of shifts worked consecutively has also been shown to contribute to nurse fatigue (Dirkx, 1993; Knauth, 1993). Specifically, Wallace (1998) has proposed that working more than four 12-hour shifts in a row is linked to both fatigue and extended periods of recovery from fatigue.

In a more recent systematic literature review (Bae & Fabry, 2013), more than 20 outcome measures related to the nurse and nearly 20 outcome measures related to the patient were found to be linked to nurse work hours. Some of the nurse-specific outcomes included work-related injuries, job satisfaction/dissatisfaction, burnout, fatigue, and intent to stay/leave the job, while some of the patient-specific measures included falls, sepsis, failure to rescue, errors, and mortality. These findings have suggested that
shift length and working hours for the nurse have a strong association with errors and adverse outcomes.

Social support. Researchers have suggested that because a culture incorporating teamwork (Manser, 2009) and respectful behavior (Leape et al., 2012a; Leape et al., 2012b) is supportive of a positive patient safety climate (Sammer, Lykens Singh, Mains, & Lackan, 2010) within a practice environment, it is important to focus on these aspects within the work environment as well as throughout an organization.

One area of concentration is the psychosocial environment, as the self-perception of fatigue may be impacted by psychosocial aspects of the working environment. These psychosocial elements may include the varying demands within the work environment as well as the social relationships among co-workers. A recent systematic review of stress and the psychosocial work environment revealed convincing evidence from several studies that increased job demands, decreased job control, and low support from both supervisors and co-workers correlate with increased cases of stress-related conditions (Nieuwenhuijsen, Bruinvels, and Fringes-Dresen, 2010). More specific to fatigue, two Dutch studies examined the relationship between psychosocial work characteristics and fatigue at work (Bültmann, Kant, Schröer, & Kasl, 2002; Bültmann, Kant, Van Den Brandt, & Kasl, 2002). The psychosocial characteristics that were examined in each of these studies included psychological demands, decision latitude, supervisor social support, co-worker social support, physical demands, emotional demands, presence of conflicts with supervisor and/or co-workers, and feelings of job insecurity. In the first study of almost 27,000 working individuals aged 18-65 years and from 45 different
organizations, the researchers found explainable correlations among fatigue and the psychosocial characteristics with the work environment (Bültmann, et al., 2002), while the second study, involving a subset of the above sample and including almost 9,000 workers, showed that characteristics within the psychosocial work environment were significant predictors of worker fatigue (Bültmann, et al., 2002).

**Nurse manager support.** Specific to the nursing profession, relationships between nursing staff members and nurse managers have been examined regarding both stress and burnout, and studies have demonstrated the importance of examining these relationships (Decker, 1997; Fletcher, 2001). According to one study, themes such as inadequate unit leadership, lack of physical presence, and unawareness of staffing issues have been identified as sources of job dissatisfaction for nurses when evaluating their respective nursing unit leadership (Fletcher, 2001). Results from a Canadian study of almost 540 nurses suggested that behavior of the nurse manager is associated with the work experiences of the nurses (Laschinger, Wong, McMahon, & Kaufmann, 1999), while findings from an English study of 50 nurses indicated that nurse managers were a primary contributor to the stress of the nurse (Taylor, White, & Muncer, 1999). To confirm these findings, several other studies have suggested that the receipt of social support from managers, supervisors, and co-workers can help to decrease the amount of work-related stress a nurse experiences (Muncer, Taylor, Green, & McManus, 2001; Joiner & Bartram, 2004).

**Nurse – physician collaboration.** Similar to relationships between nurses and nurse managers, relationships between nurses and their physician counterparts are often
examined in terms of stress and burnout as well. One study suggested that verbal abuse from physicians was a source of stress for nurses (Manderino & Berkey, 1997), while conflicts with physicians were more distressing to nurses than confrontations within their own profession (Hillhouse & Adler, 1997). Additionally, in a study of almost 215 nurses, physicians ranked third, as the most common source of verbal abuse experienced by the nurse (Rowe & Sherlock, 2005).

Both of these study findings pertaining to experiences with nurse managers and physician colleagues stress the need to continue exploring these relationships and to implement strategies to alleviate the associated stress and/or burnout. Additionally, these social support systems could be examined in relation to self-perceived nurse fatigue.

**Individual Characteristic as a Potential Moderating Factor**

A moderating factor is a variable that may impact the strength of the relationship between the independent variable and the dependent variable (Baron & Kenny, 1986). In examining the relationships among aspects of the nursing work environment and self-perceived nurse fatigue, one potential moderating factor is the individual nurse’s education level.

**Nursing experience and education level.** More than a decade ago, the American Organization of Nurse Executives (AONE) issued a position statement promoting baccalaureate preparation as the minimum education level for RNs. This was in an effort to facilitate a more highly educated nursing workforce aimed at optimizing patient outcomes and patient safety (AONE, 2005). About five years later, the IOM
continued the support of the baccalaureate education movement by releasing its report, *The Future of Nursing: Leading Change, Advancing Health*. This landmark report challenged the nursing profession to increase baccalaureate prepared nurses to 80% of the workforce to accommodate the continuing changes within the ever-evolving health care arena (IOM, 2011).

As further support for the position of a minimum education level requirement, multiple studies have suggested an impact on patient safety and patient outcomes related to the education level of the nurse. In three different studies, one utilizing a cross-sectional analysis of surgical patient outcomes (Aiken, Clarke, Cheung, Sloane, & Silber, 2003), one employing a retrospective observational study design in nine European countries (Aiken et al., 2014), and one using longitudinal methods (Kutney-Lee, Sloane, & Aiken, 2013), the results indicated that organizations employing a higher proportion of nurses prepared with a baccalaureate education or higher demonstrate a lower patient mortality (Aiken, et al., 2003; Aiken, et al., 2014; Kutney-Lee, et al., 2013) and decreased failure to rescue rates among surgical patients (Aiken, et al., 2003). Similarly, an observational study conducted within 14 teaching hospitals in South Korea found that an increased number of baccalaureate-prepared nurses is associated with fewer patient deaths. (Cho et al., 2014).

These findings may support the use of nursing education level as a potential moderating variable when examining the psychosocial aspects of the nursing work environment and self-perceived nurse fatigue. Because nursing education level is linked to patient safety and improved patient outcomes, it is warranted to utilize it as a potential
moderating variable to examine the strength of the relationship between the nursing practice environment and self-perceived nurse fatigue.

**Other Individual Characteristics**

Several studies have reported that individual nurse characteristics such as age, sleep patterns, caffeine intake, current or recent life events, and climate have the ability to impact self-perceived nurse fatigue and nurse work performance.

**Age.** Some studies have suggested that insufficient sleep may affect the performance of individuals depending on their age. One study by Philip et al. (2004), which included subjects ranging from 20-63 years of age, focused on reaction times, both with and without sleep deprivation. The study results confirmed that, overall, age impacts performance negatively, suggesting that the older study participants had slower baseline reaction times than their younger counterparts. However, although, the younger participants had better performance when rested, sleep deprivation affected the reaction time performance of the younger participants more than the older participants.

In another study, Stenuit and Kerkhofs (2005) included healthy women aged 20-65 to examine the impact of sleep restriction for three consecutive nights. Results of this study indicated that sleep restriction affects younger women more than older women in terms of vigilance.

**Hours of sleep.** Studies suggest that the amount of sleep that is obtained by an individual can also have an impact on patient safety and patient outcomes. Rogers et al. (2004) have suggested that a lack of adequate sleep increases the likelihood of nurses
committing errors on patients. Findings from the Staff Nurse Fatigue and Patient Safety Study (Fletcher & Dawson, 2001) indicated a significant association between the amount of sleep a nurse obtained in the previous 24-hour time period and the risk of committing an error. Fletcher and Dawson (2001) also found that this risk was 3.4% higher when a nurse slept six hours or less in the prior 24-hour time frame.

**Caffeine consumption.** Caffeine has been labeled as one of the most common countermeasures utilized for fatigue/nurse fatigue. According to a research study regarding the effects of several stimulants, caffeine intake has been suggested to enhance both the alertness and the performance of the consumer (Wesenten, Killgore, & Balkin, 2005).

**Current or recent life event.** In developing a Bayesian network model to help explain the complexities and uncertainties of fatigue, Lan, Ji, and Looney (2002) have suggested that any factor with the potential to affect sleep may subsequently contribute to the development of fatigue. Therefore, because the experience of a current or recent life event (i.e. death of a loved one, divorce, etc.) may disturb one’s sleep, it may also have the potential to impact the self-perception of fatigue.

**Climate.** According to a recent study that involved a survey of both students, as well as elderly individuals, higher temperatures and more daylight, have been associated with decreased levels of fatigue (Kööts, Realo, & Allik, 2011). This finding suggests that the varying climate may impact the perceptions of nurse fatigue depending upon the season in which a study is conducted.
Exploration of Nurse Fatigue Specific to the Neonatal Intensive Care Unit

(NICU) Work Environment

Infants who receive care in the NICU, including very low birth weight (VLBW) infants, or those weighing less than 1,500 grams, are considered a vulnerable population. According to Mathews, Miniño, Osterman, Strobino, and Guyer (2010), VLBW infants account for almost half of the infant mortalities in the United States every year. The complexity of the care required by infants in the NICU, accompanied by their delicate medical status and physiologic immaturity and instability, makes them at risk for experiencing an error related to the care that is provided to them. Therefore, optimal nursing care of infants in the NICU can be highly dependent on the skill and attentiveness of the nurse caring for the infant.

In a recent position statement, the National Association of Neonatal Nurses (NANN) stressed the importance of focusing on strategies to alleviate nurse fatigue by suggesting that “neonatal nurses and their employers implement a combination of countermeasures to minimize personal and patient safety risks as they relate to fatigue, shift length, and overtime” (Samra & Smith, 2015, p. 311).

Current Study

Problem Statement and Gap in the Literature

Thus far, much of the attention surrounding nurse fatigue has focused on work hours, shift length, overtime, and staffing concerns (Bae & Fabry, 2014; Griffiths et al., 2014; Hinderer et al., 2014; Lockley et al., 2007; Rogers et al., 2004; Scott, Rogers,
Hwang, & Zhang, 2006; Trinkoff et al., 2011; Witkoski-Stimpfel & Aiken, 2013; Witkoski-Stimpfel, Lake, Barton, Gorman, & Aiken, 2013), while the literature pertaining to the nursing practice environment has primarily focused on nurse burnout and stress vs. nurse fatigue (Braithwaite, 2008; Hinderer et al., 2014).

Little research has been found that examines the relationships between aspects within the nursing practice environment and self-perceived nurse fatigue. According to Lake (2002), the nursing practice environment has the potential to either “facilitate or constrain professional nursing practice” (p. 178). Therefore, an essential component to understanding self-perceived nurse fatigue is to analyze any relationship it may have with elements in the nursing practice environment.

Specifically within the NICU setting, a paucity of literature exists regarding aspects of the NICU nursing practice environment, including the psychosocial elements, and their relationship to self-perceived nurse fatigue. Such psychosocial elements include the ability and support of the unit-based nursing leadership, the variations in nurse staffing and availability of necessary resources, and the collaboration and teamwork among nurses and their physician colleagues. Because literature has suggested that several factors may influence fatigue, including the environment, it is important to understand the perceived levels of nurse fatigue among NICU nurses in order to subsequently examine the relationships that may exist within the NICU nursing practice environment. These relationships may help to inform nurses and nurse leaders of potential strategies for alleviating nurse fatigue within the nursing practice environment.
and may also help to inform future experimental research studies aimed at investigating and implementing specific interventions to reduce nurse fatigue.

