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The Role of Nursing Practice in Promoting Sleep During Brain Injury Rehabilitation

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This is to certify that the doctoral study by

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2015

Abstract

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MS, University of South Florida, 2004

BSN, Medical College of Georgia, 1995

Project Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

During hospitalization, sleep can be interrupted or even elusive. It has been established that quality sleep is essential in neural repair. Previous research has indicated that many nurses are unaware of the impact of sleep disturbance on brain injury recovery and do not understand how to promote sleep in the neurorehabilitation setting. The purpose of this project was to determine whether educational intervention would influence nurses' knowledge and attitudes toward sleep. Benner's (2001) novice to expert theory provided a framework for the project. With the collaboration of a neuropsychologist, this study produced a sleep knowledge and attitudes instrument. Pulmonary sleep specialists, rehabilitation physicians, and neuropsychologists who were experts in the treatment of sleep disorders and brain injury validated the instrument. Following instrument validation, 19 rehabilitation nurses completed the instrument prior to receiving sleep hygiene education. Immediately after education, a posttest was administered. Pretest and posttest data were compared via Wilcoxon signed-rank tests. Results indicated a statistically significant increase nurses' knowledge ($p = .015$) and attitudes ($p = .028$) toward sleep. These findings support the use of didactic methods of sleep hygiene education for nurses. Providing nurses with sleep knowledge and improving their attitudes toward sleep may shift nursing focus to sleep as an activity rather than inactivity, and it has the potential to improve quality of patient care by empowering nurses to implement good sleep hygiene practices on inpatient units. Additional research is indicated to determine whether the increase in knowledge and improvement in attitudes will be sustained and ultimately affect patient sleep outcomes.

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Dedication

This project is dedicated to my dear husband, Rick, who has always encouraged me to strive for the highest and to continue my education. The last 2 years have been trying at times, but he has stood by me through it all. There are no words worthy to express my eternal gratitude.

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I am truly indebted to my preceptor, Dr. Nakase-Richardson for her guidance and overall encouragement without which completion of this project would not have been possible. Additionally, the expertise of Drs. Murphy, Wang, and Cadena as my committee chair and members has allowed me to present this project in a scholarly manner. Lastly, I would like to thank my eternal cheerleader, Dr. Raia, for continuing to provide comradery, commiseration, and an overall light in the darkness despite her own trials and tribulations.

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Section 1: Project Overview

Introduction

Sleep is described as a period of rest and recovery necessary for normal function of every member of the animal kingdom (McGonigal, 1986). It is characterized by a rapidly reversible reduced response to environmental stimuli (Brand & Kirov, 2011). On average, an adult requires 7-9 hours of sleep nightly though individual requirements may vary (Centers for Disease Control and Prevention, 2011). Both the circadian clock and homeostatic effect regulate sleep which is made up of stages that cycle through the duration of rest (Saper, Scammell, & Lu, 2005). Each stage has been linked to specific human functions. However, this normal physiological activity does not merely provide rest and recovery.

Sleep plays a role in somatic, psychological, and cognitive processes and is vital for learning, memory processing, brain development, and cellular repair (AlDabal & BaHammam, 2011). Endocrine, immune, and metabolic functions are all affected by sleep. To date, the reported purposes of sleep are largely theoretical (Brown, 2012; Kelly, Mikell, & McKhann, 2014); however, animal data indicated sleep enhances brain processes by clearing metabolites and supports memory formation with continuous ongoing sleep (Aton, Suresh, Broussard, & Frank, 2014; Xie et al., 2013). Sleep is likely to have important functions that remain to be discovered.

Studies of sleep restriction and deprivation have provided evidence of the role of sleep disturbance in disease development and progression. More specifically, researchers have indicated deleterious effects on metabolic, endocrine, immune, and inflammatory

functions (AlDabal & BaHammam, 2011; Faraut, Boudjeltia, Vanhamme, & Kerkhofs, 2012; Maurovich-Horvat, Pollmacher, & Sonka, 2008). Experimental sleep deprivation altered immunological markers which are thought to promote low-level inflammation leading to cardiovascular and endocrine pathology (Faraut et al., 2012). Sleep disturbance has also been implicated in the disruption of hormonal regulation (AlDabal & BaHammam, 2011). Such dysregulation has been associated with endocrine, cardiovascular, and psychological disorders.

Sleep plays an important role in healing. It has been stated that the physiologic changes occurring during sleep influence growth and homeostasis (Kamdar, Needham, & Collop, 2012). During sleep, protein anabolism is promoted by growth hormone, prolactin, and luteinizing hormone (McGonigal, 1986). Growth hormone also stimulates the absorption of calcium from the large intestine and aids in the conversion of glycogen to glucose. Moreover, animal and human studies have indicated that sleep has a particularly relevant influence in the neuroplasticity required for brain injury recovery (Dash, Douglas, Vyazovskiy, Cirelli, & Tononi, 2009; Longordo, Kopp, & Luthi, 2009; McDermott et al., 2003; Walker, 2009; Zunzunegui, Gao, Cam, Hodor, & Bassetti, 2011). Enhanced sleep quality can accelerate healing (Dogan, Ertekin, & Dogan, 2005).

There are numerous sources for sleep disturbance; but, most can be categorized to one of five factors. Circadian misalignment is characterized by daytime hypersomnolence with co-occurring difficulty initiating sleep at bedtime (McCarty, 2010). Pharmacologic factors are very common and are precipitated by prescription medications as well as tobacco, alcohol, nicotine, and over-the counter medications. Quality of sleep and wake is

affected by medical factors related to symptoms of medical diagnoses. Psychiatric diagnoses, psychosocial situations, and behavioral determinants contribute to sleep and wake quality. Lastly, traditionally-described primary sleep disorders impact sleep in a variety of ways.

In the hospital setting, patients are at greater risk for sleep disturbance as sleep during hospitalization can be interrupted by environmental, physiological, and psychological factors (Dogan et al., 2005). Anxiety surrounding the hospitalization episode is common (Pilkington, 2013) and can affect sleep. Pain is particularly troublesome because patients may not be able to sleep as a result of pain or may forego requesting pain medications at night in order to avoid disturbing other patients (Reid, 2001). However, environmental factors may be most distressing.

The intensive care unit provides a compelling setting for studying hospital sleep disruption related to environmental factors. Patients in intensive care units report unit noise to be a significant disruptor (Kamdar et al., 2012). Light is necessary to perform care tasks; yet, exposure during evening hours can be disruptive to sleep. Night-time sleep is frequently disrupted in order to provide medical treatment, diagnostic tests, or personal hygiene. Despite the severity of illness or injury, research has demonstrated that intensive care units do not provide an optimal environment for patient sleep (Aaron et al., 1996; Tamburri, DiBrienza, Zozula, & Redeker, 2004).

One area in which sleep disruption is particularly problematic is neurorehabilitation. Brain injury is a prominent public health issue affecting at least 1.7 million Americans annually (Faul, Xu, Wald, & Coronado, 2010). The vast majority of

brain injuries are mild in nature and rarely require hospitalization. Those individuals who do require hospitalization and rehabilitation frequently have disrupted sleep which can impede rehabilitation progress (Burke, Shah, Schneider, Ahangar, & Al-Aladai, 2004; Nakase-Richardson et al., 2013). Researchers have demonstrated the critical role of sleep in acute neural repair (Dash et al., 2009; Longordo, Kupp, & Luthi, 2009; McDermott et al., 2003; Walker, 2009). As such, inadequate sleep can prolong recovery. Pywell (2013) states that improving sleep during brain injury rehabilitation can improve the quantity and quality of rehabilitation as well as the patient's quality of life.

Those individuals who have sustained brain injuries have a greater prevalence of sleep disorders (Burke et al., 2004). Brain injury itself affects cognition, behavior, and emotional function (Jennekens, de Casterlé, & Dobbels, 2010). Deficits in sleep quantity and quality serve only to compound these deficits (Mahmood, Rapport, Hank, & Fichtenberg, 2004). Nurses caring for individuals recovering from brain injury may affect recovery by modifying the sleep environment and addressing some of the psychological influencers of poor sleep.

Education for nursing staff that emphasizes maximizing the sleep environment may promote positive patient outcomes. A few studies have indicated improved attitude and increased nursing knowledge, skills, and behavior after participation in an evidence-based practice educational intervention (Flores-Mateo & Argimin, 2007; Ho et al., 2002; Yost, Cilisk, & Dobbins, 2014). A variety of interventions can be employed to improve sleep disorders in patients hospitalized for neurorehabilitation. Promotion of sleep hygiene educational guidelines is a low-cost, easily applied intervention that may lead to

improvement in sleep quality and quantity ultimately resulting in improved patient outcomes (Ho et al., 2002). Education for nurses detailing sleep hygiene guidelines and emphasizing exposure to light therapy may improve patient sleep outcomes. Implementing sleep hygiene guideline education may improve nurses' knowledge and attitudes toward sleep thus resulting in improved patient outcomes. A sleep promotion education intervention will be designed by translating evidence from critical care nursing literature and utilizing recommendations outlined by Makic, Rauen, Watson, & Poteet (2014).