**Study Purpose**

By examining self-perceived nurse fatigue within the context of the nursing practice environment, an initial study was conducted to examine the potential relationships among certain aspects of the nursing practice environment, such as nurse manager leadership, ability, and support, nurse staffing and resource adequacy, and collegial nurse-physician relations within the NICU setting, individual nurse characteristics, and self-perceived nurse fatigue. The overall intent of this dissertation research study was to understand the relationships among elements within the NICU nursing practice environment and self-perceived nurse fatigue, and the extent to which individual nurse characteristics, specifically highest education level, moderate those relationships.

**Specific Aims**

The specific aims and hypotheses for this dissertation research study were:

**Aim 1:** To identify relationships among aspects of the NICU nursing practice environment and self-perceived nurse when controlling for individual nurse characteristics.

The working hypothesis for Aim 1 was that relationships would exist among nurse manager ability, unit leadership, and support of nurses, staffing and resource adequacy, and collegial relations between NICU nurses and physicians.
and self-perceived nurse fatigue when controlling for individual characteristics of the NICU nurse. More specifically, it was hypothesized that strong perceptions of nurse manager ability, unit leadership, and support of nurses, staffing and resource adequacy, and collegial relations between NICU nurses and physician would be associated with lower levels of self-perceived nurse fatigue.

**Aim 2**: To identify the extent to which the highest education level of the nurse moderates the relationship between elements within the NICU nursing practice environment and self-perceived nurse fatigue.

The working hypothesis for Aim 2 was that there would be an interaction effect of highest education level in relation to aspects of the NICU nursing practice environment and self-perceived nurse fatigue. Specifically, it was hypothesized that the strength of the relationships among nurse manager ability, unit leadership, and support of nurses, staffing and resource adequacy, and collegial relations between NICU nurses and physicians and self-perceived nurse fatigue would vary based on the individual nurse’s highest level of education.

**Research Questions**

Additionally, the primary corresponding research questions for the study were as follows:

**Research Question 1**: To what extent do elements in the NICU nursing practice environment correlate with self-perceived nurse fatigue when controlling for individual nurse characteristics?
Research Question 2: Is there an interaction effect of highest education level related to aspects of the NICU nursing practice environment and self-perceived nurse fatigue?

It was expected that there would be relationships among aspects of the NICU nursing practice environment, individual nurse characteristics, and self-perceived nurse fatigue in NICU nurses. The individual nurse characteristics that were examined included age, education level, years of nursing experience, years of NICU nursing experience, length of work shift, additional employment, average hours of sleep, daily caffeine intake, a current or recent life event(s), a physical or mental contributor to fatigue, and a distressing patient event. This initial study was intended to provide insight regarding self-perceived nurse fatigue within the nursing practice environment specific to the NICU as it may relate to patient safety and to support the initial steps toward developing a program of research focused on the nursing practice environment and patient safety.

This research is important because it is intended to assist with a more comprehensive understanding of the factors within the nursing practice environment that contribute to self-perceived nurse fatigue, and it is ultimately envisioned that this research will help guide the design and implementation of relevant fatigue countermeasures.
Chapter 3: Methodology

Research design and methods are integral elements of any research study and serve as the structure and foundation for the overall plan of the research to be conducted. This section describes and discusses the research design and methodology for the dissertation research study related to self-perceived nurse fatigue of NICU nurses within the NICU nursing practice environment.

Design

This research study utilized a cross-sectional, correlational study design. By utilizing a cross-sectional approach, data were captured from a representative sample of NICU nurses at one specific moment in time. Additionally, the correlational design supported the purpose of the study and promoted the ability to examine relationships among the variables included in the study.

Sample and Setting

The sample for the study was a convenience sample of RNs working as direct patient care providers within one of five NICUs in the Midwestern United States. The NICU environment was selected because of the vulnerability of the population to patient safety risks and the clinical familiarity to the nurse researcher. The NICUs included as study sites were familiar to the nurse researcher, as a previous nursing research study had
been conducted within these sites. Because the nurse researcher was known to a contact person at each site, a professional relationship with these sites already existed. Connections with the involved NICUs were facilitated by the previous study experience and the established professional relationships, thereby promoting feasibility for the current study.

Of the five NICUs included in the research study, one was located within a free-standing children’s hospital, while the other four were located within tertiary care hospitals that provided maternal as well as neonatal care. One of the NICUs has been designated to provide level II or intermediate care to critically ill newborns, three of the five NICUs have been categorized as level III NICUs, with the ability to provide care to extremely premature infants and/or those requiring surgical intervention, and one of the five NICUs has been considered a level IV regional NICU, which allows for transportation of critically ill newborns and outreach education, in addition to services for extreme prematurity and surgical needs (Barfield, et al., 2012). The participating NICUs ranged in size from an 18-bed capacity to nearly a 60-bed capacity.

Additionally, the total number of RNs employed in each NICU ranged from approximately 25 to approximately 160. Direct patient care RNs who were employed on a regular basis (full-time or part-time) within the respective NICUs were eligible for inclusion in this study and were identified via an email distribution list maintained by the individual NICU’s nurse manager or designee. Exclusion criteria for study participation included employment as a licensed practical nurse as well as temporary or as needed employment status. It was initially estimated that up to 500 RNs may have been eligible
for participation in the research study. Individual nurse participation was voluntary and consent for participation was implied through completion of the secure, anonymous, web-based survey.

Utilizing the G* Power data analysis software package, an a priori power analysis was calculated for a linear multiple regression, using three tested predictors and 13 control predictors for a total of 16 predictors, to understand an ideal sample size for the study. To obtain a medium effect size with power = .95, a final sample size of at least 119 study participants was needed. To obtain a medium effect size with a power = .80, a final sample size of at least 78 study participants was required.

**Measures**

**Variables**

Variables for the research study were measured using data from validated and reliable survey instruments related to self-perceived nurse fatigue and the nursing practice environment, as well as from individual nurse demographic information. The study variables, accompanied by the corresponding information source, are presented in Table 1. Self-perceived nurse fatigue was considered the dependent or outcome variable and was measured subjectively by asking the study participants, NICU RNs, about their self-perception of nurse fatigue. For purposes of the study, nurse fatigue was defined as the feeling of tiredness or exhaustion that an individual nurse experiences (Ream & Richardson, 1996; Rogers & Hughes, 2008; Shen et al., 2006) and was assessed by inquiring about subjective fatigue, motivation, activity, and concentration over the
previous two-week time period (Beurskens, et al., 2000). To capture information about self-perceived nurse fatigue, the Checklist Individual Strength (CIS) Questionnaire (Vercoulen, Alberts, & Bleijenberg, 1999) was utilized.

The primary independent variables were related to the ability, leadership, and support provided by the nurse manager, nurse staffing and availability of needed resources, and nurse-physician relationships, and were measured using the Practice Environment Scale of the Nurse Work Index (PES-NWI) (Lake, 2002).

Other control variables that were examined pertained to individual characteristics of the nurse and included age, number of years of nursing experience, number of years of NICU nursing experience, highest level of education, shift length, hours of sleep, caffeine consumption, additional employment, current or recent life experience(s), physical or mental contributors to fatigue, and distressing patient event(s).

Additionally, highest education level of the nurse was examined as a potential moderating variable on the relationships among aspects of the NICU nursing practice environment and self-perceived nurse fatigue.

In relating the variables to the SEIPS Model of Work System and Patient Safety (Carayon et al., 2006), the leadership and support of the nurse manager, nurse staffing and availability of needed resources, and nurse-physician relationships were categorized as environmental factors. Process factors included total number of days worked, number of consecutive days worked, shift length, hours of sleep, caffeine consumption, additional employment, current or recent life experience(s), physical or mental contributor(s) to
fatigue, and distressing patient event(s). Age, number of years of nursing experience, number of years of NICU nursing experience, and highest level of education were considered personal factors.

Table 1.

Study Variables and Sources of Information

<table>
<thead>
<tr>
<th>Variable</th>
<th>Source of Information</th>
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</thead>
<tbody>
<tr>
<td><strong>Dependent/outcome variable</strong></td>
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<tr>
<td>Self-perceived nurse fatigue</td>
<td>CIS Questionnaire</td>
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<tr>
<td><strong>Primary Independent variables</strong></td>
<td></td>
</tr>
<tr>
<td>Nurse manager ability, leadership, and Support</td>
<td>PES-NWI</td>
</tr>
<tr>
<td>Staffing and resource adequacy</td>
<td>PES-NWI</td>
</tr>
<tr>
<td>Collegial nurse-physician relations</td>
<td>PES-NWI</td>
</tr>
<tr>
<td><strong>Moderating Variable</strong></td>
<td></td>
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<tr>
<td>RN education level</td>
<td>Demographic survey</td>
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<tr>
<td><strong>Other Control Variables</strong></td>
<td></td>
</tr>
<tr>
<td>RN age</td>
<td>Demographic survey</td>
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<tr>
<td>RN experience</td>
<td>Demographic survey</td>
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<tr>
<td>NICU RN experience</td>
<td>Demographic survey</td>
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<tr>
<td>Number of days worked</td>
<td>Demographic survey</td>
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<tr>
<td>Number of consecutive days worked</td>
<td>Demographic survey</td>
</tr>
<tr>
<td>Shift length</td>
<td>Demographic survey</td>
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<tr>
<td>Hours of sleep</td>
<td>Demographic survey</td>
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<tr>
<td>Caffeine consumption</td>
<td>Demographic survey</td>
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<tr>
<td>Additional employment</td>
<td>Demographic survey</td>
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<tr>
<td>Current/recent life event</td>
<td>Demographic survey</td>
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<tr>
<td>Physical or mental contributors to fatigue</td>
<td>Demographic survey</td>
</tr>
<tr>
<td>Distressing patient event</td>
<td>Demographic survey</td>
</tr>
</tbody>
</table>

Note. RN = registered nurse; CIS Questionnaire = Checklist Individual Strength Questionnaire; PEW-NWI = Practice Environment Scale of the Nursing Work Index
Instruments

Self-perceived nurse fatigue, as the dependent or outcome variable, was measured by administering the CIS Questionnaire via a secure, anonymous, web-based survey to individual NICU nurses within five NICUs in the Midwestern United States. Additionally, utilizing the same web-based survey methodology, aspects of the nursing practice environment were measured by administering the PES-NWI. The demographic information was also captured from questions incorporated into the web-based survey.

Checklist Individual Strength (CIS) Questionnaire. The CIS Questionnaire was initially developed to measure several aspects of fatigue in individuals with chronic diseases (Vercoulen et al., 1994; Vercoulen et al., 1999), and follow-up studies have been conducted within the working population to establish sensitivity and specificity (Bültmann et al., 2000), as well as discriminant and convergent validity of this instrument for this population (Beurskens et al., 2000). The CIS Questionnaire incorporates four dimensions, with a varying number of items per dimension, to examine self-perceived fatigue. These dimensions include: (1) the subjective experiences related to fatigue; (2) the potential decrease in an individual’s motivation; (3) the reduction in an individual’s activity; and (4) the reduction in an individual’s concentration. The CIS Questionnaire, which has been estimated to take approximately four minutes to complete and consists of 20 items (see Appendix A) for which the individual indicates to what extent the specific statement is applicable by utilizing the seven-point scale that ranges from “yes, that is true” to “no, that is not true.” The statements reference the fatigue that the individual may have experienced during the previous two-week time period. Some of the
statements on the CIS Questionnaire target behaviors (i.e. “I do quite a lot within a day”),
while others focus on psychological aspects (i.e. “I feel relaxed”). Composite scores for
the CIS Questionnaire can range from 20-140 with higher scores on the CIS
Questionnaire indicating a higher level of self-perceived fatigue, increased issues with the
ability to concentrate, decreased motivation, and diminished activity (Beurskens et al.,
2000).

By initially testing the CIS Questionnaire on patients with chronic fatigue
syndrome, the psychometric properties of the instrument have been determined to be
acceptable. Cronbach’s alpha for the overall CIS Questionnaire has been reported at .90,
while Cronbach’s alpha for the fatigue severity, concentration, motivation, and physical
activity level dimensions have been reported as .88, .92, .83, and .87 respectively
(Bültmann et al., 2000; Vercoulen et al., 1994).

Subsequent studies have been conducted to determine scoring cutoff points,
sensitivity, specificity, and validity of the CIS Questionnaire in the working population
(Beurskens et al., 2000; Bültmann et al., 2000). A cutoff point of 76 has been established
for the CIS Questionnaire scoring, indicating that CIS Questionnaire scores greater than
or equal to 76 are associated with probable fatigue, while specificity and sensitivity
values for the CIS Questionnaire have been determined to be 90% and 73%, respectively
(Bültmann et al., 2000). When the CIS Questionnaire total score was compared to the
exhaustion scale of the MBI, an instrument intended to measure burnout in human
services providers (Maslach et al., 1996), both discriminant validity and convergent
validity ($r = 0.62$) were established (Beurskens et al., 2000). This indicates that the CIS
Questionnaire is capable of discriminating between various groups regarding fatigue and would be acceptable for use in examining and measuring fatigue among working people, including nurses.

Although author permission to utilize the CIS Questionnaire for this dissertation research study was sought, correspondence from the author was unsuccessful. However, instructions for obtaining the CIS Questionnaire and indications for open use of the instrument were published in a recent article involving a review of fatigue instruments for shift workers (Sagherian & Geiger-Brown, 2016).

**Practice Environment Scale of the Nursing Work Index (PES-NWI).** Lake (2002) has indicated that the PES-NWI was derived from the Nurse Work Index (Kramer & Hafner, 1989), which was initially developed as a follow-up to the nursing shortage in the 1980’s as organizations worked to attract and retain nurses (Kramer & Hafner, 1989; McClure, Poulin, Sovie, & Wandelt, 1983). The PES-NWI was subsequently designed to focus on the practice environment and its potential influence on the individual nurse, as well as on patient safety and patient outcomes (Lake, 2002). The PES-NWI consists of 31 items dispersed across five subscales (see Appendix B). These subscales include: (1) Nurse Participation in Hospital Affairs; (2) Nursing Foundations for Quality of Care; (3) Nurse Manager Ability, Leadership, and Support of Nurses; (4) Staffing and Resource Adequacy; and (5) Collegial Nurse Physician Relations. Lake (2002) has suggested that the first two subscales pertain to organizational-level influences, while the other three subscales target unit-level influences. Therefore, for this dissertation research study
related to self-perceived nurse fatigue and aspects of the nurse practice environment, the three subscales that focused on the unit-level influences were utilized.

To complete the PES-NWI, participants are instructed to respond to the survey by rating each item on a scale of 1 (strongly disagree) to 4 (strongly agree), indicating their perception of the presence of the characteristic within his/her current nursing practice environment. The subscale score is then calculated as the average of the subscale item responses, and composite scores ranged from 1-4. Higher scores, i.e. values above 2.5, correlate with more agreement that the item is perceived in the current nursing practice environment, while lower scores, below 2.5, indicate disagreement that the characteristics are present (Lake & Friese, 2006; Lake 2002).

During the initial process of developing and testing the PES-NWI, Lake (2002) has suggested that the psychometric properties of the instrument are acceptable and support its use in analyzing the influences of the nursing practice environment on nurse outcomes. Cronbach’s alpha for the overall PES-NWI has been reported at .82, while Cronbach’s alpha for the Nurse Participation in Hospital Affairs, Nursing Foundations for Quality of Care, Nurse Manager Ability Leadership, and Support of Nurses, Staffing and Resource Adequacy, and Collegial Nurse-Physician Relations subscales have been reported as .83, .80, .84, .80, and .71, respectively. The correlation scores for the subscales have been reported to range from $r = .34$ to $.65$ indicating moderate correlation of the subscales. Additionally, confirmatory factor analysis has indicated that all five of the subscales have an acceptable loading factor ($> .40$) ranging from .52 to .78.
Since the original development of the PES-NWI, subsequent studies have been conducted to verify the validity and reliability of the instrument. Lake and Friese (2006) performed a study focused on variations in nursing practice environments and concluded that the Cronbach’s alpha values of the PES-NWI, assessed at the hospital level ranged from .88 - .98 indicating high internal consistency reliability. To demonstrate further verification of the validity and reliability of the instrument, the PES-NWI has been adapted to several languages to be tested internationally. As an example, Chiang and Lin (2009) confirmed construct and criterion validity and acceptable reliability when testing their Chinese version of the PES-NWI. Additionally, an Australian study of 1,192 nurses (Parker, Tuckett, Eley, & Hegney, 2010) utilized a principal component analysis, which explained 57.7% of the variability, to determine acceptable construct validity and Cronbach's alpha (.95) to confirm internal consistency reliability of the PES-NWI.

For this dissertation research study, permission to use the three subscales of the PES-NWI was obtained from the survey developer (Appendix C).

**Demographic information.** The demographic section of the secure, anonymous, web-based survey for this research study captured information specific to the individual nurse respondent. RN age was measured in years, RN experience was quantified as total number of years of nursing experience and total number of years of NICU nursing experience, and RN education was captured as the highest degree obtained (Associate’s Bachelor’s, Master’s or Doctoral) and whether the degree was specific to the discipline of nursing vs. non-nursing (Aiken et al., 2003; Aiken et al., 2014; Castner, Wu, & Dean-Barr, 2014; Cho et al., 2014; Kutney-Lee et al., 2013). In addition to collecting the
number of days and consecutive days worked in the past two weeks, shift length was also
captured and was represented as the average number of hours the RN’s shift was in the
past two weeks. Options of between four hours and greater than 12 hours were provided
(Griffiths et al., 2014; Rogers & Hughes, 2008; Rogers et al., 2004; Witkoski-Stimpfel &
Aiken, 2013; Witkoski-Stimpfel et al., 2013). Additional employment was captured as a
“yes” or “no” response, indicating whether or not the RN has other employment outside
of his/her current NICU nursing position. Hours of sleep was captured as the average
number of hours of sleep the RN obtained in each 24-hour period prior to going to work
in the previous two weeks. Options for this item ranged from two hours to greater than
seven hours (Rogers & Hughes, 2008). Caffeine consumption was measured related to
daily caffeine intake and options were provided as “none,” “at the beginning of the shift,”
“prior to feeling decreased alertness,” or “regularly throughout the day” (Rogers &
Hughes, 2008). Additionally, a current or recent life event was captured as a “yes” or
“no” response to understand if the participant has experienced a life event such as a
death, divorce, or other tragic event, in the past month, as this that could have potentially
impacted the perception of their fatigue level (Lan et al., 2003). Finally, existing physical
or mental contributors to fatigue, as well as recent distressing patient events were
represented by a “yes” or “no” response.

Procedure

Once the current research study was approved by the appropriate Institutional
Review Boards (Appendix D), a contact person, or site coordinator, was identified for
each of the five participating NICUs, and the nurse researcher communicated directly
with the site coordinator. All direct patient care RNs employed in the five involved NICUs were recruited for participation in this research study and were identified via an email distribution list maintained by the individual NICUs. One week prior to the initiation of the survey, an individualized introductory email (Appendix E) was sent to each of the site coordinators for email distribution to their respective staff members. Then, utilizing the Qualtrics survey system, a common survey link for the secure, anonymous, web-based survey was sent within a study notice email (Appendix F) by the site coordinator to each eligible RN utilizing the email distribution list maintained by each unit. The secure, anonymous, web-based survey included a demographic section, the survey questions intended to capture information about nurse fatigue (i.e. the CIS Questionnaire), and the three subscales of the instrument to measure the nursing practice environment (i.e. the PES-NWI) (Appendix G). According to multiple researchers who have examined survey or questionnaire techniques, use of web-based survey methods requires little to no cost and yields a faster response from the participants (Cook, Heath, & Thompson, 2000; Deutskens, De Rutyer, Wetzels, & Oosterveld, 2004).

The secure, anonymous, web-based survey link was available to the research study participants for a four-week time period to account for vacation time off from work or part-time employment status. Within this four-week time period, weekly reminder emails (Appendix H) were sent to the site coordinator requesting that they each be forwarded to the eligible study participants. The study participants were asked to complete the survey based on their perceptions of the previous two-week timeframe. As an incentive to complete the survey, a donation to a professional organization that supports the improvement in care for critically ill infants (i.e. The March of Dimes) was
Data for this research study were collected by a secure survey method and were stored on a secure computer, in which data were only accessible with password access.

**Data Analysis**

By employing the discussed instrumentation, the CIS Questionnaire and the PES-NWI promoted the collection of data for the outcome variable and the predicting variables for this dissertation research study. The data analysis method utilized was a multiple regression analysis technique. In capturing the study information in the outlined manner, a multiple regression analysis was performed to assist in the understanding of the relationships between these variables and the amount of variability in the outcome that was accounted for by the predicting variables.

For comparison, a multiple regression analysis technique was utilized in the Dutch study that examined the relationship between psychosocial work characteristics and fatigue. Results of this study suggested explainable correlations among the variables (Bültmann et al., 2002). Based on the similarities in design and methodology of this study and this dissertation research study related to self-perceived nurse fatigue and the nursing practice environment, a similar data analysis technique using a multiple regression analysis was employed to examine the relationships among self-perceived nurse fatigue, individual nurse characteristics, and aspects of the NICU nursing practice environment. This type of analysis allowed for an explanation of the relationship among the variables and an evaluation of the amount of variance in self-perceived nurse fatigue that was predicted by the nursing practice environment characteristics when controlling for individual nurse characteristics. Additionally, interaction effects of highest education
level were examined in relation to elements within the NICU nursing practice environment and self-perceived nurse fatigue.

More specifically, to examine the data for potential relationships between the independent variables and the dependent variable, a hierarchical regression analysis, utilizing the SPSS statistical software package version 22, was performed. This technique was intended to help with an understanding of the extent to which nurse manager ability, leadership, and support of nurses, staffing and resource adequacy, and collegial nurse-physician relations correlated with self-perceived nurse fatigue of NICU nurses when controlling for individual nurse characteristics. Additionally, an analysis was completed to examine the potential interaction effects of highest education level on self-perceived nurse fatigue by using self-perceived nurse fatigue as the focal variable and highest education level as the moderating variable.

To analyze the data, a hierarchical regression analysis technique was utilized with the following blocks:

- Block 1 incorporated self-perceived nurse fatigue as the dependent variable and the individual nurse characteristics as the independent control variables.
- Block 2 included self-perceived nurse fatigue as the dependent variable and nurse manager ability, leadership, and support of nurses, staffing and resource adequacy, and collegial nurse-physician relations as the primary independent variables.

Additionally, an analysis was conducted to understand the following interaction or moderating effects:
Descriptive statistics were examined related to the demographic information provided by the individual NICU nurses. Additionally, inferential/correlational statistics were analyzed in terms of associations among variables and moderating effects.
Chapter 4: Results

A hierarchical regression analysis was conducted to determine the extent to which nurse manager ability, leadership, and support of nurses, staffing and resource adequacy, and collegial nurse-physician relations predict self-perceived nurse fatigue. Additionally, the interaction effects of highest education level and nurse manager ability, leadership, and support of nurses, highest education level and staffing and resource adequacy, and highest education level and collegial nurse-physician relations were examined during this analysis.