Problem Statement

The problem addressed in this study is that disrupted sleep affects mental and physical health (Pilkington, 2013). Hospital units are commonly unconducive to sleep due to the presence of environmental factors such as noise and bright light during night-time hours (Aaron et al., 1996; Hardin, Deyal, Stewart, & Bonekat, 2006; Linder & Christina, 2012; Patel, Chipman, Carlin, & Shade, 2008). This is particularly troublesome in the neurorehabilitation unit where sleep plays a critical role in neural repair (Dash et al., 2009; Longordo, Kupp, & Luthi, 2009; McDermott et al., 2003; Walker, 2009). Nurses play a pivotal role in the promotion of sleep in the neurorehabilitation unit.

Purpose Statement

The purpose of this program was to improve nurses' knowledge and attitudes toward sleep in order to work toward an optimum environment for recovery in individuals hospitalized for brain injury rehabilitation.

Project Objective

The objective of this project was to improve nursing knowledge and attitudes toward sleep with the hope that the knowledge would produce an optimum environment for sleep, thus improve patient outcomes.

Project Question

Does an educational intervention for nurses improve their knowledge and attitudes toward sleep?

Relevance to Practice

Hospitalization is stressful for patients. Sleep deprivation attributable to hospitalization can affect circadian rhythms and immunologic processes potentially affecting morbidity and hospital costs (Cmiel, Karr, Gasser, Oliphant & Neveau, 2004; Walder, Francioli, Meyer, Lancon, & Romand, 2000). Patients with brain injury are frequently affected by sleep disturbance which can impede rehabilitation related to increase in somatic complaints and poorer cognitive performance (Burke et al., 2004; De La Rue-Evans, Nesbitt, & Oka, 2013; Mahmood et al., 2004). Anxiety and depression have been implicated in sleep disruption particularly in those patients who have suffered a brain injury (Parcell, Ponsford, Redman, & Rajaratnam, 2008). Multiple factors influence sleep and recovery in the hospital setting, and research indicates that patients hospitalized with brain injury are particularly affected.

Providing sleep hygiene education to neurorehabilitation nurses can improve understanding of the importance of sleep and can influence the provision of sleep promotion interventions (Ho et al., 2002). Development of a nursing-related education

program served to increase knowledge of sleep and improve attitudes toward sleep promotion. Research has indicated that introduction of nursing education related to sleep hygiene can improve patient outcomes (Cmiel et al., 2004; Walder et al., 2000). Modifiable environmental factors should be the focus of sleep promotion, and nurses are poised to employ these modifications in practice.

Evidence-Based Significance of the Project

Sleep disturbance is more prevalent in patients with brain injury than in the normative population (Nakase-Richardson et al., 2013). Nakase-Richardson et al. assessed a large cohort of patients with brain injury for prevalence of sleep abnormality, the course of acute sleep abnormality, and the differences in cognition and rehabilitation course for those particularly affected by sleep abnormalities. The Delirium Rating Scale-Revised-98 and the Galveston Orientation and Amnesia Test were utilized to determine sleep-wake cycle disturbance (SWCD), presence and severity of delirium, orientation, and posttraumatic amnesia. Data indicated that presence of moderate to severe SWCD at 1 month postinjury was predictive of prolonged length of stay and prolonged posttraumatic amnesia compared to those without SWCD. Two additional studies have indicated that resolution of sleep disturbance is closely correlated to resolution of posttraumatic amnesia (Makley et al., 2009; Sherer, Yablon, & Nakase-Richardson, 2009).

Bryczkowski, Loprieto, Yonclas, Sacca, and Mosenthal (2014) described a surgical intensive care unit (SICU) delirium prevention program consisting of limiting medications associated with delirium while incorporating nonpharmacologic nursing

interventions to promote sleep. Nursing staff members were educated in sleep promoting practices upon initiation of the protocol. Nursing interventions consisted of optimizing the environment by reducing nighttime noise and light, clustering care nighttime care interventions, exposing patients to simulated natural light during the day, and providing periods of quiet time without visitors. Implementation of the intervention led to a significant decrease in delirium ($p = 0.002$) and shorter SICU lengths of stay ($p = 0.01$). Though the study did not specifically address sleep quantity or quality, it did produce comparable results to the research of Nakase-Richardson et al. (2013).

A quality improvement sleep promotion project was conducted in an intensive care unit (ICU) setting (Kamdar et al., 2013). Nursing staff members participated in educational sessions presenting evidence supporting sleep interventions as well as introducing results of a pilot study identifying barriers to sleep and patient testimonials. Data analysis indicated that the interventions were feasible and did not affect work flow. Patients indicated that noise was reduced and sleep quality was improved.

Hellstrom, Fagerstrom, and Willman (2011) conducted a systematic review of sleep promoting nursing interventions. Hellstrom et al. indicated that nonpharmacologic nursing interventions are easy to apply there is low evidence for effects. Ponsford and colleagues (2014) stated that sedating medications such as sleep aids may have a deleterious impact on outcome for patients who have sustained brain injury. Sleep is a relevant issue to address, and it is favorable to implement nonpharmacologic nursing interventions to promote sleep in this patient population.

Implications for Social Change in Practice

Professional demands may override the nurse's attention to sleep hygiene in rehabilitation patients (De La Rue-Evans et al., 2013). Focus is centered on the activities required to perform job duties in a timely manner. Sleep is not viewed as a patient activity but rather inactivity. By providing education regarding the need for adequate quantity and quality of sleep, nurses are faced with the decision to incorporate the guidelines at an individual level.

Once sleep is viewed as an activity, nurses may relegate this activity to only those nurses on duty during hours of sleep. However, sleep hygiene guidelines indicate that individuals should participate in daily exercise and refrain from daytime napping (Walsh et al., 1995). Sleep and its preparation traverse all nursing shifts as well as all disciplines. Sleep assessment should occur on a daily basis with feedback to other disciplines creating clinical interruptions. These findings will influence sleep assessment, nursing, and the role of nursing within the multidisciplinary team.

Definition of Terms

Attitude: Altmann (2008) defined attitude as a feeling or manner of thought that influences individual behavior.

Knowledge: Knowledge refers to understanding, information, or competence gleaned from empiricism, ethics, relationships, aesthetics, and synthesis (Finkelman & Kenner, 2010).

Brain injury: This term refers to traumatic injury caused by a blow or jolt to the head that disrupts normal neurologic functioning of the brain (United States Department

of Veterans Affairs & United States Department of Defense, 2009). Severity is classified as mild, moderate, or severe dependent upon the length of coma, radiologic findings, and length of posttraumatic amnesia. Mild brain injuries are characterized by normal neuroimaging, loss of consciousness less than one hour, alteration of consciousness less than 24 hours, posttraumatic amnesia less than 24 hours, and Glasgow Coma Score of 13-15. Moderate brain injury is characterized by normal or abnormal neuroimaging, loss of consciousness between 1 hour and 24 hours, posttraumatic amnesia greater than one day and less than 7 days, and Glasgow Coma score between 9 and 12 (United States Department of Veterans Affairs & United States Department of Defense, 2009). Severe brain injury is characterized by normal or abnormal neuroimaging, loss of consciousness greater than 24 hours, posttraumatic amnesia greater than 7 days, and Glasgow Coma score less than 9.

Sleep hygiene: Nonpharmacologic interventions undertaken to improve the quality and quantity of sleep are considered sleep hygiene (Walsh et al., 1995). Such strategies consist of consistent sleep and wake times, limiting the intake of stimulants, regular timely exercise, maximizing the comfort of the sleeping environment, avoiding heavy eating proximal to bedtime, removing distracting technology from the sleeping environment, and reducing external interruptions.

Clinical interruptions: During the course of hospitalization clinical staff interact with patients to provide basic care, assess the condition, and perform procedures necessary for diagnosis and treatment. It has been recommended that nurses cluster

episodes of care in order for patients to provide patients with periods of uninterrupted sleep (Eliassen & Hopstock, 2011).

Sleep disorders: The continuum of sleep disorders consists of various diagnoses that may present during brain injury rehabilitation. Pertinent conditions are briefly defined here. Sleep-wake cycle disorders refer to an abnormality in sleep related to the accepted diurnal change in human behavior (Ebisawa, 2007). Sleep fragmentation is characterized by frequent awakenings and increased duration of nighttime awakenings (Gerbase et al., 2014). Insomnia refers to dissatisfaction with quantity or quality or sleep related to difficulty falling asleep or remaining asleep (First, 2014). This is in contrast to hypersomnia which refers to excessive quantity of sleep or excessive daytime sleepiness despite adequate quantity of sleep (Morgenthaler et al., 2007).

Assumptions and Limitations

My vision of improving sleep knowledge and attitudes in neurorehabilitation nurses was based on the impact of sleep in recovery. I believed that providing sleep hygiene education to nursing staff would result in application of this knowledge at the individual level and ultimately improve patients' sleep quantity and quality. Implementing the intervention with staff was appropriate due to the cognitive limitations of the patient population. Program outcomes also relied on second-order effects such as support from hospital administration to promote the program.

I recognized limitations in the program design. This project was considered a pilot project to determine the impact of the educational intervention on neurorehabilitation nurses' knowledge and attitudes toward sleep. Increased knowledge and improved

attitudes toward sleep based on pretest to posttest improvement indicated that the intervention was successful. Positive findings will lead to a larger scale project involving additional units which may provide power to generalize findings.

Continuing education is a necessary component of professional practice. Interactive techniques and simulation have proved moderately superior to didactic training and educational games (Bluestone et al., 2013). Classroom training improved knowledge but did not improve attitudes or behaviors. The educational intervention was designed with a didactic approach. However, the subject matter does not lend itself particularly well to formal training in alternative formats.