An initial review of the data indicated that 200 surveys were completed; however, after further analysis, a total of 25 cases were discarded. Sixteen cases were deleted because they contained no survey information at all, eight more cases were deleted as they contained no survey information for either the PES-NWI scale or the CIS Questionnaire, and one additional case was deleted because it contained no survey information for the PES-NWI scale. This data cleaning resulted in a final sample size of 175 completed surveys. The site coordinators confirmed the actual number of eligible full-time and part-time RNs that received the survey link within their respective units. The total number of eligible RNs among the five participating NICUs was 406, thereby providing a response rate of 43% (175/406).
In further reviewing the final sample of the 175 survey responses, a minimal amount of missing data were noted (0.6% for age, 0.6% for years of NICU RN experience, 1.7% for number of days worked in the past two weeks, and 0.6% for current physical or mental health contributor of fatigue) and were determined to be missing completely at random (MCAR). Because of this pattern, the expectation maximization (EM) technique was utilized to impute missing values for the variables. According to Polit and Lake (2010), EM is considered a preferred method for missing data imputation as it generates unbiased results for data that are MCAR, as was the case for this analysis. Additionally, the assumptions of normality, linearity, homoscedasticity, and independence, which are the typical assumptions that are tested during a regression analysis (Polit & Lake, 2010), were satisfied based on review of the histogram, P-P plot, and scatterplot.

In examining the correlations among the variables, the Pearson Correlation values were < .8 for almost all of the variables, indicating that multicollinearity among most of the predicting variables was likely not an issue for this dataset. Correlations, however, were noted between years of RN experience and age ($r = .87$) and years of NICU RN experience and age ($r = .80$). Additionally, years of RN experience and years of NICU RN experience were highly correlated with one another ($r = .93$). Therefore, years of RN experience and years of NICU RN experience were not included as individual nurse characteristics in the final hierarchical regression analysis.
Table 2 displays the characteristics of the study participants. The mean age (in years) of the sample was 39.28 ($SD = 12.63$). The majority (73.17%) of the participants had a bachelor’s degree in nursing as their highest level of education, while the mean number of years of RN experience and years of NICU RN experience were 13.86 ($SD = 12.70$) and 11.54 ($SD = 11.79$), respectively. The study participants worked an average of 6.06 ($SD = 1.46$) total days in the previous 2-week period, with an average of 2.91 ($SD = 1.02$) of those days being consecutive. Most (74.3%) of the sample indicated that the average length of their work shifts in the past 2-week timeframe was greater than 12 hours, and most (86.9%) slept between four and seven hours prior to going to work. Almost half (48.0%) of the sample slept six to seven hours, while 38.9% indicated that they slept an average of four to five hours in each 24-hour period prior to their work shifts. Most of the study participants responded that they consumed caffeine on work days, with 44.0% of the caffeine intake at the beginning of the shift and 30.9% of the consumption regularly throughout the day. Regarding employment in addition to their current NICU RN position, the majority (92.0%) of the sample denied working elsewhere. Finally, most of the study participants indicated that they have not had a recent life event (73.7%), did not currently have a physical or mental health contributor to fatigue (70.9%), and had not recently experienced a distressing patient event (78.3%).
Table 2.

Characteristics of Study Participants

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>mean [SD] or n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>39.28 [12.63]</td>
</tr>
<tr>
<td>Highest education level (after RN)</td>
<td></td>
</tr>
<tr>
<td>Diploma</td>
<td>11 (6.3%)</td>
</tr>
<tr>
<td>Associate’s degree, nursing</td>
<td>14 (8.0%)</td>
</tr>
<tr>
<td>Associate’s degree, non-nursing</td>
<td>1 (0.6%)</td>
</tr>
<tr>
<td>Bachelor’s degree, nursing</td>
<td>128 (73.1%)</td>
</tr>
<tr>
<td>Bachelor’s degree, non-nursing</td>
<td>2 (1.1%)</td>
</tr>
<tr>
<td>Master’s degree, nursing</td>
<td>14 (8.0%)</td>
</tr>
<tr>
<td>Master’s degree, non-nursing</td>
<td>5 (2.9%)</td>
</tr>
<tr>
<td>Years of RN experience</td>
<td>13.86 [12.70]</td>
</tr>
<tr>
<td>Years of NICU RN experience</td>
<td>11.54 [11.79]</td>
</tr>
<tr>
<td>Number of days worked in past two weeks</td>
<td>6.06 [1.46]</td>
</tr>
<tr>
<td>Number of consecutive days worked in past two weeks</td>
<td>2.91 [1.02]</td>
</tr>
<tr>
<td>Average number of hours worked each shift in past two weeks</td>
<td></td>
</tr>
<tr>
<td>4 or more but less than 8</td>
<td>1 (0.6%)</td>
</tr>
<tr>
<td>8 or more but less than 10</td>
<td>3 (1.7%)</td>
</tr>
<tr>
<td>10 or more but less than 12</td>
<td>41 (23.4%)</td>
</tr>
<tr>
<td>Greater than 12</td>
<td>130 (74.3%)</td>
</tr>
<tr>
<td>Hours of sleep each 24-hour period prior to shift (average #)</td>
<td></td>
</tr>
<tr>
<td>2-3 hours</td>
<td>2 (1.1%)</td>
</tr>
<tr>
<td>4-5 hours</td>
<td>68 (38.9%)</td>
</tr>
<tr>
<td>6-7 hours</td>
<td>84 (48.0%)</td>
</tr>
<tr>
<td>Greater than 7 hours</td>
<td>21 (12.0%)</td>
</tr>
</tbody>
</table>

Continued
Table 2 continued

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>mean [SD] or n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caffeine intake on work days</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>26 (14.9%)</td>
</tr>
<tr>
<td>At the beginning of the shift</td>
<td>77 (44.0%)</td>
</tr>
<tr>
<td>Prior to feeling decreased alertness</td>
<td>18 (10.3%)</td>
</tr>
<tr>
<td>Regularly throughout the day</td>
<td>54 (30.9%)</td>
</tr>
<tr>
<td>Additional employment</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>14 (8.0%)</td>
</tr>
<tr>
<td>No</td>
<td>161 (92.0%)</td>
</tr>
<tr>
<td>Recent life event (death, divorce, move, etc.)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>46 (26.3%)</td>
</tr>
<tr>
<td>No</td>
<td>129 (73.7%)</td>
</tr>
<tr>
<td>Current physical or mental health contributor to fatigue</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>50 (28.6%)</td>
</tr>
<tr>
<td>No</td>
<td>124 (70.9%)</td>
</tr>
<tr>
<td>Missing</td>
<td>1 (0.6%)</td>
</tr>
<tr>
<td>Recent distressing patient event</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>38 (21.7%)</td>
</tr>
<tr>
<td>No</td>
<td>137 (78.3%)</td>
</tr>
</tbody>
</table>

Note. N = 175; SD = standard deviation; RN = registered nurse; NICU = neonatal intensive care unit. Percentages may not add to 100% due to rounding.

Table 3 displays the descriptive statistics, including mean, standard deviation and minimum to maximum values, for the primary independent variables and the dependent variable. Scores for the primary independent variables were based on a scale of 1 (strongly disagree) to 4 (strongly agree). Using the PES-NWI, higher scores (greater than 2.5) were suggestive of more agreement that the item was perceived within the current nursing practice environment (Lake & Friese, 2006; Lake 2002). For this study, nurse
manager ability, leadership, and support of nurses had an overall mean of 2.84 ($SD = .72$), while staffing and resource adequacy and collegial nurse-physician relations showed means of 2.64 ($SD = .84$) and 2.80 ($SD = .84$), respectively. Each of the individual scores for these items ranged from 1 - 4 as the minimum and maximum values. The dependent variable, self-perceived nurse fatigue, showed an average overall score of 68.25 ($SD = 19.32$) suggesting less fatigue for the overall sample as compared to the cutoff point of 76 which has been associated with probable fatigue (Bültmann et al., 2000). The individual total scores for self-perceived nurse fatigue did, however, range from a minimum of 22 to a maximum of 128 for this sample.

Table 3.

*Descriptive Statistics for Primary Independent Variables and Dependent Variable*

<table>
<thead>
<tr>
<th>Primary independent variables</th>
<th>Mean (SD)</th>
<th>Min – Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurse manager ability, leadership, and support</td>
<td>2.84 (.72)</td>
<td>1 - 4</td>
</tr>
<tr>
<td>Staffing and resource adequacy</td>
<td>2.64 (.84)</td>
<td>1 - 4</td>
</tr>
<tr>
<td>Collegial nurse-physician relations</td>
<td>2.80 (.84)</td>
<td>1 - 4</td>
</tr>
<tr>
<td>Dependent variable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-perceived nurse fatigue</td>
<td>68.25 (19.32)</td>
<td>22 - 128</td>
</tr>
</tbody>
</table>

*Note.* $N = 175$; $SD =$ standard deviation; Min = minimum value; Max = maximum value; Responses were collected on a scale of 1 (strongly disagree) to 4 (strongly agree). Higher scores indicate more agreement that the item is perceived in the current nursing practice environment.
As seen in Table 4, Model 1 includes the individual nurse characteristics as the control variables, Model 2 incorporates the primary independent variables along with the control variables, and Model 3 includes the interaction variables in addition to the primary independent and control variables. A focus on Model 2 suggests that hours worked each shift in past two weeks ($t = 2.30; p < .05$), hours of sleep each 24-hour period prior to shift ($t = -2.10; p < .05$), a current physical or mental health contributor to fatigue ($t = 3.61; p < .001$), and a recent distressing patient event ($t = 2.13; p < .05$) were significantly associated, as individual nurse characteristics, to self-perceived nurse fatigue. In examining the primary predicting variables within Model 2, nurse manager ability, leadership, and support was significantly associated with self-perceived nurse fatigue ($t = -2.02; p < .05$), while staffing and adequacy ($t = -.81; p = .418$) and collegial nurse-physician relations ($t = -1.27; p = .21$) were not significantly associated with self-perceived nurse fatigue. Specifically focusing on the effects of nurse manager ability, leadership, and support as the significant primary predicting variable, it would be expected that as nurse manager ability, leadership, and support increases by one unit, self-perceived nurse fatigue would decrease by 4.87 points, when controlling for individual nurse characteristics. To address any potential interaction effects, Model 3 displays the interaction result of highest education level and nurse manager ability, leadership, and support, highest education level and staffing and resource adequacy, and highest education level and collegial nurse-physician relations. For this study, all three of the interactions were not significant ($t = -.92; p = .36; t = .05; p = .96; t = -.22; p = .83$, respectively), thereby indicating that moderation was not occurring and, thus, an interaction between these predicting variables was not present.
Table 4.

Coefficients Table Illustrating the Relationships between Self-Perceived Nurse Fatigue and the Various Predicting Variables

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std Error</td>
<td>B</td>
</tr>
<tr>
<td>(Constant)</td>
<td>61.30</td>
<td>20.95</td>
<td>82.93</td>
</tr>
<tr>
<td>Age</td>
<td>-.11</td>
<td>.12</td>
<td>-.14</td>
</tr>
<tr>
<td>Total days worked in 2 weeks</td>
<td>-.57</td>
<td>1.16</td>
<td>-.92</td>
</tr>
<tr>
<td>Consecutive days worked in past 2 weeks</td>
<td>-.91</td>
<td>1.67</td>
<td>-.54</td>
</tr>
<tr>
<td>Hours worked each shift in past 2 weeks</td>
<td>5.87</td>
<td>2.74</td>
<td>2.15 *</td>
</tr>
<tr>
<td>Hours of sleep each 24-hour period prior to shift</td>
<td>-5.08</td>
<td>2.14</td>
<td>-2.38 *</td>
</tr>
<tr>
<td>Caffeine intake</td>
<td>.83</td>
<td>1.29</td>
<td>.64</td>
</tr>
<tr>
<td>Additional employment</td>
<td>-2.65</td>
<td>5.05</td>
<td>-.52</td>
</tr>
<tr>
<td>Recent life event</td>
<td>4.00</td>
<td>3.25</td>
<td>1.23</td>
</tr>
<tr>
<td>Physical or mental health contributor to fatigue</td>
<td>9.40</td>
<td>3.12</td>
<td>3.02 **</td>
</tr>
<tr>
<td>Distressing patient event</td>
<td>10.53</td>
<td>3.39</td>
<td>3.11 **</td>
</tr>
</tbody>
</table>

Continued
Table 4 continued

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurse manager ability, leadership, and support</td>
<td>-4.87 (2.41)</td>
<td>-2.02* (2.56)</td>
<td>-1.94 (2.56)</td>
</tr>
<tr>
<td>Staffing and resource adequacy</td>
<td>-1.63 (2.01)</td>
<td>-.81 (2.09)</td>
<td>-.56 (2.09)</td>
</tr>
<tr>
<td>Collegial nurse-physician relations</td>
<td>-2.51 (1.98)</td>
<td>-1.27 (2.05)</td>
<td>-1.33 (2.05)</td>
</tr>
<tr>
<td>Education level x nurse manager ability, leadership, and support</td>
<td>-1.89 (2.05)</td>
<td>-.92 (2.05)</td>
<td></td>
</tr>
<tr>
<td>Education level x staffing and resource adequacy</td>
<td>.08 (1.76)</td>
<td>.05 (1.76)</td>
<td></td>
</tr>
<tr>
<td>Education level x collegial nurse-physician relations</td>
<td>-.42 (1.91)</td>
<td>-.22 (1.91)</td>
<td></td>
</tr>
</tbody>
</table>

Note. N = 175; * = p < .05; ** = p < .01; *** = p < .001

Table 5 displays the model summary statistics and indicates, per Model 1, that the individual nurse characteristics, as the control variables, accounted for 20.1% (R² = .201, F {11, 162} = 3.71, p < .001) of the variability in self-perceived nurse fatigue. The addition of the primary predicting variables significantly increased the explained variability (∆R² = .082) in self-perceived nurse fatigue by 8.2% (F change {3,159} = 6.06, p < .01). Thus, Model 2, the model that included the individual nurse characteristics as well as the primary predicting variables, significantly predicted self-
perceived nurse fatigue and accounted for 28.3% ($R^2 = .283$) of the total variability in self-perceived nurse fatigue.

Table 5.

*Model Summary Table Displaying the Amount of Variation in Self-Perceived Nurse Fatigue that is Explained by the Different Models*

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
<th>Change Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>R Square Change</td>
</tr>
<tr>
<td>1</td>
<td>.449a</td>
<td>.201</td>
<td>.147</td>
<td>17.87</td>
<td>.201</td>
</tr>
<tr>
<td>2</td>
<td>.532b</td>
<td>.283</td>
<td>.220</td>
<td>17.08</td>
<td>.082</td>
</tr>
<tr>
<td>3</td>
<td>.538c</td>
<td>.290</td>
<td>.212</td>
<td>17.17</td>
<td>.007</td>
</tr>
</tbody>
</table>

*Note.*  
* = $p < .05$; ** = $p < .01$; *** = $p < .001$

a. Predictors: Individual nurse characteristics.

b. Predictors: Individual nurse characteristics, nurse manager ability, leadership, and support of nurses, staffing and resource adequacy, collegial nurse-physician relations.

c. Predictors: Individual nurse characteristics, nurse manager ability, leadership, and support of nurses, staffing and resource adequacy, collegial nurse-physician relations, highest education level x nurse manager ability, leadership, and support of nurses, highest education level x staffing and resource adequacy, highest education level x collegial nurse-physician relations.
Chapter 5: Discussion

The results of the hierarchical regression analysis for this dissertation research study suggest that a portion of the total variance in self-perceived nurse fatigue was predicted by the independent variables; however, there was no interaction effect found between the primary independent variables and the suggested moderating variable.

Relation to Study Aims

Study aim #1 focused on the identification of relationships among aspects of the NICU nursing practice environment and self-perceived nurse fatigue when controlling for individual nurse characteristics. The working hypothesis for this aim suggested that relationships would exist among nurse manager ability, unit leadership, and support of nurses, staffing and resource adequacy, and collegial relations between NICU nurses and physicians and self-perceived nurse fatigue when controlling for individual characteristics of the NICU nurse. More specifically, it was hypothesized that strong perceptions of nurse manager ability, unit leadership, and support of nurses, staffing and resource adequacy, and collegial relations between NICU nurses and physicians would be associated with lower levels of self-perceived nurse fatigue. Based on the data analysis, nurse manager ability, leadership, and support was noted to be significantly associated with self-perceived nurse fatigue. Although staffing and resource adequacy and collegial nurse-physician relations were not found to be independently associated with self-
perceived nurse fatigue, the model including the three primary predicting variables, nurse manager ability, leadership, and support, staffing and resource adequacy, and collegial nurse-physician relations, was noted to significantly account for a portion of the variance in self-perceived nurse fatigue. Because an association among the variables was noted and significant predictors of self-perceived nurse fatigue were identified, the null hypothesis would be rejected and the study hypothesis, suggesting that a relationship among the variables would exist, would be accepted.

The premise of study aim #2 was to identify the extent to which the highest education level of the nurse moderated the relationship between elements within the NICU nursing practice environment and self-perceived nurse fatigue. The working hypothesis for this aim proposed that there would be an interaction effect of highest education level in relation to aspects of the NICU nursing practice environment and self-perceived nurse fatigue. Specifically, it was hypothesized that the strength of the relationships among nurse manager ability, leadership, and support of nurses, staffing and resource adequacy, and collegial relations between NICU nurses and physicians and self-perceived nurse fatigue would vary based on the individual nurse’s highest level of education. Results of the data analysis, however, indicated that no interaction effect occurred. Perhaps these effects were impacted by the lack of variability in education level of the study sample, as 73.1% of the sample held a Bachelor’s degree in nursing as their highest level of education. Based on these results, the hypothesis for study aim #2 would be rejected and the null hypothesis, indicating that there would be no interaction effect, would be accepted.
Implications for Practice

Based on the analysis for this dissertation research study, implications for nursing practice are evident. The results of this study regarding hours of sleep and hours worked complement and reinforce the previous work that focused on amount of sleep, working hours, and shift length as they relate to patient safety and patient outcomes (Rogers, et al., 2004). Specific to the NICU setting, the findings of this dissertation research study further substantiate the recent NANN position statement which emphasizes the importance of targeting strategies designed to alleviate nurse fatigue by encouraging both neonatal nurses, as well as organizations, to implement fatigue countermeasures designed to diminish risks to both nurses and patients (Samra & Smith, 2015).

Additionally, the findings from this study are similar to those that have focused on nurse manager support and staff stress, job satisfaction, and overall work experiences. Fletcher (2001) found an association between nursing unit leadership and nurse’s job satisfaction, Laschinger et al. (1999) correlated nurses’ work experiences with nurse manager behavior, and Taylor et al. (1999) suggested a relationship between nurses’ stress levels and the nurse manager. The relationships noted in this dissertation research study suggest that nurse manager ability, leadership, and support of nurses is significantly associated with a nurse’s self-perception of fatigue. This particular finding further strengthens the work and recommendations provided by the AACN (2005) and the AONE (2004 & 2015) regarding a healthy work environment, nurse manager competencies, and the importance of the nurse manager in supporting the nursing staff.
Journey to Excellence (2005), the AACN has stressed the importance of authentic leadership as a key driver in maintaining a healthy work environment. The AONE, as suggested within the Principles & Elements of a Healthful Practice/Work Environment (2004), indicates that the presence of expert, competent, and visible leadership is essential for advocacy for nursing practice and allocation of appropriate resources to support the nursing staff. Additionally, and more recently, the AONE (2015) established a framework consisting of three domains to capture the competencies essential to the nurse manage role. Within the domain focused on the leadership of people, the AONE (2015) emphasizes the importance of the nurse manager in promoting stress management, identifying issues that need immediate action, developing tactics to encourage staff satisfaction and engagement, and fostering a healthy work/practice environment. In relating those principles specifically to this dissertation research study, because a physical or mental health contributor to fatigue and a distressing patient event, as individual nurse characteristics, were also significantly associated with self-perceived nurse fatigue, competencies for nurse manages should include recognition of staff members’ personal situations that may impact fatigue as well as recent patient situations that could also contribute to an increased self-perception of fatigue and subsequent impact on patient safety.

In addition to further supporting the work of the AACN and the AONE, findings from this study reinforce the recent recommendations from the ANA (2014) that stress the importance of implementing evidence-based strategies, targeted at both the individual and the systems levels, focused on proactively addressing nurse fatigue. This dissertation research study suggests that the number of hours of sleep obtained prior to each work
shift, as well as the number hours worked during each shift, are both significantly associated with self-perceived nurse fatigue. Considering these findings along with the recommendations by the ANA, individual nurses should continue to concentrate on strategies for obtaining healthy sleep and addressing overall well-being, while employers should remain cognizant of nurse’s work schedules, break periods, and the use of overtime to remedy staffing concerns (ANA, 2014).

Based on the results of this dissertation research study, as well as on findings from similar studies and recommendations from professional organizations, it is clear that the nurse manager holds an important role and is positioned as the leadership figure capable of impacting the nursing practice environment. As nurse manager leadership development opportunities continue, incorporation of strategies focused on dealing with staff members who have a physical or mental health contributor to fatigue, as well as supporting staff members through distressing patient situations will be ideal. Together with the existing nurse manager competencies recommended by AONE (2015), these tactics can help to alleviate nurse fatigue and create and sustain a healthy work environment, thereby promoting safe care, optimal patient outcomes, and nurse well-being, all within a healthy work environment upheld within a culture of safety.

**Study Strengths and Limitations**

As with most research studies and data analyses, strengths and limitations of the research study design and measurement approach were apparent within this study. The following section will discuss both the study strengths and the study limitations.
Study Strengths

As the first known study focused on self-perceived nurse fatigue and elements within the nursing practice environment, specifically nurse manager ability, leadership, and support, staffing and adequacy, and nurse physician collegial relations, several strong points for this study were recognized. The strengths of this dissertation research study were noted in the methods of data collection, the inclusion of possible confounding variables, the link to a theoretical framework, the nurse researchers previous experiences and relationships, the strength and support for the use of the measures, the support for the suggested data analysis, and the potential for the results of the study to inform and provide a foundation for future research studies related to nurse fatigue and the nursing practice environment.

Methods of data collection. The method of data collection that was utilized in this research study was a common, secure, anonymous, web-based survey link, in which the same 4-week period was employed for all five participating NICUs. According to multiple researchers who have examined survey or questionnaire techniques, use of web-based survey methods requires little to no cost and yields a faster response from the participants (Cook, et al., 2000; Deutskens, et al., 2004). For this study, the survey that was distributed to the participants was easy to understand and follow. Additionally, the participants had the opportunity to access the survey link from any computer. Both the ease of use and the convenient accessibility of the survey lessened the burden to the participants by facilitating quicker responses, while also containing costs. This data collection method helped to maximize the response rate and ultimately yielded a 43%
response rate for this study. This response rate exceeds current literature that suggests a
typical response rate for web-based surveys is around 30%, but sometimes less (Cook et al., 2000; Sheehan, 2001; Vehovar & Manfreda, 2008). In additional to the weekly
reminder emails to the nursing staff members, another potential contributor to this
response rate was the continued encouragement by the site coordinators to the nursing
staff members to complete the survey. Additionally, the incentive offered to the March
of Dimes for each survey completed could have also assisted with the high response rate.
According to Deutskens, et al., (2004), incentives can be used as a way to minimize the
threat of mortality or attrition and optimize the response rate. For this study, based on a
total of 175 completed survey responses, $175 will be donated to the March of Dimes.