Summary

Sleep is a necessary human function serving purposes that are not fully understood. It is, however, known that sleep disruption is correlated with physical and psychological symptoms. A number of bodily functions necessary for healing such as hormone secretion and glucose metabolism are affected by sleep disruption. A number of factors affect sleep quantity and quality: circadian misalignment, pharmacologic factors, medical diagnoses, psychiatric disorders, primary sleep disorders, and environmental factors. In the hospital setting, environmental factors are problematic yet most easily addressed. Neurorehabilitation inpatients are a particularly vulnerable population due to the implications of sleep on neural repair. Education of nurses allowed changes to benefit patient outcomes, and sleep hygiene education affected outcomes in neurorehabilitation patients.

Section 2: Review of Scholarly Evidence

Search Strategy

A literature review was conducted to retrieve articles from CINAHL and PubMed. The key terms *brain injury, sleep, adult,* and *rehabilitation* yielded 172 articles. The pool was further limited to primary research articles and systematic reviews published in peer-reviewed journals in English and full-text available via accessible databases which limited the results to 49 articles. An additional limiter of *nurse education* yielded no results. Therefore, a second search was performed utilizing key terms *nurse* and *continuing education* limited to research articles written in the English language and available in full text. Forty-two articles were returned. I reviewed titles and abstracts of each of the 91 total articles to determine applicability to the population and setting. Forty-two articles were retained for literature review.

What is Sleep?

The regulation of sleep is centered in the hypothalamus which controls complex interactions of neurotransmitters which are stimulated by light, melatonin, and neural pathways (Kamdar et al., 2012). Sleep is a physiological state consisting of two key phases: nonrapid eye movement (NREM) and rapid eye movement (REM) sleep. NREM sleep is comprised of light sleep, moderate sleep, and deep sleep stages (Berger, 2009). REM is considered the most restorative phase of sleep. Healthy individuals cycle through NREM and REM phases several times per night with each cycle lasting 90-100 minutes (Kamdar et al., 2012; Matthews, 2011). Frequent interruptions in sleep, such as those

encountered during hospitalization, inhibit true restful sleep (Bihari et al., 2012; Matthews, 2011).

Sleep differs from sedation and other alterations in consciousness. The states appear similar due to altered level of responsiveness, reduced muscle tone, decreased respirations, and lack of temperature control (Gehlbach et al., 2012). Disorders of consciousness are characterized by periods of profound unresponsiveness, and drug-induced sedation is considered a reversible coma (Brown, Lydic, & Schiff, 2010). Sleep cycles can occur during altered consciousness but the sleep that occurs is abnormal (de Biase et al., 2014; Weinhouse & Schwab, 2006).

Role of Sleep in Healthy Individuals

All members of the animal kingdom require good quality sleep that is of sufficient quantity (Brand & Kirov, 2011; McGonigal, 1986). It is generally accepted that sleep plays a role in physical, cognitive, and psychological well-being. Until recently, the proposed functions of sleep were largely theoretical with theories mainly focused on adaptation and restoration. Animal models indicated that sleep is neither purely restorative nor adaptive. In a murine model Aton et al. (2014) determined that sleep is required for memory consolidation. Xie et al. (2013) discovered the mechanism by which the brain clears toxic interstitial waste products during sleep. Without sleep, memory would fail and neurotoxins would destroy the brain.

Benefits of Sleep on Healing

Sleep restoration has been associated with improved physical, cognitive, and psychological performance (Brand & Kirov, 2011). Multiple growth and homeostatic

processes occur during sleep. Most notably, immune processes are affected by sleep. Cellular immunity and cytokine function are altered when sleep is disrupted (Faraut et al., 2012; Kamdar et al., 2012; Maurovich-Horvat et al., 2008). Adaptive immune cells have healing properties in the central nervous system and play a role in brain plasticity (Schwartz, Kipnis, Rivest, & Pratt, 2013). Likewise, immune cells are important in wound healing and angiogenesis. Increased levels of circulating cortisol associated with sleep deprivation have been implicated in delayed wound healing and increased risk of severe infection (Godbout & Glaser, 2006; Valenza, Rodenstein, & Fernandez-de-las-Penas, 2012). Unadulterated immune function promotes an optimal healing environment in the body.

McGonigal (1986) described functions of the endocrine system during sleep. The hypothalamic-pituitary-thyroid axis is important in physical recovery. Growth hormone and prolactin secretion increase during sleep to promote protein anabolism. Conversely, an elevation in corticosteroid production related to sleep deprivation is associated with protein catabolism and increased energy expenditure. Catabolism has been associated with opportunistic infection and subsequent death in animal models (Kamdar et al., 2012). Secretion of growth hormone which stimulates anabolism is dependent upon sleep, thus sleep supports physical healing.

Neurocognitive and psychological processes are enhanced by sleep. Animal studies have indicated that sleep modulates neuroplasticity (Dash et al., 2009; Longordo, Kupp, & Luthi, 2009; McDermott et al., 2003; Walker, 2009). Both memory encoding and consolidation are affected by sleep disturbance (Walker, 2009). In healthy

individuals, REM sleep increases after certain learning tasks are introduced (McDermott et al., 2003). When REM sleep is disturbed before or after learning, performance of this task is adversely affected. Sleep plays a role in affective reactivity which also modulates memory (Walker, 2009; Zunzunegui et al., 2011). Adequate sleep is necessary for memory processes which are often affected in neurological illness and injury.

Consequences of Sleep Restriction and Deprivation

Studies of sleep restriction and sleep deprivation provide some insight to the impact of sleep on physical, cognitive, and psychological symptoms. Animal studies have indicated that total sleep deprivation is more quickly fatal than is starvation (Brand & Kirov, 2011). Sleep restriction in humans correlates to a number of cognitive processes. Ferrara et al. (2008) studied sleep restriction in college students and determined that sleep plays an important role memory and learning, particularly spatial learning. Alertness and sustained attention were the cognitive domains most greatly affected by sleep disruption in a study by Lo et al. (2012). Similar findings were also reported by Valenza et al. (2011) who stated that memory, verbal learning, divided attention, and decision-making are all affected by sleep disturbance.

Psychological effects of sleep restriction are well-represented in the literature. Mellman (2009) reported that sleep disturbance contributes to the evolution and persistence of Post-Traumatic Stress Disorder. Individuals with sleep disturbance also exhibit an increased risk of depression (AlDabal & BaHammam, 2011). Sleep disruption and psychiatric disturbance have a bidirectional relationship as evidenced by higher rates

of sleep disorders in individuals with psychiatric and psychological diagnoses (Dogan et al., 2005).

The physical effects of sleep restriction are evident in various body systems. Brand and Kirov (2011) stated that sleep serves metabolic, immune, thermoregulatory, cardiovascular and respiratory function. Immune processes are adversely affected by sleep disturbance (Born, Lange, Hansen, Molle, & Fehm, 1997; Kamdar et al., 2012). Pain and sleep have a bidirectional relationship with increased pain leading to poorer sleep which results in increased pain (Dogan et al., 2005; Valenza et al., 2011). Poole et al. (2013) noted that extended or truncated sleep duration was associated with an increased risk of developing or dying from coronary heart disease or stroke. Individuals who are employed in shift work, which is highly associated with sleep disturbance, have increased risk of cardiovascular and gastrointestinal diseases (Harma, 2006). It is also thought that these individuals have greater risk for breast cancer, Type 2 diabetes mellitus, and disturbances in pregnancy outcomes. Shift workers have increased rates of occupational injuries as a result of sleep disturbance.

Issues that Inhibit Sleep

The importance of sleep has been established; but, adequate quantity and quality of sleep is sometimes elusive. A number of factors influence sleep. First, circadian misalignment causes individuals to have the urge to sleep during the day while having difficulty initiating sleep at night (McCarty, 2010). Sleep-wake cycle disturbances are common in shift workers and individuals who have travelled across time zones ("jet lag"). Pharmacologic agents which are prescribed, over-the-counter, or socially derived

(i.e., alcohol) affect sleep in various ways. Medications may produce alerting or sedating effects, affect sleep stages, or produce physical effects that inhibit sleep. Exacerbation of medical diagnoses may inhibit sleep due to symptoms such as pain, respiratory difficulties, poor thermoregulation, or decreased ability to reposition. Primary psychiatric disorders such as anxiety, bipolar disorder, and attention deficit disorder are associated with overstimulation. Furthermore, sleep may be inhibited by social and behavioral attitudes toward sleep: patient expectations, concerns, and beliefs regarding sleep habits. Primary sleep disorders such as obstructive sleep apnea or insomnia affect both quality and quantity of sleep. Each of these areas can be medically addressed to improve the quality and quantity of sleep.

Environmental factors may impact the sleep-wake cycle by creating disturbances in either sleep or wakefulness. Light exposure inhibits melatonin production which is necessary for initiation of sleep (Ho, Wong, Tang, & Pang, 2002). Acquiring bright light exposure in the morning and during the day enhances melatonin production thus promoting sleep. Skin temperature is related to the thermal environment (Kamdar et al., 2012). Neuronal activity in the sleep-activating areas of the brain are affected by skin temperature. Environmental noise can cause not only frank disruptions but microdisruptions of sleep related to subconscious sensitivity to noise (Cmiel et al., 2004; Kamdar et al., 2012). Providing an optimal environment for sleep improves sleep quality and sleep quantity.