**Inclusion of potential confounding variables.** In addition to collecting
information regarding self-perceived nurse fatigue and perceptions of the nursing practice
environment, demographic information was also solicited from the individual NICU
nurses via the secure, anonymous, web-based survey method. The collection of this
demographic information assisted with the understanding of any potential confounding or
interaction effects of the relationship among the variables. As suggested by Campbell,
Stanley, and Gage (1963), one way to control for potential confounding variables is to
measure them as part of the research study. In an effort to control for a possible
maturation effect, which could have potentially impacted the self-perception of fatigue
within this study, age was controlled for, as some studies have suggested that insufficient
sleep may affect performance by individuals of varying ages (Philip, et al., 2004; Stenuit
& Kerkhofs, 2005). In considering RN experience and RN education, multiple studies
have been conducted to suggest an impact on patient outcomes (Aiken, et al., 2003;
Therefore, information regarding RN education level and number of years of nursing experience was collected from the individual nurses. Based on the recommendations provided by Rogers and Hughes (2008), shift length, hours of sleep, and caffeine consumption were measured as components of this study given that these variables may influence nurse responses regarding self-perceived nurse fatigue. Further, additional employment, a current or recent life event, a physical or mental contributor to fatigue, and a recent distressing patient event items were added to the demographic section of the survey to capture other circumstances that may have had the potential to impact the self-perception of nurse fatigue (Lan et al., 2003). Despite the complexity and variability within the NICU nursing practice environment, information related to confounding variables was able to be captured and helped to explain some of the variance in the self-perception of nurse fatigue.

**Link to a theoretical framework.** As discussed, this study was informed by the Systems Engineering Initiative for Patient Safety (SEIPS) Model of Work System and Patient Safety, as described by Carayon et al. (2006), with self-perceived nurse fatigue acting as the performance shaping factor (Sneddon, et al., 2013) capable of impacting patient safety within the nursing practice environment as a result of varying influences. As a theory based outside of the profession of nursing, the SEIPS Model of Work System and Patient Safety assisted with the partnership between the profession of nursing and other disciplines to target a common goal of optimizing patient safety.
**Previous experience and relationships.** The NICUs that participated in this study were familiar to the nurse researcher as a previous nursing research study had been conducted within these sites. The nurse researcher was known to a contact person at each site; therefore, a professional relationship with these sites had previously been established. Additionally, the nurse researcher has had previous experience with elements of the PES-NWI during participation in a prior study and has collaborated on a previous study with the nurse researcher who developed the PES-NWI. The previous experience with the instrument and established professional relationship with the PES-NWI author allowed for familiarity of the tool and access to the appropriate resource if questions were to arise as part of the study.

**Strength of the measures.** Both of the measures used in the study have strong psychometric properties indicating acceptable validity and reliability. The CIS Questionnaire was utilized because the psychometric testing results have indicated that this instrument is an acceptable measure of fatigue in the working population. It has been estimated to take approximately four minutes to complete the CIS Questionnaire (Hewlett, Dures, & Almeida, 2011), therefore, the brevity of the instrument coupled with the ease of use and understanding, make this instrument a reasonable measure to effectively evaluate self-perceived nurse fatigue. The PES-NWI has also received several verifications of its validity and reliability (Chiang & Lin, 2009; Lake, 2002; Lake & Friese, 2006; Parker et al., 2010) indicating that this instrument is acceptable for use in capturing information related to elements within the nursing practice environment. In utilizing only three of the five subscales in the research study, the participants were asked
to respond to five items in the nurse manager subscale, four items in the staffing subscale, and three items regarding nurse-physician relationships. Overall, the participants were presented with 12 of the 31 items from the PES-NWI, thereby, controlling the number of items to be answered, while still capturing the desired information. Based on its validity, reliability, ease of use, and theoretical basis, the PES-NWI has been regarded as a highly-recommended tool for assessing the nursing practice environment (Lake, 2007). Use of the PES-NWI has not only been supported by the ANA, but also endorsed by the National Quality Forum (Tavenner, 2012). According to Warshawsky and Havens (2011), a lack of literature exists for the use of the PES-NWI within varying practice settings. Therefore, the use of this instrument within this dissertation research study has the potential to strengthen the body of knowledge related to the practice environment for nurses. The use of the PES-NWI within this study not only helps to address the paucity of literature, but it also targets a key area of focus, the nursing practice environment, as proposed by the IOM (Levy, 2004; Page, 2004).

As additional support for the use of the PES-NWI, the National Database for Nursing Quality Indicators (NDNQI®) has endorsed the use of the PES-NWI as a component of the annual RN satisfaction survey that participating organizations can utilize for their respective staff members. Many organizations that participate in NDNQI® are either Magnet® recognized or preparing to become Magnet® recognized (ANCC, 2009). The intent of the NDNQI® RN satisfaction survey is to assess the level of nurse engagement within an organization, and it focuses on the nurse manager as one of the primary domains. Local results from one organizational-wide nurse engagement
survey (The Ohio State University Wexner Medical Center, Columbus, Ohio, 2012) using NDNQI® and subsequently the PES-NWI have indicated opportunities within the domain of nurse manager leadership, ability, and support of nurses as it relates to nurse staff engagement and maintenance of a healthy work environment. These local findings are consistent with these dissertation research study results and further emphasize the need to strengthen the development and competencies that accompany the nurse manager role.

**Supports use of suggested data analysis.** By employing the discussed instrumentation, the CIS Questionnaire and the PES-NWI promoted the collection of data for the outcome variable and the predicting variables for this research study. In capturing this information, a hierarchical regression analysis technique was utilized to assist in the understanding of the relationships between these variables and the amount of variability in the outcome that is accounted for by the predicting variables. This analysis was able to significantly predict 28.3% of the variability in self-perceived nurse fatigue. Additionally, in utilizing the G*Power data analysis software package, a post-hoc power analysis was performed utilizing a sample size of 175 and an explained variance of .283. The power for this analysis was determined to be 1.0. This value indicates strong power with a minimal chance of committing a Type II error for this research study.

**Foundation for future studies.** Potential exists for the results of this study to provide a foundation and inform future experimental or quasi-experimental studies focused on specific strategies or interventions to alleviate nurse fatigue within particular nursing practice environments.
Study Limitations

The limitations of this dissertation research study include the likelihood of additional confounding variables, the lack of a causal inference, the threat of history (Campbell, et al., 1963), the potential impact of the study location, the risk of a narrow scope, the ongoing complexities with measuring fatigue, the potential for overexposure to surveys, the potential for response bias, and the potential for recall bias.

**Likelihood of additional confounding variables.** One of the primary threats to internal validity in any correlational study design is the presence and influence of confounding variables. For this study, although significant, only 28.3% of the total variance in self-perceived nurse fatigue was able to be explained. Therefore, other unanticipated confounding variables that were not included in this study may help to explain the remainder of the variance in self-perceived nurse fatigue.

**Lack of causal relationship.** As with any correlational research study design, a causal relationship between the dependent or outcome variable and the independent or predicting variable(s) is not able to be determined. This lack of a causal relationship can be viewed as an additional threat or limitation to the research study design. This study employed a correlational design, in which a causal relationship was unable to be determined; however, significant results were noted in the relationships among the variables.

**Threat of history.** Another threat to the internal validity of this research study design was the threat of history (Campbell et al., 1963). Potential for recent or current
organizational-wide or unit-specific events occurring during the survey period can influence survey responses by the participants. For this study, two of the five participating NICUs were in the process of implementing an electronic medical record system during the time of this survey, thereby introducing an additional limitation. Conversations did occur, however, between this nurse researcher and each of the site coordinators to determine the best possible common time period for all five participating NICUs.

**Impact of the study site location.** For this research study, the setting was located in the Midwestern United States, which involves a climate consisting of four seasons that range from warm and sunny to cold and snowy. According to a recent study, higher temperatures and more daylight have been associated with decreased levels of fatigue (Kööts, et al., 2011). Considering this, the varying climate could have impacted the self-perceptions of nurse fatigue as the study was conducted within the autumn season.

An additional impact of the site location is the possibility of similar thoughts and characteristics of the study participants impacting the study findings. Because a common link was utilized for data collection, there was no ability to determine the site from which the individual survey responses were generated. Considering this, it is quite possible that a majority of the responses were generated from one of the study sites more than the others, which has the potential to bias the results because of conceivable similarities and correlations among the staff members within the individual NICUs. While the use of a common link does not allow for organizational-specific information to be captured, it
does promote de-identification and anonymity of individual respondents during the data collection process.

**Risk of narrow scope.** Several factors, including scope and discipline, may have the potential to impact the generalizability of these study findings. First, the narrow scope of this study within the NICU nursing practice environment has the potential to limit the generalizability to other types of nursing practice environments or to other disciplines. Additionally, because the sample was obtained as a convenience sample from one region of the country at one point in time (i.e. cross-sectional), generalizability may be jeopardized to other types of units or other NICUs around the country or worldwide. Also, the study setting could limit the generalizability of the study results to specific regions of the country or particular climates. Next, because this study included nurses who worked a shift-based schedule, it may be difficult to generalize these results to nurses who are not employed in shift-based positions or to other disciplines, such as physicians, whose work schedules are regulated by the total number of hours worked. Despite the potential limitations with narrow scope and generalizability of these study results to other disciplines, these findings should be generalizable to many NICU nursing practice environments that care for the critically ill neonatal population as the study sample included both level II and level III NICUs, which is representative of the NICU community.

**Ongoing complexities with measuring fatigue.** As discussed previously, fatigue continues to be a difficult concept to measure accurately because of the varying dimensions surrounding fatigue (Shen et al., 2006), the options for both objective and
subjective data collection techniques, and the multitude of instruments that are available for measuring fatigue (Beurskens et al., 2000; Shahid, et al., 2012; Winwood, et al., 2006; Winwood, et al., 2005). For this dissertation research study, fatigue was measured subjectively by asking the study participants, NICU nurses, about their self-perception of nurse fatigue. Measuring nurse fatigue in this manner captured information about nurse fatigue from only one perspective, which could be considered a potential limitation to the research instrumentation approach.

Another potential contributor to the variations in the measurement of fatigue is the idea of inconsistent time scales for measurement. One assumption within this research study was that each of the variables was measured by collecting data on the same time scale. Although the instructions for responding to the survey explicitly stated for the study participant to utilize the time period of the previous two weeks to respond to the survey items measuring self-perceived nurse fatigue, individual nurse characteristics, and characteristics within the nursing practice environment, the possibility exists that the time frame for the individual respondents was not the same. Beliefs from organizational theory literature propose that varying time scales may impact the theoretical relationships among the variables of interest (Lemke, 2000; Mitchell & James, 2001; S. Zaheer, et al., 1999). This viewpoint has the potential to create doubt in a reader who believes that fatigue should be measured within various dimensions and within a timeframe different than that outlined in this research study, thereby introducing a potential study limitation.

**Potential for over exposure to surveys.** Another limitation to this research study was the possibility of over exposure to surveys as experienced by the study
participant. Capture of information from the individuals at the front-line or “sharp end” (Hughes, 2008) of the work is revealing; however, the administration of other surveys within the same or recent timeframe needs to be considered. For this study, two of the five organizations had recently administered a staff engagement survey to all of their staff members, thus increasing the potential for “survey fatigue” and an impact on the study participants’ responses. The site coordinators for these two NICUs, however, did indicate that they continually encouraged their respective RN staff members to complete the survey and explained the difference between this dissertation research survey and the organizational survey that was recently administered.

**Potential for response bias.** Potential for response bias occurs with the administration of any survey and can be considered a potential limitation to the research instrumentation approach. Response bias refers to a cognitive reaction that occurs when study participants reply to survey items in a socially desirable manner, even if the responses are not an accurate reflection of their true feelings (Furnham, 1986; Nederhof, 1985). For example, when answering survey questions for this research study, there was potential that participants could have been hesitant to answer truthfully to items about their respective nursing leadership or physician colleagues for fear of retribution if their responses did not remain de-identified, despite the anonymous nature of the survey technique.