Hospitalized Patients are Vulnerable

Sleep disturbance is more prevalent in hospitalized patients. It is estimated that over 50% of critically ill patients have sleep disturbance (Bihari et al., 2012). As described by McCarty (2010), exacerbations of medical conditions contribute to sleep disturbance. Additionally, pharmacologic interventions affect the sleep-wake cycle. Patients who are hospitalized are likely to be affected by each of these factors. Hospitalization may provoke or exacerbate existing anxiety due to uncertainty about illness, lack of environmental control, or change of environment (Dogan et al., 2005). Increased sensitivity to noise has been noted in critically ill patients (Kamdar et al., 2012).

Increased perturbations of melatonin production are common in patients with sepsis. Primary sleep disorders are more prevalent in hospitalized patients (Kamdar et al., 2012; McCarty, 2010). A frequent complaint of hospitalized patients is increased pain (Reid, 2001; Valenza et al., 2011). The bidirectional relationship between pain and sleep is intensified in this patient population. Lastly and likely most importantly, patient sleep has not traditionally been a priority to healthcare providers during hospitalization (Pilkington, 2013). Hospitalization affects sleep relative to physiologic functions; but, hospital settings are frequently not amenable to sleep.

Challenges of Sleep in the Hospital Setting

Environmental factors in the hospital setting compound the physiologic and pharmacologic processes occurring during hospitalization. Researchers addressing ICU, medical surgical units, and rehabilitation environments have highlighted the

environmental factors associated with sleep disturbance in hospitals. ICU hospitalizations are punctuated by excessive environmental stimuli such as superfluous noise, constant bright light, uncomfortable temperature, and frequent interruptions for patient care (Eliassen & Hopstock, 2011; Connor & Ortiz, 2009). Similar environmental disruptions are common in other hospital units as well (Cmiel et al., 2004; De La Rue-Evans et al., 2013; Dogan et al., 2005; Pilkington, 2013).

Noise has been studied more than most other environmental disruptors. It has been estimated that 17% of hospital sleep disruptions are related to noise (Pilkington, 2013). Sources of noise disruptions vary. Overhead paging systems, other patients, equipment alarms, telephone ringers, and staff conversations were noted as the most frequent offenders (Cmiel et al., 2004; Connor & Ortiz, 2009; Dogan et al., 2005; Eliassen & Hopstock, 2011;). Noise is an easily-modified environmental disruptor of sleep.

While noise disruptions have been studied more frequently, the impact of light exposure and disruptions related to patient care have also been stated (Pilkington, 2013). In ICU settings, bright lights are frequently used thus limiting the production of melatonin and impacting sleep initiation (Eliassen & Hopstock, 2011; Ho et al., 2002). In other hospital units, sources of night time light exposure are hallway lights and nurses' use of lights to provide patient care (Bernhofer, Higgins, Daly, Burant, & Hornick, 2013; Pywell, 2013). Additionally, lack of natural light exposure during optimal times – morning and normal daylight hours – affects the sleep wake cycle (Ho et al., 2002; Ponsford et al., 2012). Lack of windows, keeping blinds closed, and patient immobility

contribute to this deficit. Patient care activities understandably take precedence in the hospital setting. However, timing and frequency of these interventions impact sleep (Eliassen & Hopstock, 2011; Pilkington, 2013). Light exposure impact and patient care interruptions are surmountable environmental factors in the hospital setting.

Neurorehabilitation Patients are Particularly Affected

In neurorehabilitation, sleep disturbance can be more problematic. Sleep disruptions are implicated in an array of cognitive, physical, and emotional symptoms which mirror symptoms common in individuals with brain injury (Burke et al., 2004; Dash, 2009; Jennekens et al., 2010; Longordo, Kopp, & Luthi, 2009; Mahmood et al., 2004; Makley et al., 2009; Parcell et al., 2008; Pywell, 2013; Valenza et al., 2011; Wiseman-Hakes et al., 2013). Worthington and Melia (2006) studied the effects of sleep disorders on rehabilitation performance. Nearly half exhibited symptoms of sleep disturbance: excessive daytime sleepiness (27.4%), frequent waking (21.5%), delayed sleep onset (18.5%), delayed waking (13.3%), and early waking (11.9%). Fifty-eight percent of the sample exhibited more than one type of sleep disturbance. Twenty individuals had at least one psychiatric diagnosis. Sleep disorders were more common when the individual had a comorbid psychiatric diagnosis ($p < 0.05$). It was determined that rehabilitation was affected by sleep disturbance in 65.6% of the sample though the specific effects were variable.

Lo et al. (2012) studied the effects of sleep deprivation on cognitive performance. Thirty-six individuals participated in this cross-over controlled study. The subjects participated in two 11-night periods of sleep manipulation. Each subject completed self-

report questionnaires and underwent neuropsychological testing at baseline and during each trial period. Sleep disruption most greatly affects alertness and sustained attention. Data indicated that seven consecutive nights of sleep restriction produced cognitive effects consistent with total sleep deprivation. Though the study did not include individuals with brain injury, it does highlight the potential effects in individuals with cognitive deficits.

Education of Nurses Allows Changes to Benefit Patient Outcomes

Continuing professional education is an important component of nursing practice. Educational interventions to promote evidence-based practice have been associated with improvement in skills, knowledge, behaviors, and attitudes (Flores-Mateo & Argimon, 2007). Yost et al. (2014) described an improvement in knowledge after a continuing education workshop. At 6 month follow up, retention of knowledge and implementation of skills was observed. Educational intervention led to translation of evidence to practice. Similarly, Gregory, Morgan, and Lynall (2012) studied the outcomes of a 3 day sleep management course for Parkinson's disease nurse specialists. Patient interviews after the intervention indicated that their sleep was improved as a result. Educational interventions for nurses can be a cost-effective means for translating evidence to practice in order to improve patient outcomes.

Providing Sleep Hygiene Education to Rehabilitation Nurses May Improve Outcomes

Patient sleep outcomes have been improved by educational interventions in general nursing settings, thus it is expected that similar outcomes would be seen in the

rehabilitation setting. De La Rue-Evans et al. (2013) conducted a needs assessment on a neurorehabilitation unit and discovered that nurses lacked knowledge of sleep hygiene practices. A physician and nurse team provided nurses with sleep hygiene education focusing on exercise, relaxation training, cognitive behavioral therapy, sleep restriction, and stimulus control. A review of sleep quantity after the intervention did not reveal a discernable change. However, patients admitted for neurorehabilitation have variable sleep practices, and objective measures of sleep were not utilized.

Ho et al. (2002) found that nurses lacked knowledge of sleep and were unfamiliar with nursing methods to promote sleep. The researchers provided sleep hygiene education encouraging bright light therapy during the day. Following the intervention, nursing interventions were observed, and patient outcomes were measured. The educational intervention resulted in translation of evidence to practice and improved patient sleep outcomes. While these two studies had disparate findings, it is anticipated that improving nurses' knowledge and attitudes toward sleep will impact objectively measured sleep outcomes.

Nursing Theory

The novice to expert theory was utilized as a framework for the project. In 1984, Benner first examined clinical performance and situation appraisal in nursing by applying the Dreyfus model of skill acquisition in the clinical setting (Benner, 2001). The latter model, developed by a mathematician and system analyst as well as a philosopher, describes a progressive trajectory of knowledge acquisition comprised of five distinct levels of proficiency: novice, advanced beginner, competent, proficient, and expert. To

test this model in clinical nursing situations, Benner gathered data from beginning nurses and their preceptors, senior nursing students, and experienced nurses via interview and participant-observer interactions.

Benner (2001) introduced the concept of nursing intuition. Interpretation of her qualitative data indicated that the model could be applied to nursing intuition, and Benner's theory was born. The theory has been successfully applied in research projects testing educational interventions for nurses as well as the development of mentorship programs and clinical nursing ladders (Dracup & Bryan-Brown, 2004; Larew, Lessans, Spunt, Foster, & Covington, 2006; Vought-O'Sullivan, Meehan, Havice, & Pruitt, 2006). A relative paucity of sleep promotion research in the rehabilitation setting indicated that the concept would be novel to most nurses. As such, the educational intervention was tailored to the novice and advanced beginner levels.

Summary

Sleep is a necessary function for physical health and emotional well-being. It improves healing by supporting the immune system and promoting tissue growth. There are a number of factors that inhibit sleep including internal physiologic and psychological processes as well as external factors such as pharmacological and environmental factors. Hospitalized patients are at risk of sleep disruption as a result of exacerbations of physical conditions and pharmacological interventions. The hospital setting is not particularly conducive to sleep due to environmental factors such as uncomfortable temperature and increased levels of noise and light. Neurorehabilitation patients are particularly vulnerable because of the prevalence of sleep disorders in the population and

because cognitive and emotional symptoms commonly attributed to sleep disorders are also common in patients with brain injury. Nurses exhibit increased knowledge and skills after receiving educational interventions. Providing nurses with sleep hygiene education may improve patient sleep outcomes.