**Potential for recall bias.** The potential for recall bias can also exist with the completion of surveys. Recall bias refers to the differences in the information remembered and subsequently reported by the study participants (Stommel & Wills,
2004). For this study, the participants were asked to respond based on their feelings of fatigue in the past two weeks. It is quite possible that the study participants answered the survey items based on his/her current feelings of tiredness or exhaustion. Timing of survey completion, such as at the end of a work shift, at the beginning of a work shift, or on a day when not working, may have also introduce recall bias and impacted how the study participants responded to the survey items.

**Suggestions for Future Research**

With consideration to the implications for nursing practice, as well as the identified strengths and limitations of this study, further research focused on nurse fatigue in the work environment is warranted. Opportunities exist to concentrate on specific interventions to alleviate self-perceived nurse fatigue, to strengthen the internal and external validity in future studies, and to incorporate additional concepts into studies focused on understanding and alleviating nurse fatigue.

As the results of this dissertation research study suggest, nurse manager ability, leadership, and support of nurses was significantly associated with self-perceived nurse fatigue. Additionally, physical or mental health contributors, as well as distressing patient events, were also significantly associated with the self-perception of nurse fatigue.

Future research studies should focus on optimal strategies for nurse managers to recognize and support staff members through difficult situations, both personal and patient-related.
To help strengthen the validity of studies focused on nurse fatigue, one of the primary adjustments to a future study would be to include and measure additional potential confounding variables to account for more of the variability in self-perceived nurse fatigue. In addition, to improve the generalizability of the results, future replication studies could increase and diversify the study sample. Use of an email distribution list from a professional organization could help to increase the number of study participants being recruited and also reach more nurses throughout the country, world-wide, and within different climates. Specific to the NICU population, one suggested professional organization to consider involving would be NANN, which is an organization whose mission is to address “the educational and practice needs within the evolving specialty of neonatal nursing, while giving all neonatal nurses national representation” (NANN, n.d.). With membership ranging from all over the country, the NANN distribution list would reach many NICU nurses and could help to increase national representation from various regions and climates within the United States, thus, allowing for more generalizability of the study results. According to Huitt, Hummel, and Kaeck (1999), generalizability of research study results can be strengthened by both replicating and extending the study. Considering this, the results of future research studies may be more widely accepted by the nursing scientific community if the study were to be replicated in additional NICUs or within other nursing practice environments. Replication in other nursing practice environments would allow for a comparison of self-perceived nurse fatigue among varying nursing practice environments to examine if different relationships exist among the predicting variables.
To address the ongoing issue with complexities in measuring nurse fatigue, in addition to measuring nurse fatigue subjectively by asking participants to self-report their perceived fatigue levels, further understanding of the impacts of nurse fatigue may be possible with the use of an instrument designed to objectively measure information processing speed, for example. Additionally, by utilizing a multi-level modeling analysis technique, organizational level characteristics can be collected, examined, and compared to characteristics in the nursing practice environment, individual nurse characteristics, and self-perceived nurse fatigue to provide a more system-wide overview of the associations with self-perceived nurse fatigue.

As a way to incorporate additional concepts into studies related to nurse fatigue, one suggestion would be to consider measuring burnout, compassion fatigue, missed nursing care, and even workplace bullying, along with self-perceived nurse fatigue. Additionally, because this dissertation research study has provided a foundation for exploring the emerging sciences of human factors/performance shaping factors and resilience engineering within healthcare, these would be important future concepts to examine as they relate to nurse fatigue. The discipline of human factors involves the exploration of human interactions with one another, as well as with aspects of the environment and is gaining attention within the healthcare arena (Hughes, Carayon, & Gurses, 2008; Norris, 2009). Resilience engineering is focused on exploring both the resilience or adaptability and the brittleness or lack of adaptability within a system (Hollnagel, Paries, Woods & Wreathall, 2010; Hollnagel, Woods, & Leveson, 2007).
Within this context, the nursing practice environment could be considered either the resilient or brittle system, which warrants further exploration.

**Conclusion**

Because this is the first known study to concentrate on self-perceived nurse fatigue and the nursing practice environment, specifically on the importance of the nurse manager role, dissemination of these study findings is essential. A poster presentation of these dissertation research study results is planned for the Midwestern Nursing Research Society conference. Additionally, presentations at other conferences and forums focused on the NICU setting, nursing administration, and patient safety arenas will be considered. Also, a manuscript submission highlighting these significant results will be initiated to disseminate the study findings on a broader level. Interest from a nursing leader at a local organization has already been expressed regarding replication of this dissertation research study within the medical-surgical department of the hospital. Therefore, work within this area will be planned at the local level to understand differences between the NICU nursing practice environment and the medical-surgical nursing practice environment and to assist with the ongoing development of the current curriculum targeting nurse manager competencies and leadership development.

This dissertation research study has been the first step in a program of nursing research focused on performance shaping factors, the nursing practice environment, and patient safety. Results from this study have added to the existing body of knowledge regarding nurse fatigue and the nurse manager’s role in establishing a healthy work environment; however, further work is needed to target strategies focused on
understanding and alleviating nurse fatigue, thereby enhancing the nursing practice environment and improving patient safety. Future work on a more wide-spread level, including partnership and collaboration with organizations such as NANN, ANCC, or AONE, would be welcomed to continue the focus on nurse fatigue, nurse manager leadership development, and a healthy work environment. The ultimate goal is to continue developing a program of nursing research that is focused on optimizing patient safety.
References


American Nurses Association (ANA) Position Statement (2014). *Addressing nurse fatigue to promote safety and health: Joint responsibilities of registered nurses and employers to reduce risks.*


deprivation conditions. *Aviation, Space, and Environmental Medicine,* 78(Supplement 1), B25-B38.


APPENDIX A: The Checklist Individual Strength (CIS) Questionnaire
The Checklist Individual Strength (CIS) Questionnaire (adapted from Vercoulen, Alberts, & Bleijenberg, 1999)

1. I feel tired
2. I feel very active
3. Thinking requires effort
4. Physically I feel exhausted
5. I feel like doing all kind of nice things
6. I feel fit
7. I do quite a lot within a day
8. When I am doing something, I can concentrate quite well
9. I feel weak
10. I don't do much during the day
11. I can concentrate well
12. I feel rested
13. I have trouble concentrating
14. Physically I feel I am in a bad condition
15. I am full of plans
16. I am tired very quickly
17. I have a low output
18. I feel no desire to do anything
19. My thoughts easily wander
20. Physically I feel in a good shape

Note. Study participants were asked to respond base on how they felt in the previous two-week time period by answering each statement "Yes, that is true" or "No, that is not true" on a seven-point scale.
APPENDIX B: Practice Environment Scale of the Nurse Workload Index (PES-NWI)
Practice Environment Scale of the Nurse Workload Index (adapted from Lake, 2002)

Nurse Participation in Hospital Affairs
- Staff nurses are involved in the internal governance of the hospital
- Opportunity for staff nurses to participate in policy decisions
- Many opportunities for advancement of nursing personnel
- An administration who listens to and responds to employee concerns
- A director of nursing highly visible and accessible to staff
- Career development/clinical ladder opportunity
- Nursing administrators consult with staff on daily problems and procedures
- Staff nurses have the opportunity to serve on hospital and nursing department committees
- A chief nursing executive equal in power & authority to other top level hospital executives

Nursing Foundations for Quality of Care
- Use of nursing diagnoses
- An active quality assurance program
- A preceptor program for newly hired RNs
- Nursing care is based on a nursing, rather than a medical model
- Patient care assignments that foster continuity of care, i.e., the same nurse cares for the patient from one day to the next
- A clear philosophy of nursing that pervades the patient care environment
- Written, up-to-date nursing care plans for all patients
- High standards of nursing care are expected by the administration
- Active in-service/continuing education programs for nurses
- Working with nurses who are clinically competent

Nurse Manager Ability, Leadership, and Support of Nurses
- A head nurse who is a good manager and leader
- A head nurse/supervisor who backs up the nursing staff in decision making, even if the conflict is with a physician.
- Supervisors use mistakes as learning opportunities, not criticism
- A supervisory staff that is supportive of the nurses
- Praise and recognition for a job well done

Staffing and Resource Adequacy
- Enough staff to get the work done
- Enough registered nurses to provide quality patient care
- Adequate support services allow me to spend time with my patients
- Enough time and opportunity to discuss patient care problems with other nurses

Collegial Nurse–Physician Relations
- A lot of teamwork between nurses and doctors
- Physicians and nurses have good relationships
- Functional collaboration (joint practice) between nurses and physicians

Note. Study participant were instructed to respond to the survey by rating each item on a scale of 1 (strongly disagree) to 4 (strongly agree).
APPENDIX C: Permission to Use the PES-NWI
Hi Amy

It is great to hear from you. Yes of course you can use the 3 subscales. Let’s keep in touch as your work progresses and also to publish the pilot study results.

Best,
Eileen

Eileen T. Lake, PhD, RN, FAAN
Jessie M. Scott Term Chair in Nursing and Health Policy
Associate Professor of Sociology
Associate Director, Center for Health Outcomes and Policy Research
Chair, Graduate Group in Nursing
School of Nursing Constituency Representative, University Faculty Senate Executive Committee
University of Pennsylvania School of Nursing
Room 302 Fagin Hall
418 Curie Blvd.
Philadelphia, Pennsylvania 19104-4217
tel: (215) 898-2557

From: Knupp, Amy M. [mailto:Amy.Knupp@osumc.edu]
Sent: Friday, May 27, 2016 10:28 AM
To: Lake, Eileen <elake@nursing.upenn.edu>
Cc: Patrick, Thelma <patrick.166@osu.edu>; Patrick, Thelma (tpatrick@con.ohio-state.edu)
<tpatrick@con.ohio-state.edu>; Knupp, Amy M. <Amy.Knupp@osumc.edu>
Subject: question regarding my dissertation research

Dear Eileen,

It has been a little while since we have connected, so I am hoping this email finds you well.
In addition to saying “hello,” I am reaching out to you to ask a question. I have recently presented my dissertation proposal here at Ohio State and am preparing to start my dissertation research.
The title of my study is: Associations Among Aspects of the Nursing Practice Environment Within the Neonatal Intensive Care Unit Setting, Individual Nurse Characteristics, and Self-Perceived Nurse Fatigue
To measure self-perceived nurse fatigue, I am planning to utilize the Checklist Individual Strength (CIS) Questionnaire.
Additionally, I am planning to use the last 3 subscales of your tool, the Practice Environment Scale of the Nursing Work Index (PES-NWI), to measure aspects of the nursing practice environment (Nurse Manager Ability, Leadership, and Support of Nurses; Staffing and Resource Adequacy; and Collegial Nurse Physician Relations).
I wanted to connect with you to make sure that I have your permission to do so.
Also, I am planning to reach out to the same 5 NICUs that participated in the NICU missed care study (the 3 Akron sties, HUP, and Pennsy) to see if they would be able to assist me with my dissertation work by participating in my study.
Please let me know if you are OK with me using the 3 subscales of the PES-NWI in my dissertation work. Please let me know if you have any questions.
Thanks so much.

Amy
APPENDIX D: Study Approval Letters
06/30/2016

Study Number: 2016E0382
Study Title: Associations Among Aspects of the Neonatal Intensive Care Unit Nursing Practice Environment, Individual Nurse Characteristics, and Self-Perceived Nurse Fatigue

Principal investigator: Thelma Patrick
Date of determination: 06/30/2016

Qualifying exempt category: #2

Dear Thelma Patrick,

The Office of Responsible Research Practices has determined the above referenced project exempt from IRB review.