Section 3: Methodology

The purpose of this project was to determine if providing sleep hygiene education to neurorehabilitation nurses would result in increased knowledge and attitudes toward sleep. This section is a detail of the project design, population, data collection and analysis, and the project evaluation plan

Phase I: Designing the Tool and Establishing Content Validity

Due to a lack of validated instruments to specifically assess knowledge and attitudes toward sleep and sleep hygiene, the first phase of the project addressed the design and validation of such a tool. Following Institutional Review Board (IRB) approval, the Sleep Hygiene for Healing Hospitals (SHHH) tool (Appendix A) was designed and optimized based on existing evidence regarding sleep hygiene recommendations for hospital units. Once and the neuropsychologist and I were satisfied that the tool consistently measured concepts included in the planned intervention, I selected three sleep medicine physicians, and four doctoral level clinicians specializing in brain injury based on their knowledge in treating brain injured patients with sleep disorders. Commensurate with the "competent" level described in Benner's (2001) Novice to Expert theory, these individuals were only selected if they possessed at least 5 years of experience with the patient population.

It is important to validate measurement tools to indicate that the scale adequately represents the topic of interest. The Content Validity Index (CVI) is widely used and has been compared to alternate forms of validation (Polit, Beck, & Owen, 2007). CVI can be calculated for the scale as a whole (S-CVI) and for each item within the scale (I-CVI).

Consistent with the recommendations of Polit et al. items for this tool were validated on a 4-point nominal scale: (1) *not relevant*, (2) *somewhat relevant,* (3) *quite relevant,* or (4) *highly relevant*. For each item, the number of experts rating the relevance as 3 or 4 were tabulated then divided by the total number of experts reviewing the tool. The I-CVI for each item was computed, then SCI/Ave was determined by calculating the average I-CVI across all items. The tool was judged to be acceptable when the S-CVI/Ave reached at least 0.80.

To ensure anonymity, each of the identified participants received an electronic invitation containing a link to the content validity survey via Survey Monkey. The invitation also included an electronic copy of the SHHH. Participants were asked to review the SHHH then complete the content validity survey within 1 week. Those items not reaching the threshold of 0.80 for validity were eliminated from the final version. Upon satisfying item and scale validity, the project moved forward to Phase II.

Phase II: Educational Inservice

Setting

The chosen unit is housed in a 415 bed teaching hospital which provides primary to quaternary care utilizing cutting edge technology (James A. Haley Veterans' Hospital, 2013). Nearly 90,000 veterans and active duty service members receive care at the facility annually. Organizationally, the facility is led by the medical center director who is supported by the chief of staff, deputy director, associate directors, and the assistant director. Annual strategic planning retreats attended by these leaders, service chiefs, and

administrative officers culminate in the determination of annual facility goals. Hospital oversight is maintained through The Joint Commission.

The hospital houses one of five Polytrauma Rehabilitation Centers (PRC) within the United States Department of Veterans Affairs. This center specializes in the complex care of brain and spinal cord injuries complicated by comorbid conditions and injuries (United States Department of Veterans Affairs, 2011). Annually, the 14 bed unit serves approximately 100 patients aged 17 years of age or older (personal communication, Angela Whitener). Because length of stay is not restricted by insurance guidelines, the average length of stay is approximately 6 weeks which is longer than that in private facilities. This center's commitment to excellence is bolstered by local and national partnerships: Polytrauma/Blast Related Injury Quality Enhancement Research Initiative (QUERI) Center, Center of Excellence for Maximizing Rehabilitation Outcomes, The Center of Innovation on Disability and Rehabilitation Research, United States Department of Defense, and the Defense and Veterans Brain Injury Center. The Commission on Accreditation of Rehabilitation Facilities (CARF) certifies accreditation of the PRC.

Subjects

The selected neurorehabilitation unit employed 41 nursing staff members who were invited to participate in the program (Deanna Goff, personal communication, May 9, 2014). Participants freely chose to complete pretests and posttests (Appendix B). The pretest differed from the posttest as the pretest included six basic demographic questions. They were informed that the tests would be used to determine change in knowledge and

attitudes to inform a performance improvement project. In an attempt to eliminate coercion, no incentives were provided. Each participant received a number coded test upon entry to the course.

After the presentation, each participant received a similar posttest and was asked to provide the same number on the top of the posttest. These number codes only served to link pretests and posttests in order to determine within subject change. Codes were otherwise not linked to individuals. Completion and submission of the anonymous feedback tool was constituted as consent to participate in the project. In order to maintain anonymity, pretests and posttests were deposited into a slotted locked box near the exit of the venue. The project director collected the box 15 minutes after the end of each session to allow participants time to complete feedback tools. The project proposal was reviewed by the facility's Research and Development Service, and it was determined to be non-experimental (Appendix C). Local institutional review board approval was not sought. However, institutional review board approval was sought from the academic institution. Data will continue to be retained in accordance with institutional regulations. In the Veterans' Affairs system, data must be maintained indefinitely (United States Department of Veterans' Affairs, 2012).

Procedures

Phase II of this project followed a nonexperimental within subject pretest/posttest design. A similar method was utilized by Farrington, Lang, Cullen, and Stewart (2009) to evaluate nurses' knowledge after implementing education regarding assessment of nasogastric tube placement. The focus of the current study was to determine whether

providing sleep hygiene education for neurorehabilitation nursing staff would result in a change of knowledge and attitudes toward sleep.

To raise staff awareness of the problem, an educational program for nurses detailing nonpharmacologic sleep hygiene guidelines and corresponding interventions was offered on three occasions. The primary focus of education highlighted the importance of mitigating environmental distractors and stimuli such as noise, bright lights, clinical interruptions, and uncomfortable temperature. Attendees were encouraged to implement these practices in order to maintain consistent sleep-wake routines similar to preinjury behaviors. A clinical neuropsychologist emphasized the importance of environmental contributors to quality sleep such as noise and light disturbances, clinical interruptions, daily exercise, environmental comfort, and sleep and caffeine restriction. Nurses were reoriented to relaxation promoting interventions such as guided imagery and meditation. Training materials were provided to all participants.

The educational intervention was conducted for each shift by a neuropsychologist. Each potential participant was provided with a copy of the approved consent form and was allowed ample time to read it and ask questions (Appendix D). Prior to education, each staff member was asked to complete a coded anonymous SHHH to assess baseline knowledge and attitudes about sleep and sleep hygiene. At the end of the educational opportunity staff members were again asked to complete the SHHH. Those individuals who chose to complete the posttest were asked to write the pretest code at the top of the posttest in order to determine within participant differences. Upon exit, participants were asked to deposit both pretests and posttests into a locked box with a slotted top. The

researcher returned later to retrieve the box containing the pretests and posttests. This pretest/posttest design allowed the researchers to obtain quantitative data to ensure educational objectives were met and to inform future research.

Analyses

Using a medium to large effect size, a priori alpha set at 0.05; and 80% power, it was estimated that 20 to 25 participants per group would be necessary to detect an effect of the intervention (Pallant, 2013; Polit & Beck, 2014). Following data collection, each participant's SHHH pretest and posttest were reviewed for the number of correct responses as well as the numerical attitude value. These raw scores were entered into a Microsoft Excel (2010) spreadsheet then imported to SPSS Statistics software (version 21.0) (IBM Corporation, released, 2012) for analysis.

First, the Shapiro-Wilk test of normality was used to estimate the normality of the pre- and post-test scores. For knowledge (n = 19), the data were normally distributed (pre: $w = 0.92$, $p > 0.05$ and post: $w = 0.941$, $p > 0.05$). For attitude (n = 15), the data were not normally distributed (pre: $w = 0.87$, p = 0.04 and post: $w = 0.872$, $p = 0.03$). However, given the small sample size (n = 19 and n = 15), a nonparametric test was used to estimate the data as nonparametric methods do not rely on the estimation of parameters in describing the distribution of the data (Pallant, 2013). Therefore, a Wilcoxon signed-rank test was used to estimate the differences between pretest and posttest scores.

The Wilcoxon signed-rank test is a nonparametric test used when comparing two related samples to assess where the mean ranks differ. It can be used as an alternative to the paired *t*-test when the population cannot be assumed to be normally distributed or

when there is a small (less than 30) sample size (Polit, 2010). Similarly, a Spearman's rank-order correlation was used to determine correlations between demographics and participants' responses (Polit, 2010). Only aggregate scores of the individual questionnaires were analyzed.

Project Evaluation

Determining success of the program relies on evaluation. Program evaluation was accomplished through formative and summative evaluation. A fidelity checklist was utilized during each educational intervention to ensure that equivalent information was relayed among each of the sessions. A pretest/posttest design was used. Prior to the educational intervention, staff members were asked to complete an anonymous multiple choice pretest and Likert-type survey that I designed. Immediately after the presentation, attendees were asked to complete the same multiple choice test and Likert-type survey. Unstructured interviews with selected staff were conducted periodically during the week after the educational intervention. These formative and summative evaluations served to identify barriers and facilitators to implementation.

Summary

Sleep is an often elusive and disrupted necessary human activity. A number of factors influence the quality and quantity of sleep in the neurorehabilitation setting. Neurologic manifestations of brain injury, medications, and underlying psychological diagnoses contribute to sleep disturbance. Such factors can also be exacerbated by stimuli from the environment. Poor sleep contributes to poor performance in rehabilitation thus contributing to longer lengths of stay and poorer outcomes (Worthington & Melia, 2006).