Please note the following about this determination:

- Retain a copy of this correspondence for your records.
- Only the Ohio State staff and students named on the application are approved as Ohio State investigators and/or key personnel for this study.
- Simple changes to personnel that do not require changes to materials can be submitted for review and approval through Buck-IRB.
- No other changes may be made to exempt research (e.g., to recruitment procedures, advertisements, instruments, protocol, etc.). If changes are needed, a new application for exemption must be submitted for review and approval prior to implementing the changes.
- Records relating to the research (including signed consent forms) must be retained and available for audit for at least 5 years after the study is closed. For more information, see university policies, Institutional Data and Research Data.
- It is the responsibility of the investigators to promptly report events that may represent unanticipated problems involving risks to subjects or others.

This determination is issued under The Ohio State University's OHRP Federalwide Assurance #00006378. Human research protection program policies, procedures, and guidance can be found on the ORRP website.

Please feel free to contact the Office of Responsible Research Practices with any questions or concerns.

Jacob Stoddard
Stoddard.13@osu.edu
(614) 292-0526
September 8, 2016

Amy Knupp, MSN, RN
Akron Children’s Hospital
One Perkins Square
Akron, OH 44308

Re: Associations Among Aspects of the Neonatal Intensive Care Unit Nursing Practice Environment, Individual Nurse Characteristics, and Self-Perceived Nurse Fatigue

Dear Ms. Knupp:

The IRB Chair has reviewed the application and protocol for the above study. The study is a survey of nurses who practice in the NICU, regarding their self-perceived level of fatigue, and factors that may affect their perception. The survey is performed in such a manner that the respondents cannot be identified. As such, it is eligible for exemption from ongoing IRB review.

Please retain this letter as evidence of IRB review. Material changes in the study may require additional IRB submission and review.

Sincerely,

Robert W. Novak, M.D.
Chairman, Institutional Review Board

cc: Connie Teal, MSN
APPENDIX E: Study Introduction Email
Email subject line: NICU Nursing Practice Environment and Nurse Fatigue Survey – Invitation to Participate

Dear Registered Nurses of NAME NICU/ICN,

Your unit has agreed to participate in a study of the neonatal intensive care unit (NICU)/intensive care nursery (ICN) nursing practice environment and nurse fatigue. This study is being conducted by The Ohio State University School of Nursing, as part of a doctoral student dissertation. Five NICUs/ICNs are participating in the study.

This study will be held for an entire month, beginning DATE. Any registered nurse that is employed full-time or part-time within the NICU/ICN is asked to complete a web-based, secure, anonymous survey one time during the month that the study is being held. The link to the survey will be sent to you in a separate email.

This study is research and is completely voluntary and anonymous. Your nurse manager will have no way to know if you participate or not. Your place of employment will not be identified or linked to your responses, and data will not be reported by hospital of origin. Your consent to participate will be implied by your completion of the survey, and you may skip any questions that you do not wish to answer.

The co-principal investigator (co-PI) for this study is Amy Knupp, MSN, RN, CNS, CPPS, doctoral candidate at The Ohio State University College of Nursing. The study will be conducted under the guidance of Thelma Patrick, PhD, RN, Associate Professor at The Ohio State University College of Nursing and doctoral candidate advisor, who will serve as the study’s principal investigator (PI).

The survey should take no longer than 15-20 minutes to complete. For each survey that is completed, a donation of $1 will be made to the March of Dimes, whose mission is to improve the lives of babies by preventing prematurity, birth defects, and infant mortality.

This study is designed to examine the potential relationships among certain aspects of the nursing practice environment and nurse fatigue. The study data will help to contribute to the science of patient safety research, provide a more comprehensive understanding of the factors within the nursing practice environment that contribute to nurse fatigue, and
guide the design and implementation of relevant fatigue countermeasures, thereby improving patient safety.

We hope you will participate and believe that your efforts will advance nursing science and further optimize the care for critically ill infants.

For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.

Sincerely,

Amy Knupp, MSN, RN, CNS, CPPS  
The Ohio State University College of Nursing  
Co-Principal Investigator and Doctoral Candidate

Thelma Patrick, PhD, RN,  
The Ohio State University College of Nursing  
Principal Investigator and Doctoral Candidate Advisor
APPENDIX F: Study Notice Email with Survey Link
Email subject line: NICU Nursing Practice Environment and Nurse Fatigue Survey – Study Notice and Survey Link

Dear Staff Nurses of NAME NICU/ICN,

You are receiving this message because you are eligible to participate in a nursing practice environment and nurse fatigue survey as part of a study that begins today.

Details about this research, which is voluntary, anonymous, and confidential, were sent to you one week ago. That notice is attached here as an FYI, and contains the name and contact information of your site coordinator and the principal investigators.

To take the survey, please click on the following internet link.

Internet link: XXXXXX.com

We appreciate your consideration,

Amy Knupp, MSN, RN, CNS, CPPS
The Ohio State University College of Nursing
Co-Principal Investigator and Doctoral Candidate

Thelma Patrick, PhD, RN,
The Ohio State University College of Nursing
Principal Investigator and Doctoral Candidate Advisor

As a reminder, for questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.
APPENDIX G: NICU Nursing Practice Environment and Nurse Fatigue Survey
Dear Staff Nurse,

Welcome to the NICU Nursing Practice Environment and Nurse Fatigue Survey. The purpose of this study is to examine the potential relationships among certain aspects of the nursing practice environment and nurse fatigue. The study data will help to contribute to the science of patient safety research, provide a more comprehensive understanding of the factors within the nursing practice environment that contribute to nurse fatigue, and guide the design and implementation of relevant fatigue countermeasures, thereby improving patient safety.

Your participation is voluntary. Your job will not be affected by participation or nonparticipation. Your response will be anonymous and will go directly to a database without subject identifiers at The Ohio State University. Your place of employment will not be identified or linked to your responses, and data will not be reported by the hospital of origin.

The study is being conducted by The Ohio State University College of Nursing as part of a doctoral candidate dissertation. If you want to contact the investigators, Amy Knupp, MSN, RN, CNS, CPPS, can be reached by phone at 614-366-8218 or by email at amy.knupp@osumc.edu. Dr. Thelma Patrick at The Ohio State University College of Nursing is the principal investigator for this study and can be reached by phone at (614) 292-6217 or by email at patrick.166@osu.edu.

Any registered nurse that is employed full-time or part time within the NICU/ICN is asked to complete the web-based, secure, anonymous survey one time during the month that the study is being held. Your consent to participate will be implied by your completion of the survey. You may skip any questions that you do not wish to answer.

For each survey that is completed, a donation of $1 will be made to the March of Dimes, whose mission is to improve the lives of babies by preventing prematurity, birth defects, and infant mortality.

Contact your site coordinator for questions or assistance with the survey. For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.

Thank you for your participation!!

Sincerely,

Amy Knupp, MSN, RN, CNS, CPPS and Thelma Patrick, PhD, RN
Co-Principal Investigators
This first section asks you some demographic questions as well as some questions related to your work experience.

1. What is your age in years?

2. What is your highest level of education?

   - Diploma
   - Associate’s degree in nursing
   - Associate’s degree, non-nursing
   - Bachelor’s degree in nursing
   - Bachelor’s degree, non-nursing
   - Master’s degree in nursing
   - Master’s degree, non-nursing
   - Doctoral degree in nursing
   - Doctoral degree, non-nursing

3. How many years of registered nurse (RN) experience do you have?

4. How many years of NICU RN experience do you have?

5. How many days have you worked in the past 2 weeks?

6. What is the maximum number of days that you have worked in a row without a day off in the past 2 weeks?
7. On average, how many hours have you worked during each shift in the past 2 weeks.

- Less than 4 hours
- 4 or more but less than 8
- 8 or more but less than 10
- 10 or more but less than 12
- Greater than 12 hours

8. What is the average number of hours of sleep you got in each 24-hour period prior to going to work in the past 2 weeks?

- Less than 2 hours
- 2-3 hours
- 4-5 hours
- 6-7 hours
- Greater than 7 hours

9. Which best describes your caffeine intake on days you are at work?

- None
- At the beginning of the shift
- Prior to feeling decreased alertness
- Regularly throughout the day

10. Do you work at another job in addition to being a NICU RN?

- Yes
- No

11. Have you recently experienced a life event such as a death, divorce, or move, etc.?

- Yes
- No

12. Is there anything with your health (physical or mental) that may contribute to how fatigued you feel at the beginning of your work shifts?

- Yes
- No

13. Have you recently experienced a distressing patient event?

- Yes
- No
For the questions in this next section, please respond based on how you have felt about the items in the past two-week time period. Please rate each item from 1 (Yes, that is true) to 7 (No, that is not true).

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>14. I feel tired</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>15. I feel very active</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>16. Thinking requires effort</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>17. Physically I feel exhausted</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>18. I feel like doing all kind of nice things</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>19. I feel fit</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>20. I do quite a lot within a day</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>21. When I am doing something, I can concentrate quite well</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>22. I feel weak</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>23. I don't do much during the day</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>24. I can concentrate well</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>25. I feel rested</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>26. I have trouble concentrating</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>
27. Physically I feel I am in a bad condition
   1  2  3  4  5  6  7

28. I am full of plans
   1  2  3  4  5  6  7

29. I am tired very quickly
   1  2  3  4  5  6  7

30. I have a low output
   1  2  3  4  5  6  7

31. I feel no desire to do anything
   1  2  3  4  5  6  7

32. My thoughts easily wander
   1  2  3  4  5  6  7

33. Physically I feel in a good shape
   1  2  3  4  5  6  7

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Scale 1</th>
<th>Scale 2</th>
<th>Scale 3</th>
<th>Scale 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>34.</td>
<td>A nurse manager (head nurse) who is a good manager and leader</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>35.</td>
<td>A nurse manager (head nurse) who backs up the nursing staff in decision making, even if the conflict is with a physician</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>36.</td>
<td>Supervisors use mistakes as learning opportunities, not criticism</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>37.</td>
<td>A supervisory staff that is supportive of the nurses</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>38.</td>
<td>Praise and recognition for a job well done</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>39.</td>
<td>Enough staff to get the work done</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

This final section asks about your experiences within your current NICU nursing practice environment. Please rate each item on a scale of 1 (strongly disagree) to 4 (strongly agree).
40. Enough registered nurses to provide quality patient care  

1 2 3 4

41. Adequate support services allow me to spend time with my patients  

1 2 3 4

42. Enough time and opportunity to discuss patient care problems with other nurses  

1 2 3 4

43. A lot of teamwork between nurses and doctors  

1 2 3 4

44. Physicians and nurses have good relationships  

1 2 3 4

45. Functional collaboration (joint practice) between nurses and physicians  

1 2 3 4

_______________________________________________________________________

Closing

Thank you for your time and valuable input! As a reminder, all of your responses will be strictly confidential and there is no way for your identify to be revealed.
APPENDIX H: Study Reminder Email
(Weekly reminder of data collection to be emailed by the site coordinator at the beginning of weeks 2, 3, and 4 of the survey to all full-time and part-time registered nurses.)

Email subject line: NICU Nursing Practice Environment and Nurse Fatigue Survey – Survey Reminder

Dear Staff Nurses of NAME NICU/ICN,

This is a reminder of your eligibility to participate in a nurse survey as part of a study that began on DATE.

Details about this research, which is voluntary, anonymous, and confidential, were sent to you before the survey opened. That notice is attached here as an FYI, and contains the name and contact information of your site coordinator and the principal investigators.

To take the survey, please click on the following internet link.

Internet link: XXXXXX.com

If you have already completed the survey, thank you very much for your participation.

If you have not yet completed the survey, we appreciate your consideration,

Amy Knupp, MSN, RN, CNS, CPPS
The Ohio State University College of Nursing
Co-Principal Investigator and Doctoral Candidate

Thelma Patrick, PhD, RN,
The Ohio State University College of Nursing
Principal Investigator and Doctoral Candidate Advisor

As a reminder, for questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.