Sleep hygiene education programs implemented in intensive care units have exhibited improvements in patients' sleep as well as decreased lengths of stay (Kamdar et al., 2013). Nurses play an important role in promoting sleep hygiene in the neurorehabilitation setting. Building upon this knowledge utilizing Benner's (2001) novice to expert theory, this nonexperimental project sought to determine the effects of sleep hygiene education on the knowledge and attitudes of neurorehabilitation nurses. It was assumed that improvement in knowledge and attitudes would result in translation to practice thus improving patient outcomes.

Section 4: Findings, Discussion, and Implications

Sleep disturbance during neurorehabilitation hospitalization is impacted by a number of environmental factors. Nursing staff members can effect change by implementing sleep promotion activities. The purpose of this project was to determine if an educational intervention would improve nurses' knowledge and attitudes toward sleep during acute neurorehabilitation. Findings did, in fact, support the hypothesis that knowledge and attitudes would be improved.

Phase I

Seven sleep experts were invited via Survey Monkey to provide anonymous feedback on the SHHH tool. The selection consisted of pulmonary sleep specialists, neuropsychologists, and physiatrists specializing in brain injury rehabilitation. Each individual was considered an expert in the field with at least 5 years of experience caring for the specified patient population. Five individuals completed and returned the survey after reviewing the fifteen-item tool (Appendix A – a copy of the 15-item tool). An I-CVI was calculated for each item. The S-CVI for the tool was 0.77 (Table 1). Three of the items, (13, 14, and 15) had an I-CVI less than 0.80 and were considered either somewhat irrelevant or irrelevant by each of the five experts, thus were subsequently removed from the tool. After removing these items, the S-CVI/Ave was 0.95 (Table 2). The resulting twelve item tool (Appendix B) was considered valid (Polit & Beck, 2007).

Table 1

Ratings on the Original SHHH by 5 Experts: Items Rated 3 or 4 on a 4-Point Relevance Scale

	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Experts	I-CVI Agreeing
1	R	R	R	R	R	5	1.00
2	R	--	R	R	R	4	.80
3	R	R	--	R	R	4	.80
4	R	R	R	R	R	5	1.00
5	R	R	R	R	R	5	1.00
6	R	--	R	R	R	4	.80
7	R	R	R	R	R	5	1.00
8	R	R	R	R	R	5	1.00
9	R	R	R	R	R	5	1.00
10	R	R	R	R	R	5	1.00
11	R	R	R	R	R	5	1.00
12	R	R	R	R	R	5	1.00
13	R	--	--	--	--	4	.20
14	--	--	--	--	--	5	.00
15	--	--	--	--	--	5	.00
						S-CVI/AVE	.77
Rel	.87	.67	.73	.87	.87		

Note. I-CVI=item-level content validity index; S-CVI-Ave=scale-level validity indext average; Rel=relevance.

Table 2
Ratings on the Revised SHHH by 5 Experts: Items Rated 3 or 4 on 4-Point Relevance Scale

	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Experts	I-CVI Agreeing
1	R	R	R	R	R	5	1.00
2	R	--	R	R	R	4	.80
3	R	R	--	R	R	4	.80
4	R	R	R	R	R	5	1.00
5	R	R	R	R	R	5	1.00
6	R	--	R	R	R	4	.80
7	R	R	R	R	R	5	1.00
8	R	R	R	R	R	5	1.00
9	R	R	R	R	R	5	1.00
10	R	R	R	R	R	5	1.00
11	R	R	R	R	R	5	1.00
12	R	R	R	R	R	5	1.00
						S-CVI/AVE	.95
Rel	1.00	.83	.92	1.00	1.00		

Note. I-CVI=item-level content validity index; S-CVI-Ave=scale-level validity index average; Rel=relevance.

Phase II

A total of 21 registered nurses attended one of three educational sessions. Nineteen individuals completed both pretest and posttest knowledge questions, and 15 individuals completed attitude questions at both time points. The final sample consisted of 19 nurses for knowledge assessment and 15 nurses for attitude assessment.

Each session was 50 minutes in length and consisted of didactic presentation of sleep physiology, description of sleep disorders and sleep measurement, and an overview of recent research during and after which participants were encouraged to ask questions.

Prior to the start of the educational intervention, participants completed a brief demographic survey and the 11-item pretest to measure sleep knowledge and a one-item question to measure attitude toward sleep using a Likert-type scale of 1 to 10 in which 1 represented *never* and 10 represented *always* for a total of 12 questions. The content validity of the tool was established in Phase I of the project. Following the completion of the intervention, the participants completed only the 12-item posttest.

All participants were registered nurses (RN) with 63% of the RNs in age range of 50 and older. The majority of RNs (63%) had over 20 years of experience, but about half the RNs had less than 10 years of experience working in rehabilitation. A small proportion (17%) had achieved graduate degrees however, 79% had obtained specialty nursing certification. Of those reporting type of specialty certification, 92% reported certification in rehabilitation nursing (Table 3). Similarly, the National Council of State Boards of Nursing (NCSB) reported that over half the 2013 RN work force was over the age of 50 with a mean time since graduation of 16.6 (*SD* = 12.4) years (2013). NCSB's survey also reported a comparable proportion of nurses with advanced degrees (13.76%).

Table 3
Participant Characteristics

Characteristic	Frequency
Age in years	
30-39	1
40-49	6
50-59	9
60+	3
Education[a]	
College Graduate	15
Graduate Degree	3
Years as a Registered Nurse	
0-5	2
6-10	1
11-15	3
16-20	1
21+	12
Years working in rehabilitation	
0-5	7
6-10	4
11-15	4
16-20	2
21+	2
Certification Status	
Certified[b]	15
CRRN	11
CMSRN	1

Note. CRRN = Certified Rehabilitation Registered Nurse; CMSRN = Certified Medical-Surgical Registered Nurse.
[a]Education level was missing for one individual.
[b]Certification designation was missing for three individuals.

The mean pretest score (number of correct questions) was 7.95 (*SD* = 1.75) with the mean post-test score being 8.90 (*SD* = 1.45). The mean pretest score of attitude towards sleep among the participants was 6.87 (*SD* = 1.77) and the mean post-test score of attitude was 7.80 (*SD* = 1.15; Table 4). A Wilcoxon signed-ranked test indicated that the one-time educational intervention produced statistically significant differences between pretest and posttest knowledge (z = -2.43, p = 0.015) and attitude (z = -2.20, p = 0.028) score rankings (Table 5). These data support the hypothesis that the intervention increases nurses' knowledge and improves their attitudes toward sleep (Table 6).

Table 4
Pretest and Posttest Descriptive Statistics

Score by time	*N*	Minimum Score	Maximum Score	Mean	Standard Deviation
# Correct pre	19	5.0	11.0	7.95	1.75
# Correct post	19	6.0	11.0	8.90	1.45
Attitude pre	15	3.0	10.0	6.87	1.77
Attitude post	15	6.0	10.0	7.80	1.15

Table 5
Wilcoxon Signed Ranks Tests for Knowledge and Attitude

Variable	*N* Rank	Mean of Ranks	Sum
# Correct posttest- # Correct pretest			
Scores declined	3	4.00	12.00
Scores increased	10	7.90	79.00
Attitude posttest- Attitude pretest			
Scores declined	1	2.50	2.50
Scores increased	7	4.79	33.50

Table 6
Summary Table

Summary	*N*	Mean Score	Standard Deviation	z	p
# Correct pre	19	7.95	1.75		
# Correct post	19	8.90	1.45	-2.435	.015
Attitude pre	15	6.87	1.77		
Attitude post	15	7.80	1.15	-2.200	.028

Note. Significant at $p < 0.05$

Discussion

The issue of sleep disruption during hospitalization has captured the attention of researchers, healthcare teams, and hospital administrators and is documented in the literature (Berhnofer et al, 2013; Cmiel et al, 2004; Connor & Ortiz, 2009; Dogan et al, 2005; Eliassen & Hopstock, 2011; Pywell, 2013). Other researchers have indicated that a didactic approach to continuing education is successful in increasing nursing knowledge and improving attitudes (Flores-Mateo & Argimon, 2007; Yost et al., 2014). This project supported existing literature by indicating that an educational intervention led to increased sleep knowledge and improved attitude toward sleep. Literature has also indicated that improvement in nursing skills, knowledge, and attitudes may translate to improved patient outcomes (Flores-Mateo & Argimon, 2007; Yost et al., 2014). Additional research is necessary to determine whether the significant gains in the present study will be sustained and translate to improved patient sleep.

Existing instruments measuring sleep knowledge and attitudes were directed toward sleep self-assessment (Buysse, et al., 1989) and evaluation of sleep medicine curriculum (Sateia, Reed, & Jernstedt, 2004). After minor modification, the content of the

SHHH was validated (S-CVI/Ave = .95) and provided a suitable instrument by which to measure nurses' knowledge and attitudes toward sleep. Subsequently, the instrument was utilized to test the hypothesis in Phase II of the project. This new validated instrument adds to the literature by providing an instrument that addresses knowledge of sleep at a level appropriate for direct-care nurses rather than more advanced sleep practitioners. It may also be used in other settings to ascertain nurses' knowledge and attitudes toward sleep for performance improvement projects or research.

Implications for Practice

Sleep promotion education has the potential to change how nurses perceive the consequences of their practice in regard to patients' sleep. Providing education about sleep in neurorehabilitation and highlighting specific actions to improve sleep allows nurses to improve their knowledge and apply it to practice. If sleep is improved in this patient population, there is potential for patient outcomes to improve. However additional research is necessary to determine sustained effects of the intervention and the actual effect on patient outcomes.

Project Assessment

Strengths

One of the strengths of this project is that it stimulated nurses to consider the role of their actions in patients' sleep. The participants asked pertinent questions and requested additional information, indicating their interest in the subject of sleep promotion. In the time since the final presentation, participants and nurses who were not involved in the project have been observed discussing the role of sleep in

neurorehabilitation. Awareness of the problem is the first step in addressing the role of the nurse in sleep promotion.

Limitations

Despite efforts to lessen limitations, they do exist in all projects. The first limitation of this project was the small number of participants. It is suggested that for future projects, creative and strategic recruitment strategies be used in order to maximize the attendance of the educational session. For this project, having face-to-face sessions may have limited attendance, however, the delivery mode allowed for interaction and engagement among the registered nurses. Identifying convenient times, for example, scheduling additional sessions while providing lunch may enhance the number of participants. Although the results reached statistical significance, generalizability to a larger population cannot be assumed. It is recommended that future educational interventions be provided in an additional alternate format, such as an online program, which nurses could view at their own convenience thus increasing participation. Recruitment efforts may be improved by offering continuing education credits as a benefit.

Secondly, there were limitations with the SHHH. All the experts were identified from the practice setting and were familiar with the project director. This may introduce bias. Additionally, reliability was not established for the instrument. For future projects, it is recommended that outside experts be invited to provide input regarding validity and that reliability be established to ensure a higher quality evaluation tool.

A third limitation was the lack of follow up. The results indicated immediate improvement in knowledge and attitudes; but, the project did not address sustainability of these gains. Implementation of recommendations relies on participants' recollection of recommendations. Nursing checklists may be considered to serve as a reminder of the educational content. Visual aids may be placed on the unit as cues to staff members as well as to patients and families. The presentation should be made available in a self-directed learning format for future reference. To determine sustainability of future educational projects, it is recommended that participants complete a follow up query a few weeks after the intervention.

Ultimately, it is anticipated that improving knowledge and attitudes toward sleep will result in translation to practice. Improvements in patient outcomes would evidence such translation. However no patient outcomes were measured. Additional research is needed to determine if increased knowledge and improved attitudes toward sleep will translate to improved sleep in patients hospitalized for brain injury rehabilitation.

Recommendations

Neurorehabilitation nurses should be provided with sleep promotion education in order to enhance patient care. It is recommended that the one-hour educational intervention be included in orientation of new neurorehabilitation nurses. Given that neurorehabilitation care is provided by multiple disciplines, it is recommended that this educational intervention be offered to these other disciplines as well. Enlisting support from other key stakeholders may elicit desired results on patient outcomes.

In order to allow maximum participation in sleep promotion education, it is recommended that the intervention delivery method be altered to allow for self-study. Computer-based education would allow participants to individually pace learning. Participants would also be able to optimize the individual learning environment. Self-study prevents limitations in accessibility.

The selected facility previously implemented a noise reduction campaign in order to improve patient outcomes. Incorporating sleep promotion education for nurses throughout the facility may augment the noise reduction project. It is recommended that the intervention be translated to other units. As previously mentioned, self-study may facilitate such translation.

Analysis of Self

Throughout the process of this project, I participated in an inner journey. Early on in the Doctor of Nursing Practice program a DiSC profile (IPB Partners, 2014) identified my strengths as steadiness and conscientiousness. These strengths served me well throughout the extensive development and implementation of this project. Teamwork and systematic thinking were also crucial in this process. Identification of these traits was helpful in providing a sense of positivity that allowed me to be successful.

Attributes such as possessiveness, predictability, and emotional restraint could have easily hindered progress; but challenges were surmountable with the support of a seasoned preceptor and key stakeholders. Enhancement of leadership skills is ongoing through the pursuit of higher education and participation in courses for emerging leaders. This continuance of education will assist me in identifying and enhancing personal

strengths in order to develop potential. Future successes will rely on finding balance between positive and negative leadership traits.

The American Association of Colleges of Nursing identified essentials for the nursing practice doctorate (Zaccagnini & White, 2011). Development of this project required implementation of a number of these essentials. Scientific underpinnings for practice and evidence-based practice were fundamental in planning the intervention. Implementation of the project required systems thinking and interprofessional collaboration. Advocating for changes in healthcare policy at the facility-level is foreseen as a future endeavor. Overall, I feel as though each of the essentials has been applied throughout this journey.

Achievement as a scholar practitioner is measured by a shift in thinking from individual patient-level care to population-level care. This is what leads to the development of evidence-based practice. It is the implementation of evidence-based practice that leads to the improvement of health at the population level. Once the practitioner understands these relationships and his or her role in the process, he or she truly becomes the scholar practitioner.

Summary

The 1 hour educational intervention that was provided to registered nurses on the neurorehabilitation unit has the potential to improve sleep promotion activity and ultimately improve patient outcomes. Statistical significance was reached for changes in knowledge and attitudes. Data analyses supported the hypothesis that providing education

would increase knowledge and improve attitudes toward sleep. Additional research is necessary to evaluate effects on patient outcomes.

Section 5: Executive Summary

Sleep is an activity common among all animal species. Its role in physical and psychological health is well-documented. Cellular repair and cognitive processes are greatly impacted by sleep. Thus, those individuals who are ill or injured are susceptible to deleterious effects of poor sleep. In the hospital setting, there are a number of environmental factors that impact sleep. Of particular interest are noise, light, and disruptions for medical treatment. In the neurorehabilitation population, these sleep disturbances are particularly problematic due to the role of sleep in neural repair. Neurorehabilitation nurses are poised to introduce activities to promote sleep.

Traditionally, nurses have not received education specific to sleep issues or instruction regarding sleep promotion interventions. In order to implement strategies, it is necessary to provide the education. This one-hour educational intervention provides information regarding issues unique to patients in the neurorehabilitation setting as well as specific actions that nurses can employ to promote sleep. The pre and posttest results demonstrated significant gains in knowledge and improvement in attitudes toward sleep.

The author recommends that all new neurorehabilitation nursing staff members receive sleep promotion education during orientation. Providing self-study options for existing nursing staff will ensure that the information is accessible to applicable staff members. Given that the care provided by other disciplines also impacts sleep, it is advisable to provide educational opportunities for those individuals as well. Continuing education has the potential to improve the care provided for patients in the neurorehabilitation setting and ultimately improve patient outcomes.

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Appendix A: Sleep Hygiene for Healing Hospitals

Age Range:

☐ Under 20 ☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60+

Highest level of education

☐ Some HS ☐ HS grad ☐ Some College ☐ College Graduate

☐ Some Graduate work ☐ Graduate Degree

Profession:

☐ Nursing Assistant ☐ LPN ☐ RN ☐ Other _____

☐ PT ☐ OT ☐ SLP ☐ Psychology

Number of years in this profession:

☐ 0-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21+

Total years working in rehabilitation:

☐ 0-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21+

Do you hold a specialty certification?

☐ Yes (Certification: _____) ☐ No

Choose the best answer for the following questions.

1. Daytime naps of what duration do not impact nighttime sleep?

   ☐ 15-20 min ☐ 60-75 min ☐ 90-120 min ☐ naps do not affect nighttime sleep

2. What is the most common sleep disorder on the brain injury rehabilitation unit?

   ☐ insomnia ☐ sleep apnea ☐ Circadian rhythm disorder ☐ sleep insufficiency

3. Which sleep regulating body system is affected by external factors such as light, ambient temperature, and feeding?

   ☐ Homeostatic effect ☐ Lymphatic system ☐ Circadian Clock ☐ Neurologic system

4. Untreated obstructive sleep apnea can adversely affect the cardiovascular and endocrine systems.

   ☐ True ☐ False

5. What is the optimum timing of natural light exposure to promote quality sleep?

   ☐ morning ☐ afternoon ☐ evening ☐ natural light exposure is not important

6. The following activities are suitable for bed (choose all that apply).

   ☐ watching TV
   ☐ listening to radio
   ☐ reading on an electronic device
   ☐ eating
   ☐ homework
   ☐ none of the above

7. Sleep stages occur cyclically throughout the sleep period

   ☐ True ☐ False

8. Sleep disorders adversely impact memory, attention, and concentration.

   ☐ True ☐ False

9. The following factors influence sleep (choose all that apply)

   ☐ medical
   ☐ psychological
   ☐ pharmacologic
   ☐ environmental
   ☐ primary sleep disorders

10. On the rehabilitation unit, the following symptoms may be suggestive of primary sleep disorder (choose all that apply):

    ☐ snoring ☐ irritability ☐ dilated pupils ☐ daytime hypersomnolence

11. My clinical practice has no effect on night time sleep.

☐ True ☐ False

12. How frequently do patients' sleep disorders interfere with the treatment you provide?

1	2	3	4	5	6	7	8	9	10
Never		Sometimes				Often			Always

13. What strategies do you currently use to address sleep in your patient population?

_____

_____

_____

_____

14. This education will benefit my clinical practice.

1	2	3	4	5	6	7	8	9	10
Strongly disagree								Strongly agree	

15. How will you incorporate this information into your practice?

_____

_____

_____

Appendix B: Sleep Hygiene for Healing Hospitals (Revised).

Age Range:

☐ Under 20 ☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60+

Highest level of education

☐ Some HS ☐ HS grad ☐ Some College ☐ College Graduate

☐ Some Graduate work ☐ Graduate Degree

Profession:

☐ Nursing Assistant ☐ LPN ☐ RN ☐ Other _____

☐ PT ☐ OT ☐ SLP ☐ Psychology

Number of years in this profession:

☐ 0-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21+

Total years working in rehabilitation:

☐ 0-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21+

Do you hold a specialty certification?

☐ Yes (Certification: _____) ☐ No

Choose the best answer for the following questions.

1. Daytime naps of what duration do not impact nighttime sleep?
   ☐ 15-20 min ☐ 60-75 min ☐ 90-120 min ☐ naps do not affect nighttime sleep

2. What is the most common sleep disorder on the brain injury rehabilitation unit?
   ☐ insomnia ☐ sleep apnea ☐ Circadian rhythm disorder ☐ sleep insufficiency

3. Which sleep regulating body system is affected by external factors such as light, ambient temperature, and feeding?
   ☐ Homeostatic effect ☐ Lymphatic system ☐ Circadian Clock ☐ Neurologic system

4. Untreated obstructive sleep apnea can adversely affect the cardiovascular and endocrine systems.
   ☐ True ☐ False

5. What is the optimum timing of natural light exposure to promote quality sleep?
   ☐ morning ☐ afternoon ☐ evening ☐ natural light exposure is not important

6. The following activities are suitable for bed (choose all that apply).

☐ watching TV
☐ listening to radio
☐ reading on an electronic device
☐ eating
☐ homework
☐ none of the above

7. Sleep stages occur cyclically throughout the sleep period

☐ True ☐ False

8. Sleep disorders adversely impact memory, attention, and concentration.

☐ True ☐ False

9. The following factors influence sleep (choose all that apply)

☐ medical
☐ psychological
☐ pharmacologic
☐ environmental
☐ primary sleep disorders

10. On the rehabilitation unit, the following symptoms may be suggestive of primary sleep disorder (choose all that apply):

☐ snoring ☐ irritability ☐ dilated pupils ☐ daytime hypersomnolence

---

11. My clinical practice has no effect on night time sleep.

☐ True ☐ False

12. How frequently do patients' sleep disorders interfere with the treatment you provide?

1	2	3	4	5	6	7	8	9	10
Never		Sometimes				Often			Always

Appendix C: Determination of research as provided by practicum site

VHA Operations Activities That May Constitute Research

VHA Handbook 1058.05 establishes procedures for determining whether a VHA operations activity constitutes research and establishes procedures for verifying and documenting the non-research status of certain VA operations. This form has been developed to assist program offices and services to determine if an operations activity constitutes research. The ACOS/R&D can provide assistance in determining if an activity constitutes research. (See definitions on page 2)

Section 1: Project and Reviewer Identification

Program Office	JAH PM&R (POLYTRAUMA)
Title of Project/Operations Activity	THE ROLE OF NURSING PRACTICES IN PROMOTING SLEEP DURING BRAIN INJURY REHABILITATION HOSPITALIZATION
Project Manager	JILL MASSEGLE MS, ARNP-C
Reviewer	ROBERT R. CAMPBELL JD MPH PhD

Section 2: Operations Activity Review

	NO	YES
1. Is the Operations Activity **designed** (and/or implemented) for **internal VA purposes in support of the VA mission(s)**?	☐	☒
2. Are the activity's **findings designed to be used by and within VA** (or by entities responsible for overseeing VA)?	☐	☒
3. Is the activity **designed** for the purpose of contributing to **generalizable knowledge**?	☒	☐
4. Is the activity **designed** for the purpose of expanding the **knowledge base** of a **scientific discipline** or scholarly field of study?	☒	☐
5. Is the activity funded or supported **as research**?	☒	☐
6. Is the activity a **clinical investigation** as defined under Food and Drug Administration **(FDA) regulations**?	☒	☐
7. Does the activity include **double-blind interventions**?	☒	☐
8. Does the activity include **placebo controls**?	☒	☐
9. Does the activity include **prospective patient-level randomization** to a clinical intervention **not tailored to individual patient benefit**?	☒	☐
10. Has the activity been **supplemented or modified before, during, or after implementation** in order to produce information to expand **the knowledge base of a scientific discipline** or scholarly field of study or otherwise **contribute to generalizable knowledge**?	☒	☐
11. Has the purpose of the activity **changed** so that it is **now designed or intended** to expand the **knowledge base of a scientific discipline** or scholarly field of study or otherwise **contribute to generalizable knowledge**?	☒	☐
Comments: PRELIMINARY ACTIVITIES LOOKING AT NURSING ROLE IN ENHANCING SLEEP IN POLYTRAUMA TBI 1). USING ALREADY ESTABLISHED PROCEDURES 2) EDUCATIONAL ACTIVITY WITH NURSES AT PRC 3) INITIAL EFFICACY BASED ON ESTABLISHED ACTIGRAPHY MONITORING 4) RECOMMEND PRC/PM&R CLINICAL DIRECTOR CONCURRENCE. (attached)		

Done ★

Section 3: Operations Activity Reviewer Determination

Key for Black and White Forms

Green boxes: Question 1-Yes, Question 2-Yes, Questions 3-11-No

Red boxes: Question 1-No, Question 2-No, Questions 3-11-Yes

The Reviewer makes one of the following final determinations:	
☑	If all the green boxes above are checked, this operations activity is **NOT** research and Institutional Review Board (IRB) approval is **not** required. Documentation of non-research status is (i) required prior to peer –reviewed publication and (ii) encouraged whenever non-research status may be questioned.
☐	If any of the red boxes above are checked, this operations activity constitutes research and Institutional Review Board (IRB) approval is required.
☐	Defer for Review by ACOS/R&D. Reasons for Deferral are indicated below.
Reasons for Deferral:	
Signature of Reviewer	**Date** 1/15/2014

Definitions:

Generalizable Knowledge: For purposes of this VHA Handbook 1058.05, generalizable knowledge is information that expands the knowledge base of a scientific discipline or other scholarly field of study. Systematic investigations designed to develop or contribute to generalizable knowledge constitute research. Thus, systematic investigations designed to produce information to expand the knowledge base of a scientific discipline or other scholarly field of study constitutes research.

Clinical investigations: As defined under Food and Drug Administration (FDA) regulations clinical investigators include studies of FDA-regulated drugs, devices, and biologics, regardless of whether the investigation or comparison requires an Investigational New Drug Application (IND) or Investigational Device Exemption (IDE), and regardless of whether the investigation or comparison involves approved or unapproved (i.e., off-label) uses.

Systematic Investigation: A systematic investigation is an activity that is planned in advance and that uses data collection and analysis to answer a question. Although research must include systematic investigation, non-research operations activities also include systematic investigation to ensure reliable outcomes. Systematic investigation does not, in and of itself,

Appendix D: Approved Consent Form

CONSENT FORM

You are invited to take part in a research study of the effects of sleep promotion and sleep hygiene education on nurses' knowledge and attitudes.The researcher is inviting all polytrauma nurses employed at James A. Haley VA to be in the study. This form is part of a process called "informed consent" to allow you to understand this study before deciding whether to take part.

This study is being conducted by a researcher named Jill Massengale, who is a doctoral student at Walden University. You may already know the researcher as a nurse practitioner, but this study is separate from that role.

Background Information:
The purpose of this study is to determine if providing sleep promotion and sleep hygiene education will result in increased knowledge and improved attitudes about the subject.

Procedures:
If you agree to be in this study, you will be asked to do the following:

- Before the sleep promotion and hygiene presentation, complete the attached pretest which should take approximately 5 minutes.
- After the presentation, complete the posttest which should take approximately 5 minutes
- Deposit the pretest and posttest in the locked box located in the conference room.

Here are some sample questions:
How long have you been a nurse? What is the most common sleep disorder on the brain injury rehabilitation unit? .

Voluntary Nature of the Study:
This study is voluntary. Everyone will respect your decision of whether or not you choose to be in the study. No one at James A. Haley Polytrauma Rehabilitation Center will treat you differently if you decide not to be in the study. If you decide to join the study now, you can still change your mind later. You may stop at any time.

Risks and Benefits of Being in the Study:
Being in this type of study involves some risk of the minor discomforts that can be encountered in daily life, such as stress or anxiety. By participating in the study, you may increase your knowledge and improve your attitude toward sleep hygiene and sleep promotion.

Payment:
You will not be compensated in any way as a result of your participation in this study.

Privacy:
Any information you provide will be kept anonymous. The researcher will not use your personal information for any purposes outside of this research project. Also, the researcher will not include your name or anything else that could identify you in the study reports. Data will be kept secure by being held in a locked cabinet in a locked office (paper documents), The electronic database of responses will contain no identifiable information and will be accessible only by the researcher and other individuals conducting the study. Data will be kept for a period of at least 5 years, as required by the university.

Contacts and Questions:
You may ask any questions you have now. Or if you have questions later, you may contact the researcher via email at jill.massengale@waldenu.edu. If you want to talk privately about your rights as a participant, you can call Dr. Leilani Endicott. She is the Walden University representative who can

discuss this with you. Her phone number is 612-312-1210. Walden University's approval number for this study is **01-21-15-0376728** and it expires on **January 20, 2016.**

Please keep this consent form for your records. (for anonymous paper-based research)

Statement of Consent:

I have read the above information and I feel I understand the study well enough to make a decision about my involvement. By returning the completed survey , I understand that I am agreeing to the terms described above.